The Veterinarian's Handbook

INTAS
ANIMAL HEALTH

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Disclaimer

Science and technology are constantly changing fields. New research and experience broaden the scope of information and knowledge. The editors have tried their best in giving information available to them while preparing the material for this book. Although all efforts have been made to ensure optimum accuracy of the material, yet it is quite possible some errors might have been left uncorrected. The publisher and the editors will not be held responsible for any inadvertent errors or inaccuracies.

Foreword

It is both a privilege and a responsibility to introduce The Veterinarian's Handbook-A timely and comprehensive guide crafted to support and shape the next generation of Veterinary professionals in India.

Veterinary science today stands at the intersection of tradition and transformation. As the role of Veterinarians continues to expand-panning public health, sustainable food systems, animal welfare and One Health-the need for an updated, accessible and practically-oriented reference has never been more pressing. This handbook arrives at precisely such a moment.

Designed to guide undergraduate Veterinary students as they transition from academic instruction to real-world clinical practice, this book lays a robust foundation in both the science and the art of Veterinary care. It not only equips students with essential Good Clinical Practices (GCP), but also cultivates the confidence, critical thinking and ethical grounding needed to thrive in diverse practice settings.

What makes The Veterinarian's Handbook truly distinctive is the breadth and depth of its content, which has been curated with strategic clarity and clinical relevance. It begins by exploring the Genesis of the Veterinary Profession, setting historical and ethical context, before delving into core scientific disciplines such as Veterinary Physiology, Animal Nutrition and Veterinary Pharmacology and Toxicology.

Equally significant is its comprehensive focus on applied practice-through chapters on Veterinary Public Health, Clinical Diagnosis, Veterinary Medicine, Veterinary Gynaecology and Obstetrics, and Veterinary Surgery. These sections offer students actionable insights, contemporary diagnostic frameworks and emerging trends in Veterinary care, effectively bridging the gap between theory and hands-on expertise.

The collective effort of team at Intas Pharmaceuticals and their work is commendable. Their commitment to Veterinary education, clinical excellence, and industry collaboration is evident in every chapter. This book is more than a compilation of knowledge-it is a companion for students, a refresher for practitioners, and a roadmap for all who are invested in advancing animal health in India and beyond.

As we nurture the next generation of Veterinary professionals, let this handbook serve not only as a reference, but as a catalyst-encouraging thought, guiding practice, and upholding the highest standards of care.

19.06.2025

Dr. Umesh Chandra Sharma
President
Veterinary Council of India

Foreword

It is with immense pride and a forward-looking vision that I introduce The Veterinarian's Handbook-A foundational resource dedicated to shaping the clinical acumen and compassionate approach of the next generation of Veterinary professionals.

At Intas Pharmaceuticals, our belief is simple yet profound: education is the catalyst for enduring progress in animal healthcare. Our responsibility extends far beyond the creation of innovative therapeutics—it encompasses the nurturing of scientific minds and the empowerment of young professionals through accessible, relevant and practical knowledge.

This handbook is a manifestation of that commitment. Crafted with purpose, it aims to do more than impart information—it seeks to ignite curiosity, cultivate clinical insight, and reinforce the highest ethical and scientific standards in veterinary practice.

Through transformative platforms such as Face2Vet, Avipod, Petpod, Confluence, Specare, Webvet and our academic forums like Clinical Case Conferences and V-Voice, Intas continues to invest in knowledge ecosystems that promote learning, dialogue and professional development across the Veterinary community.

As you engage with this book, may it serve as more than a guide—may it become your trusted companion in learning, a bridge between aspiration and action. At Intas, we remain steadfast in our support for your journey and in our belief that empowered Veterinary professionals are key to building a healthier world—for animals, communities and ecosystems alike.

Warm regards,
Vijay Teng
President
Intas Animal Health

Preface

We are honoured to present The Veterinarian's Handbook—an initiative by Intas Pharmaceuticals developed to support undergraduate Veterinary students as they embark on their clinical education.

Veterinary medicine today is marked by rapid advancements, multidisciplinary integration and increasing societal expectations. In this dynamic landscape, academic excellence must be complemented by practical insight, clinical reasoning and compassionate care. This handbook has been carefully curated to bridge the gap between theoretical foundations and hands-on application.

Covering key domains such as Basic Insights, Veterinary Physiology, Animal Nutrition, Pharmacology and Toxicology and Veterinary Public Health, the book lays a robust foundation for clinical interpretation. Further, it offers practical guidance in essential disciplines including Clinical Diagnosis, Veterinary Medicine, Veterinary Gynaecology and Obstetrics and Veterinary Surgery and Radiology-all aimed at preparing students for real-world clinical challenges.

This is not just a book-it is a learning companion. It reflects Intas' unwavering commitment to Veterinary science and our belief in nurturing talent that will shape the future of animal health.

We hope this handbook sparks intellectual curiosity, sharpens clinical judgement and fosters a lifelong passion for Veterinary excellence.

Warm regards,
Editors:

Dr. Nitin Bhatia
Dr. Amol Upase
Dr. Rahul Patel
Dr. Krishna Kt. Baruah
Dr. Sachin Gayal
Dr. Batul Ranasiya

Veterinarian's Oath

Being admitted to the profession of Veterinary medicine, I solemnly swear to use my scientific knowledge and skill for the benefit of society through the protection of animal health and welfare, the prevention and relief of animal suffering, the conservation of livestock resources, the promotion of public health and the advancement of medical knowledge.

I will practice my profession conscientiously, with dignity and in keeping with the principles of veterinary medical ethics.

I accept as a lifelong obligation the continual improvement of my professional knowledge and competence.

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Section – I
Genesis of Veterinary Profession

Veterinary Profession is as old as human civilization having history before the birth of Jesus Christ. First true written records appears to have Egyptian origin in form of a Textbook on Veterinary Medicine. The book describes diseases of cattle, dogs, birds and fish. Author had some knowledge of anatomy and has documented about animal diseases and suggested remedies.

Similar fragments of Chinese writing containing references to the diseases of horses, cattle and buffalo have been found. Even the Mohenjodaro and Harappa civilizations (2500 BC) had both humped and humpless cows, buffaloes, elephants, goats and fowls etc. Care for animals has been depicted from the paintings and carvings of ancient times viz. Hindu art showing care and affection for elephants and Egyptian carvings showing animals and the uses they were put to. Ancient man used animals for food, transport and agriculture, but in some civilisations they took on a religious significance such as cats in ancient Egypt. It is not clear how or when pet animals evolved but there must have been a strong bond between ancient hunters and their dogs as depicted in the hieroglyphics. Cattle husbandry was well developed during the Rigvedic period (1500-1000 BC) and the cow (Kamdhenu) was adored and considered as 'the best wealth' for mankind. The Aryans laid great emphasis in protection of cows.

18th Century Manuscript of Shalihotra Samhita, showing an Eye Operation on a Horse

Ayurvedic Veterinary medicine developed at the time of Atharvaveda (1000 BC) and several medicinal plants, grasses, shrubs, herbs, etc. were used for treatment of animal diseases. People of Indus Valley civilization were familiar with dogs, bulls, sheep, goats, buffaloes, horses and elephants.

Shalihotra (2350 BC) considered as the first known Veterinarian of the World was an expert in equine rearing and medicine and wrote 'Salihotra Samhita' having some 12,000 shlokas in Sanskrit describing equine and elephant anatomy, physiology, surgery, diseases and its prevention and cure. This was followed by others viz. Muni Palkapya wrote 'Hasti Ayurveda' covering all aspects of elephant medicine (1800 BC) and Sage Palakapya composed 'Gaja Ayurveda', a treatise on elephant science (1000 BC). Nakula and Sahdeva, the two Pandava brothers were experts of horse and cattle husbandry

respectively. In conversation with King Virata, Nakula proudly claimed to know the art of treating all illnesses of horses. He also mentioned his exceptional skill as a charioteer. Lord Krishna was an expert caretaker and conservator of cow husbandry. Gokul and Mathura were famous for excellent breeds of cows, high milk production, quality curd, butter and other milk products. Buddha was a great protector of all kinds of animals and birds (including game) in ancient India as he preached lessons of non-violence to masses.

Aristotle (375 BC) authored a book "History of Animals", is a detailed compilation of observations on over 500 species of animals. He recognized that animals, much like humans, could suffer from diseases.

History of Animals

After the Kalinga war, Samrat Ashoka (300 BC) projected Veterinary profession as its 'best heritage' and established first known Veterinary Hospitals of the World. The 'Baniyan Hospital' of Surat is believed to be one of them. Today's VCI insignia is also an adaptation of the stone edict from Ashoka.

First animal to be domesticated by humans was the dog, as a commensal, at least 15,000 years ago. Other animals including cows, goats and sheep were domesticated around 11,000 years ago. Among birds, the chicken was first domesticated in East Asia, seemingly for cockfighting, some 7,000 years ago. Horse came under domestication around 5,500 years ago in central Asia as a working animal. Among invertebrates, silkworm and the western honey bee were domesticated over 5,000 years ago for silk and honey, respectively.

Samrat Ashoka

The term "Veterinarian" has its roots in the first century when Columella, a Roman scholar and writer on animal care and breeding, used and recorded the term "Veterinarius" for a person who takes care of animals. After the fall of Roman Empire to the Barbarians, very few traces of Veterinary Medicine were left, until Carlo Ruini (1600 AD) an Italian, wrote a book called "The Anatomy of the Horse".

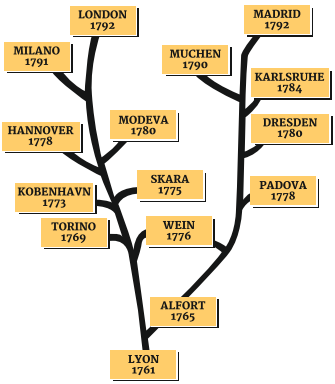
After witnessing the devastation being caused by cattle plague (Rinderpest) to the French herds, Claude Bourgelat, a French Barrister and Director of the Académie Royale d'Equitation devoted his time to seeking out a remedy. This led to France becoming the first country where the teaching of Veterinary medicine became institutionalised with their first Veterinary college being founded in Lyon, France in 1761. From this establishment Bourgelat dispatched students to combat the disease. In a short time, the plague was stayed and

Lyon Veterinary School

health of stock restored, through the assistance rendered to agriculture by Veterinary science and art. This can be identified as the beginning of Veterinary profession with Bourgelat considered the founder of scientific Veterinary medicine.

Reputation of Lyon Veterinary school soon spread and students from all over Europe attended and became the lights providers of Veterinary science. A second school was established in Alfort, France (1764) and soon Veterinary schools built on the Lyon model appeared in Germany, England and other European countries.

Readers, who are keen on the Sport of Kings, may know the name of 'Eclipse', a racehorse from which most of today's bloodstock have descended. When Eclipse died, there was only one qualified Veterinary Surgeon, Dr St. Bel a graduate from Lyon in England who was called upon to carry out the post mortem on Eclipse. This brought the profession to the notice of public in England. Dr St. Bel then went on to establish the first British Veterinary School in London at Camden Town (1972).



Genealogy of First Veterinary Schools

The British Royal Army Veterinary Service was founded (1796) because of the concern of loosing a significant number of army horses due to disease, ignorance and poor husbandry. Prof. Edward Coleman graduates and took charge of London Veterinary School were recruited to the regiments of cavalry. Dr John Shipp was the first Veterinary Surgeon commissioned into the army and is now regarded as the "Father of Modern Royal Army Veterinary Corp". This marked the establishment of Veterinary profession on two fronts, one civilian being the Veterinary Schools and other being the Army.

Slowly and gradually Veterinary Profession was recognised as an appreciable branch of medical field. Development and improvement of hypodermic syringe by Dr Tabourin (1845) ushered in a new era. In 1847, the world's first animal operation using anaesthesia was carried out at the Veterinary School in London, prior to which primitive operations were carried out under restraint, but the suffering must have been immense and surgery on animals did not really advance. So by the late nineteenth century Veterinary profession evolved into something we might recognise today, *viz*. anaesthesia, syringes and stethoscopes. Drug therapy during this time was more primitive compared to modern times but advances were being made in parallel to human medicine.

Bombay Veterinary College

The first Veterinary Training School came into existence in India at Pune (1862) followed by the first Veterinary College in unpartioned India in Lahore (1882) followed by the first Veterinary College in India in Bombay (1886), Calcutta (1893), Madras (1903) and Patna (1927). At the time of independence, India had only nine Veterinary colleges and today that number has grown to 75, reflecting significant progress in Veterinary education.

During the First World War in 1914, horses, mules, dogs and even pigeons were engaged in the British Army. They were used to pull light artillery, wagons and ambulances; they carried supplies, food, water and ammunition. To put it simply, they became the backbone of the army's supply lines at a time when mechanisation was in its infancy. Dogs were used as messengers and proved reliable as soldiers. Carrier pigeons were the most successful 'war animal with their great strength of flying speed and extraordinary homing instinct. In 1918, in recognition of their services and bravery the Veterinary Corp were given the "Royal" status and thus coined "Royal Army Veterinary Corp". The Second World War (1943) was yet another milestone in the history of Veterinary profession when Soviet mine dogs were responsible for discovering 5,29,000 German mines. The Russian army deployed suicide dogs wearing explosive back packs, which were trained to seek food under tanks and when released blew up the enemy tanks. Out of this unfortunate time, came a great discovery which was to advance Veterinary Medicine, the discovery of Antibiotics.

The 1950's were periods of change and development for Veterinary Profession, antibiotics and other drugs were coming into use in Veterinary and new surgical procedures were being developed and adopted to cure diseases, which a decade back would have been incurable. In the late 1960's, Veterinary practice had a new face from a purely food and transport animal expertise to a mixed practice with companion animals. The entry of X-ray and anaesthetic machines set the future trend in Veterinary medicine.

Dr. James Alfred Wight

Dr. James Alfred Wight better known by his pen name James Herriot, was a British Veterinary surgeon and author from Glasgow Veterinary College. He authored books on Veterinary Science and his creative books became movies and television series, motivating youngsters to enroll into Veterinary profession. James single handedly raised the profile of Veterinary Profession worldwide and also the public expectation of Veterinary services in general.

The end of 20th century and start of 21st brought about a significant change in Veterinary Profession with clinical practice expanding with the spurt of small animal practice, entry of more and more women into the profession, developments of latest diagnostic aids like Automated Laboratory Machines, Ultrasound Scanners, MRI Scanners etc. in all providing us feel of the cutting edge. It's now the time for *in-vitro* Fertilization, Cloning, Stem Cell Technology, Sexing of Semen and much more.

Veterinarians and Veterinary institutions worldwide play a crucial role in supporting and promoting the profession, with the goal of improving public awareness and reminding policymakers of the importance of animal health and welfare. Currently, there are more than 13000 Veterinary hospitals and polyclinics, more than 30000 Veterinary dispensaries, 25000 Veterinary aid centers and more than 4000 mobile Veterinary units, along with around 88000 registered Veterinary practitioners in India. Modern Veterinarians are not only animal doctors and animal welfare advocates; they are also key public health and stakeholders because of their crucial role in:

- Reducing global hunger
- Controlling zoonoses
- Monitoring food quality and safety
- Biomedical research
- Protecting environment and biodiversity
- Supporting one health approach

Pioneer of Veterinary Sciences

- Father of Indian Veterinary Sciences – Shalihotra
- Father of Animal Breeding – J. L. Lush
- Father of Animal Genetics – William Bateson
- Father of Animal Nutrition – Antoine Lavoisier
- Father of Veterinary Microbiology – David Bruce
- Father of Veterinary Pharmacology – Leo Meyer Jones
- Father of Veterinary Public Health – Dr. James Harlan Steele
- Father of Veterinary Epidemiology – Calvin W. Schwabe
- Father of Veterinary Medicine – Renatus Vegetius
- Father of Veterinary Radiology – Dr. R. Eberlein

First in India

- First Agriculture university in India – GBPUAT, Pantnagar (1960)
- First Veterinary college in India – Bombay Veterinary College (1886)

- First Veterinary university in India – TANUVAS, Tamil Nadu (1989)
- First Artificial Insemination (AI) Programme was started at the Palace Dairy farm at Mysore by Sampat Kumaran (1939)
- First calf through AI was born at the Allahabad Agricultural Institute, Allahabad (1943)
- First Embryo transfer (ET) cattle calf developed by Andhra Pradesh Agriculture University (APAU), Tirupati (1986)
- World's first IVF buffalo calf 'PRATHAM' developed by NDRI, Karnal (1990)
- World's first cloned buffalo calf 'SAMRUPA' developed by NDRI, Karnal (February 6, 2009)
- First Male calf 'SHREYAS' was developed by Frozen Semen Bull Station, Harilghata, West Bengal (January, 2011)
- First IVF cattle calf 'HOLI' (Sahiwal breed) developed by NDRI, Karnal (March 7, 2012)
- World's first cloned Pashmina goat 'NOORI' developed by SKUAST-Kashmir (March 9, 2012)
- World's first Mithun calf 'BHARAT' through embryo transfer technology developed by NRCM, Nagaland (March 27, 2012)
- India's first cloned desi Gir female calf 'GANGA' produced at NDRI, Karnal (March 16, 2023)

Colour Revolution in India

Colour Revolution	Production	Father of Revolution
Blue Revolution	Fish	Dr. Hiralal Chaudhari Dr. Arun Krishnan
Green Revolution	Food grains	M. S. Swaminathan
White Revolution	Milk	Dr. Verghese Kurien
Silver Revolution	Egg	Former PM Indira Gandhi

Veterinary Universities and Colleges in India

At present there are 30 Veterinary Universities involving 74 Veterinary Colleges in the country offering Bachelor's degrees in Veterinary Science and Animal Husbandry (B.V.Sc. & A.H.) and Master's degrees in Veterinary Science (M.V.Sc.). Of these, 60 colleges are in the government sector, while 14 are in the private sector.

Government Veterinary Colleges in India

Sr. No.	Name of College	Name of University	State
1.	NTR College of Veterinary Science, Gannavaram	Sri Venkateswara Veterinary University, Tirupati	ANDHRA PRADESH
2.	College of Veterinary Science, Proddatur		
3.	College of Veterinary Science, Tirupati		
4.	College of Veterinary Science, Garividi		
5.	College of Veterinary Science, Guwahati	Assam Agricultural University, Jorhat	ASSAM
6.	Lakhimpur College of Veterinary Science, Assam		
7.	Bihar Veterinary College, Patna	Bihar Animal Science University, Patna, Bihar	BIHAR
8.	College of Veterinary Science and Animal Husbandry, Durg	Dau Shri Vasudev Chandrakar Kamdhenu Vishwavidyalaya, Anjora, Durg	CHHATTISGARH
9.	College of Veterinary Science and Animal Husbandry, Anand	Kamdhenu University, Gandhinagar, Gujarat	GUJARAT
10.	College of Veterinary Science and Animal Husbandry, Junagadh		
11.	College of Veterinary Science and Animal Husbandry, Navsari		
12.	College of Veterinary Science and Animal Husbandry, Sardarkrushinagar		
13.	College of Veterinary Science, Hisar	Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar	HARYANA
14.	Dr. G.C. Negi College of Veterinary and Animal Sciences, Palampur	Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishwavidyalay, Palampur	HIMACHAL PRADESH

Sr. No.	Name of College	Name of University	State
15.	Faculty of Veterinary Sciences and Animal Husbandry, Jammu	Sher-e Kashmir University of Agricultural Sciences and Technology, Jammu	JAMMU & KASHMIR
16.	Faculty of Veterinary Sciences and Animal Husbandry, Srinagar, Kashmir		
17.	College of Veterinary Science and Animal Husbandry, Ranchi	Birsa Agricultural University, Ranchi	JHARKHAND
18.	Veterinary College Hebbal, Bengaluru	Karnataka Veterinary, Animal and Fisheries Sciences University, Bidar	KARNATAKA
19.	Veterinary College Nandinagar, Bidar		
20.	Veterinary College, Hassan		
21.	Veterinary College, Shimoga		
22.	Veterinary College, Gadag		
23.	College of Veterinary and Animal Sciences, Thrissur	Kerala Veterinary and Animal Science University, Pookode	KERALA
24.	College of Veterinary and Animal Sciences, Pookode		
25.	College of Veterinary Science and Animal Husbandry, Jabalpur	Nanaji Deshmukh Veterinary Science University, Jabalpur	MADHYA PRADESH
26.	College of Veterinary Science and Animal Husbandry, Mhow		
27.	College of Veterinary Science and Animal Husbandry, Rewa		
28.	Mumbai Veterinary College, Mumbai	Maharashtra Animal and Fishery Sciences University, Nagpur	MAHARASHTRA
29.	Nagpur Veterinary College, Nagpur		
30.	Krantisinh Nana Patil College of Veterinary Science, Shirwal		
31.	College of Veterinary and Animal Sciences, Udgir		
32.	College of Veterinary and Animal Sciences, Parbhani		
33.	College of Veterinary and Animal Sciences, Akola		

Sr. No.	Name of College	Name of University	State
34.	College of Veterinary Science and Animal Husbandry, Aizawl, Mizoram	Central Agricultural University, Imphal, Manipur	MANIPUR
35.	College of Veterinary Science and Animal Husbandry, Jalukie, Peren, Nagaland		
36.	College of Veterinary Science and Animal Husbandry, Bhubaneswar	Orissa University of Agriculture and Technology, Bhubaneswar	ODISHA
37.	Rajiv Gandhi College of Veterinary and Animal Sciences, Puducherry	Pondicherry University, Puducherry	PUDUCHERRY
38.	College of Veterinary Science, Ludhiana	Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana	PUNJAB
39.	College of Veterinary Science, Rampura Phul, Bathinda		
40.	College of Veterinary and Animal Science, Bikaner	Rajasthan University of Veterinary and Animal Sciences, Bikaner	RAJASTHAN
41.	College of Veterinary and Animal Science, Navania, Udaipur		
42.	Post Graduate Institute of Veterinary Education and Research, Jaipur		
43.	Madras Veterinary College, Chennai	Tamil Nadu Veterinary and Animal Sciences University, Chennai	TAMIL NADU
44.	College of Veterinary Science and Research Institute, Namakkal		
45.	Veterinary College and Research Institute, Orathanadu, Thanjavur		
46.	Veterinary College and Research Institute, Tirunelveli		
47.	Veterinary College and Research Institute, Theni		
48.	Veterinary College, Udumalpet, Tiruppur		
49.	Veterinary College and Research Institute, Salem		

Sr. No.	Name of College	Name of University	State
50.	College of Veterinary Science, Hyderabad	P.V. Narsimha Rao Telangana Veterinary University, Hyderabad	TELANGANA
51.	College of Veterinary Science, Korutla		
52.	Veterinary College at Mamnoor, Warangal		
53.	College of Veterinary Science and Animal Husbandry at R.K. Nagar, Agartala, Tripura	Tripura University, Agartala	TRIPURA
54.	College of Veterinary Science and Animal Husbandry, Ayodhya	Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya	UTTAR PRADESH
55.	College of Veterinary Science and Animal Husbandry, Mathura	Uttar Pradesh Pandit Deen Dayal Upadhyay Pashu Chikitsa Vigyan Vishwavidyalay Evam GoAnusandhan Sansthan, Mathura	
56.	Indian Veterinary Research Institute (IVRI), Izatnagar, Bareilly	ICAR-Indian Veterinary Research Institute	
57.	College of Veterinary and Animal Sciences, Meerut	Sardar Vallabh Bhai Patel University of Agriculture & Technology, Meerut	
58.	Faculty of Veterinary and Animal Sciences, Institute of Agricultural Sciences, Rajiv Gandhi South Campus, Barkachaa, Mirzapur	Banaras Hindu University, Varanasi	
59.	College of Veterinary & Animal Sciences, Pantnagar	Govind Ballabh Pant University of Agriculture & Technology, Pantnagar	UTTRAKHAND
60.	Faculty of Veterinary & Animal Sciences, Kolkata	West Bengal University of Animal & Fishery Sciences, Kolkata	WEST BENGAL

Private Veterinary Colleges in India

Sr. No.	Name of College	Name of University	State
1.	International Institute of Veterinary Education and Research, Rohtak	Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar	HARYANA
2.	Sanskaram College of Veterinary and Animal Science, Jhajjar, Haryana		
3.	RPS College of Veterinary Sciences, Satnali Road, Balana, Mahendergah, Haryana		
4.	M.R. College of Veterinary Science and Research Centre, Hassanpur, Jhajjar		
5.	Institute of Veterinary Science and Animal Husbandry	Siksha 'O' Anusandhan University, Bhubaneswar	ODISHA
6.	Khalsa College of Veterinary and Animal Sciences, Amritsar	Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana	PUNJAB
7.	Sri Ganganagar Veterinary College, Sri Ganganagar	Tantia University, Sri Ganganagar	RAJASTHAN
8.	Apollo College of Veterinary Medicine, Jaipur	Rajasthan University of Veterinary & Animal Sciences, Bikaner	
9.	Arawali Veterinary College, Sikar		
10.	R.R. College of Veterinary and Animal Science, Deoli, Tonk Jaipur		
11.	Mahatma Gandhi Veterinary College, Bharatpur		
12.	M.B. Veterinary College, Dungarpur		
13.	Shourabh College of Veterinary Science, Hindaun City, Karauli		
14.	Mahatma Jyotiba Fule College of Veterinary and Animal Science, Chomu, Jaipur		

Section – II
Basic Insights

Classification of Animals

Farm Animals	Companion Animals	Wild Animals	Laboratory Animals
Cattle	Dog	Elephant	Rat
Buffalo	Cat	Lion	Rabbit
Sheep		Tiger	Mice
Goat		Leopard	Guinea pig
Horse		Deer	Hamster
Camel		Hippopotamus	
Chicken		Giraffe	
Pig		Bear	
Rabbit		Rhinoceros	
Donkey		Monkey	

Animals and their Scientific Name

Animal	Scientific Name	Species
Indian cattle/ Exotic cattle	*Bos indicus/ Bos taurus*	Bovine
Buffalo	*Bubalus bubalis*	Bovine
Sheep	*Ovis aries*	Ovine
Goat	*Capra hircus*	Caprine
Horse	*Equus cabalus*	Equine
Donkey	*Equus asinus*	Equine
Camel	*Camelus dromedarius*	Cameline
Dog	*Canis lupus familiaris*	Canine
Cat	*Felis catus*	Feline
Chicken	*Gallus domesticus*	Phasianine
Pig	*Sus scrofa*	Suine
Rabbit	*Oryctolagus cuniculus*	Leporine

Terminologies

Animal	Adult Male	Adult Female	Newborn	Group	Act of Giving Birth
Cattle	Bull	Cow	Calf	Herd	Calving
Buffalo	Bull	Cow	Calf	Herd	Calving
Sheep	Ram	Ewe	Lamb	Flock	Lambing
Goat	Buck	Nanny/Doe	Kid	Trip	Kidding
Horse	Stallion	Mare	Foal	Stable	Foaling
Camel	Bull	Cow	Calf	Flock	Calving
Dog	Dog	Bitch	Pup	Kennel	Whelping
Cat	Tom	Queen	Kitten	Clowder	Queening
Chicken	Cock	Hen	Chick	Flock	Hatching
Pig	Boar	Sow	Piglet	Drove	Farrowing
Rabbit	Buck	Doe	Kit/Kitten	Colony	Kindling

Heifer: A young female cow, especially one that has not yet had a calf.

Gilt: A female pig that has not produced a litter of piglets yet.

Chromosome Numbers

Animal	Chromosome Nos.
Cattle	60
River buffalo	50
Swamp buffalo	48
Sheep	54
Goat	60
Horse	64
Donkey	62
Camel	74
Dog	78
Cat	38
Chicken	78
Pig	38
Rabbit	44

Body Weight and Life Span

Animal	Birth Weight (kg)	Mature Body Weight (kg)	Life Span (years)	Maximum Recorded Lifespan (years)
Cattle	25-45	464-653	20-25	30
Buffalo	26-35	450-550	15-25	40
Sheep	2.0-4.0	34-80	10-18	20
Goat	2.5-3	26-102	10-15	18
Horse	45-55	300-1000	20-25	50
Donkey	8.6-13.6	90-590	27-40	50
Camel	19-52	400-650	40-50	50
Dog	0.06-0.76	5.4-44.9	7-20	29
Cat	0.08-0.11	2.2-11	12-18	30
Chicken	0.049-0.065	1.5-3.3	2-5	23
Pig	1.0-2.0	70-128	16-18	27
Rabbit	0.04-0.08	3.0-4.9	5-8	>13

Body Weight Estimation Equation

Bovine

$$\text{Live weight in lbs} = \frac{\text{Body length in inches x (Heart girth in inches)}^2}{300}$$

Ib = Pound. 1 Ib = 0.454 kg; 1 Inch = 2.54 cm

Equine

$$\text{Live weight in kgs} = \frac{\text{Body length in cm x (Heart girth in cm)}^2}{11{,}880}$$

Body Condition Scoring

Body condition scoring is an important management practice used as a tool to help optimize production, evaluate health and assess nutritional status. Different scores can be given for individual animals and can further classify as normal, fatty, lean/thin or emaciation.

Score 1: Very thin: Skeletal structure of this animal is very prominent. Notice deep depressions next to spine, between pelvis and rib cage, between hooks and pins and around tail head.

Score 2: Thin: Skeleton of this animal is still very apparent. Individual spinous processes are clearly visible, but there is a small amount of fat tissue over spine, hooks and pins.

Score 3: Medium (Normal body condition): Animal appears smooth over spine, ribs, and pelvis and the skeletal structure can be easily palpated. Hooks and pins are still discernible, with a moderate, rather deep depression between pelvis and rib cage, hooks and pins and around tail-head.

Score 4: Fat: There are no spinous processes detectable and no depression in loin area, which gives top line of the animal a flat, tabletop appearance. Ribs can no longer be felt and pelvis can only be felt with firm pressure. Hooks and pins have a rounded appearance due to areas of fat covering.

Score 5: Very fat: Animal appears rounded and smooth with a square-shaped appearance, because of the amount of fat filling in loin. Skeletal structure is no longer visible and can only be palpated with excessive pressure.

Cattle Demeanour Scoring

Cattle demeanour scoring involves assessing their mental state and behavioral patterns to identify science of health problems or distress.

- **Normal demeanour:** If an animal makes a normal response to external stimuli, such as movement and sound, exihibit normal gait, then demeanour is said normal (bright). Animals are actively participates in grazing, drinking and other normal activities. Normal reaction under these circumstances may consist of elevating head and ears, turning towards and directing attention at source of stimuli, walking away and evincing signs of attack or flight.
- **Abnormal demeanour:** Behavioural change/response to external stimuli. Abnormal demeanours in domestic animals are as follows;
    - Decreased response (Depression): Dull (apathetic); dummy state; comma.
    - Increased response (Excitation): Apprehension (mildly anxious); restlessness, mania, frenzy.
    - Posture: It denotes anatomical configuration when they remain in stationary situation. How does it stand? How does it sit? How does it lie-down?
    - Gait: It indicates about locomotion process of an animal.
    - Body conformation: Shape and size of different body regions relative to other regions.

Animal Flooring Requirements

Animal	Floor Space (Sq. feet)		Manger Length (inches)
	Covered Area	Open Area	
Cattle	20-30	80-100	20-24
Buffalo	25-35	80-100	24-30
Pregnant cow	100-120	180-200	24-30
Bulls pen	120-140	200-250	24-30
Sheep	6.6-8	13.515	10-12
Goat	6.6-8	13.5-15	10-12
Broiler bird	1	-	-
Layer bird	2	-	-

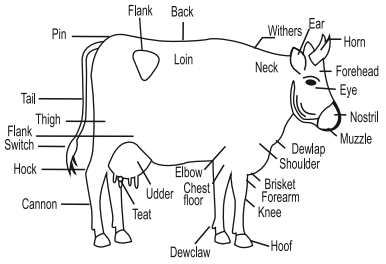
Dental Formula

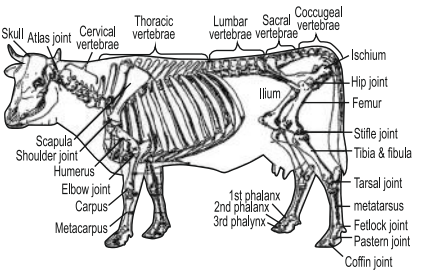
Animal	Deciduous Teeth	Total	Permanent Teeth	Total
Cattle, Buffalo, Sheep and Goat	2 (I 0/4, C 0/0, PM 3/3)	20	2 (I 0/4, C 0/0, PM 3/3, M 3/3)	32
Horse	2 (I 3/3, C 0/0, PM 3/3)	24	2 (I 3/3, C 0-1/0-1, PM 3-4/3-4, M 3/3)	36-44
Camel	2 (I 2/2, C 1/1, PM 2/2)	20	2 (I 1/3, C1/1, PM 3/1-2, M3/3	32-34
Dog	2 (I 3/3, C 1/1, PM 3/3)	28	2 (I 3/3, C 1/1, PM 4/4, M 2/3)	42
Cat	2 (I 3/3, C 1/1, PM 3/2)	26	2 (I 3/3, C 1/1, PM 3/2, M 1/1)	30
Pigs	2 (I 3/3, C 1/1, PM 3/3)	20	2 (I 3/3, C 1/1, PM 4/4, M 3/3)	44
Rabbit	2 (I 2/1, C 0/0, M 3/2)	16	2 (I 2/1, C 0/0, PM 3/2, M 3/3)	28
Fowl	No teeth			

I - Incisors, C - Canine, PM - Pre Molor, M - Molor

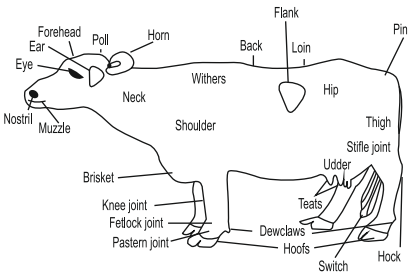
Body Parts and Skeleton

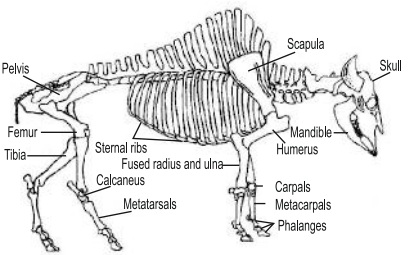
Cattle



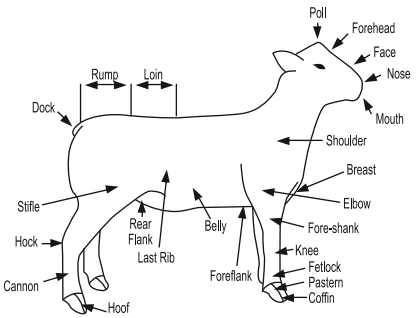


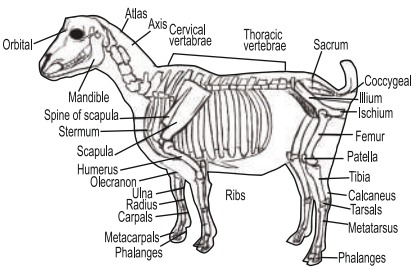
Buffalo



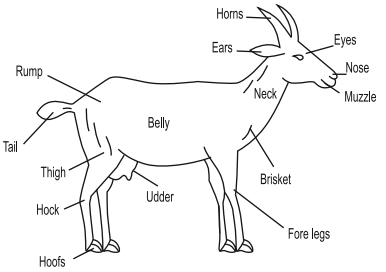


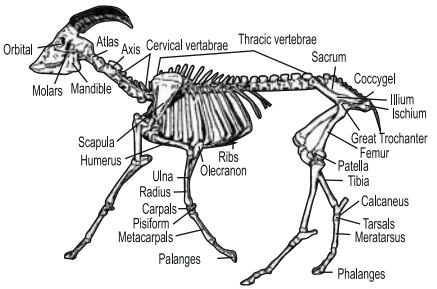
Sheep



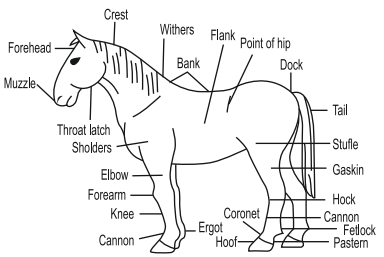


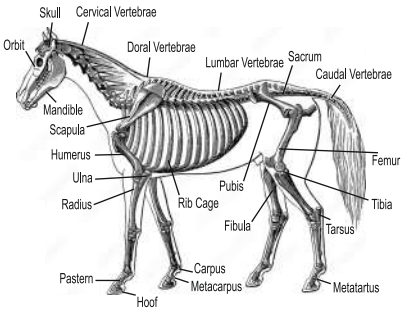
Goat



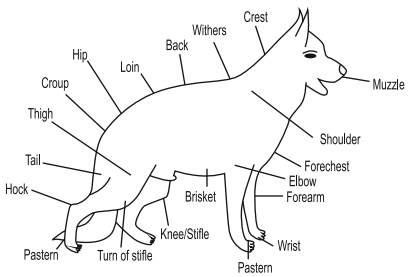


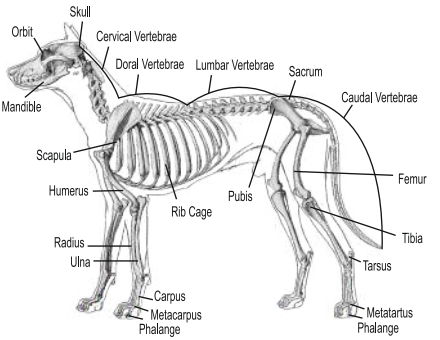
Horse



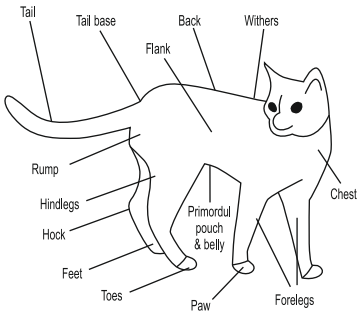


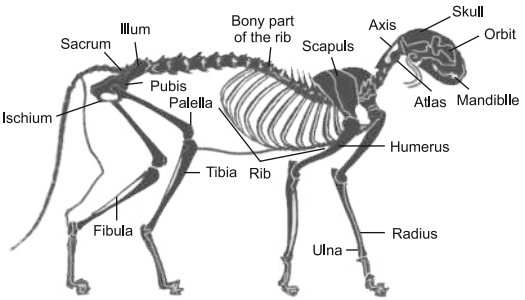
Dog



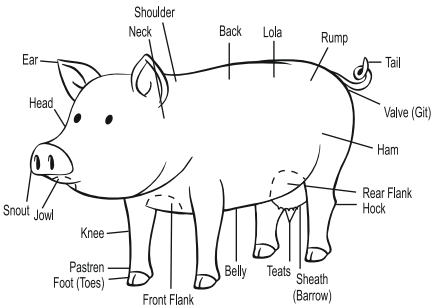


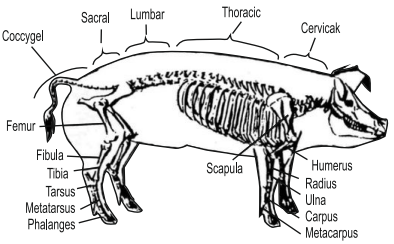
Cat





Pig





Bones and Joints

Osteology is branch of science, which deals with study of bones. Bones are living tissues because, they have blood vessels, lymphatic vessels, nerves and they can grow and can repair themselves, if damaged. According to gross appearance, bones have been classified into seven groups as long, short, flat, irregular, pneumatic, sesamoid and visceral bone.

Bone Type	Characteristics
Long	• Greater in length than any other dimension • Contain marrow/medullary cavity • Located mostly in region of limbs • Functions: Aid in support, locomotion and prehension • E.g. Humerus, Radius-ulna, Metacarpal, Femur, Tibia-fibula, Metatarsal and Phalanges • Femur is the largest long bone • Elongated Long bones-Diminutive forms of long bones, are slender and long, but devoid of medullary cavity e.g. Ribs
Short	• Small bones of uniform dimensions • No marrow cavity • Mainly found in joints between two large bones • Functions: Increase mobility of joints and distribute pressure • E.g. Carpal and Tarsal bones
Flat	• Relatively thin and expanded in two dimensions • Functions: Protect vital organs and provide large area for muscle attachment • E.g. Scapula and Pelvic bones
Irregular	• Irregular in shape • Generally unpaired and located on median plane • Functions: Serve for protection, support and muscle attachment • E.g. Vertebrae
Pneumatic	• Contain air spaces or sinuses, which communicate with exterior • Bones of bird are light in weight due to presence of air spaces • E.g. long bones of birds
Sesamoid	• Small, sesame seed like short bones • Placed between bones and tendons • Function: Work as pulley to avoid friction • E.g.Patella (largest sesamoid bone in animal)
Visceral	• Bones developed in substance of visceral or soft organs • Function: Give support and rigidity to organs • E.g. Os cordis (heart of ox) and Os penis (penis of dog)

Syndesmology or Arthrology is branch of science deals with study of structure and functions of joints. Joints or articulations are structures formed by union of two or more articular ends of bones or cartilages. Joints are classified into three groups on the basis of structure and degree of mobility.

Joint Type	Characteristics
Fibrous or Synarthrodial	• Do not contain joint cavity • Immovable joints • United by fibrous tissues • E.g. Skull joints
Cartilaginous or Amphiarthrodial	• Do not contain joint cavity • Permit limited movements • United by cartilage • E.g. Pelvic symphysis
Synovial or Diarthrodial	• True joints • Movable joints • Contains joint cavity or articular cavity • Joint cavity is surrounded by joint capsule, which consists of an external fibrous layer and internal synovial membrane. • Synovial membrane secretes a lubricant fluid known as synovial fluid. • Articular cartilage covers surface of bone over joint and lessens concussion and friction • Ligaments bind to bones, which are placed around the joints • E.g. Knee and Hock joints

Vertebral Column Formula

Animal	Vertebrae				
	Cervical	Thoracic	Lumbar	Sacrum	Coccygeal
Cattle/Buffalo	C-7	T-13	L-6	S-5	Cy-18-20
Sheep	C-7	T-13	L-6	S-4	Cy-16-18
Goat	C-7	T-13	L-7	S-5	Cy-16-18
Horse	C-7	T-18	L-6	S-5	Cy-15-21
Camel	C-7	T-13	L-6	S-5	Cy-10-25
Pig	C-7	T-14-15	L-6-7	S-4	Cy-20-23
Dog	C-7	T-13	L-7	S-3	Cy-20-23
Cat	C-7	T-13	L-7	S-3	Cy-20-24
Fowl	C-13-14	T-7	LS-14	–	Cy-4-9
Rabbit	C-7	T-12-13	L-6-7	S-4	Cy-14-18

Restraining/ Handling of Farm Animals

Restraining is the process of manual or mechanical means to limit some or all of an animal's normal voluntary movement for the purposes of physical examination, collection of samples, drug administration, carrying out surgical procedures or manipulations.

Principles of animal handling

A general principle of animal handling is to avoid getting animal excited and thus, maintaining safety of animal handler. Working in close contact with dairy cattle is a necessary part of most of dairy operations.

Basics of animal behaviour in relation to handling

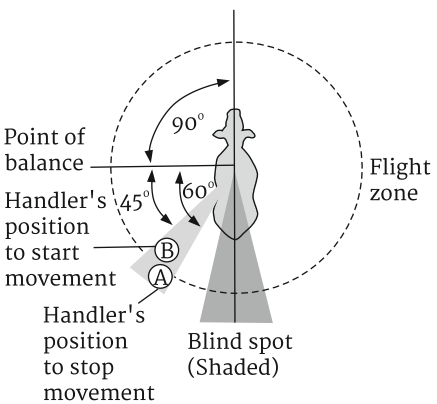
Reaction of animals to a stimulus is called behaviour. Understanding behaviour of animals and their relationship with humans has greatly contributed to easier handling.

Essential elements of animal handling

Although the area of animal behaviour and control is quite vast, an animal handler must be well conversant with the following three essential elements of animal behaviour and control *viz.* flight zone, blind spot and point of balance.

1. Flight zone: All animals have a flight zone, which is animal's personal space. Animal feels comfortable in this space. It is the minimum distance in which animal tries to maintain between itself and any perceived threat. Size of flight zone varies depending on how calm or aggressive the animal is. Cattle confined to a small space have a smaller flight zone than kept in a large area. Size of flight zone slowly diminishes when animals receive frequent gentle handling. An understanding of flight zone of animal can help handlers to reduce stress and prevent accidents.

2. Blind spot: It is necessary to remember that the area immediately behind tail of animals extending up to 15° on either side (*i.e.*, total 30°) is treated as 'blind spot', where animal cannot perceive handler. Hence, animals should never be approached in this area as it may get frightened and cause injury to handler.



3. Point of balance: It is another important concept of livestock handling. Farm animals have a wide

angle of vision. Point of balance is the imaginary point located on animal's shoulder, which divides animal's body into two portions, *i.e.*, front and rear portion. If handler crosses this hypothetical point in direction of front portion, animal generally moves backwards. However, if handler stays in rear portion, animal moves in forward direction.

Important aspects of livestock handling

While handling farm animals, following points must be taken into consideration:

- Never handle excited animals
- Proper handling techniques should be used
- Animals change behaviour due to stress
- Cattle are sensitive to contrasts
- Animals are frightened by high-pitched noises
- Animals remember bad experiences
- Must be aware of direction of kicking of different species

Approaching farm animals

Right way of approaching large animals e.g. cattle and buffalo is important for handling them safely. Following aspects need to be considered while approaching large animals.

- Before approaching an animal, ask attendant/owner whether animal is docile or furious.
- Never carry a stick when approaching an animal.
- If possible, approach preferably from left side.
- Most large animals kick in an arch beginning towards front and moving towards back. Avoid this kicking region while approaching animals.

Restraining of individual cattle and buffalo

Halters and ropes can be useful for handling cattle and for moving them. Soft rope or leather strap can be used for this purpose. Following precautions must be kept in mind while restraining animals.

- Cows are generally more nervous than other animals. Always announce your presence when approaching a cow and gently touch it. Avoid talk loudly.
- If a cow tends to kick, consider using a rope. Gentle cows can be dangerous while defending their calves.
- Special care is required for handling breeding bulls. Handler should never come in direct contact with a breeding bull.
- Cattle can be difficult to handle if forced them to act in ways that are not natural for them.

(A) Restraining of head region

For manual restraining grasp the bridge between nostrils with thumb and forefinger of one hand and hold it firmly. With other hand, hold the horn.

Besides this method, following tools are also commonly used for controlling head region of large animals.

Restraining head of a young cattle

1. **Bull nose ring:** It is fixed to nasal septum of bulls and used to restrain head region. It is made up of two semi-circular pieces of aluminium, copper or some alloy, which does not rust. Rope or bull holder is attached to bull nose ring to control bulls.

Bull nose ring fitted to nostril of bull

2. **Bull holder:** It is a wooden pole fitted with metal structure, which entraps the bull nose ring to control bull.

Bull holder

3. **Bull nose leader:** It is used if examination of animal is likely to be prolonged or if animal is restive. The swivel allows animal to turn and twist its head without twisting operator's wrist. The ring is used as a handle. The finger-like structure can be separated and inserted into the two nostrils of a bull and then closed tight.

Bull nose leader and muzzle cover

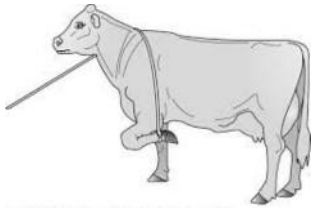
4. **Muzzle cover:** It is made of rope, string, bamboo splits and wire netting or leather straps and used to envelope mouth of animals to prevent them from biting and overeating.

Wooden mouth gag

5. **Mouth gags:** Used for keeping two jaws of cattle open for examination of mouth. One gag is used for right jaw and other for left jaw.

(B) Restraining of foreleg

Foreleg of cattle is raised and held off the ground for examination or treatment. Raising foreleg also helps in controlling movement of animals and hinder their kicking with hind leg.



Restraining of foreleg

(C) Restraining of hind leg

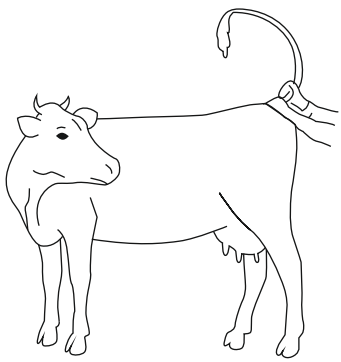
Raising of hind leg off the ground and holding it in that position facilitates examination or treatment of animal. It is particularly useful for treatment of hooves.

Anti-kicker and Milker's knot are used to prevent animal from kicking during examination of udder and teats while milking or examination of hind region in case of mastitis and udder swelling. In an anti-kicker, two metal spring clips connected by a chain are used.

Anti-kicker and Milker's knot

(D) Restraining of tail

It is done to divert animal's attention. For this purpose, restrainer have to stand on side of cow to avoid being kicked. Both hands to be kept close to base of tail as much as possible and grip should be gentle but firm. Restraining of tail is required to distract cattle's attention from another part of its body on which some operation is being done.



Restraining of tail

Casting of Whole Animal

It means making animal fall on ground.

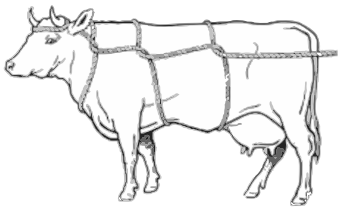
Purposes: For surgical operations, hoof trimming, etc. to prevent accidents during handling.

Casting pit should be set up to avoid injury during casting, which is a circular area of about 8 metres in diameter and filled with bedding materials like sand, wheat straw, saw dust, etc. Sharp or piercing objects are never kept in casting pit. Before casting, animal should be kept on fasting for 12 hours to prevent injury to distended digestive organs. Casting of pregnant animals must be avoided. Following two methods are used for casting of large animals.

1. Reuff's method

Most common and efficient method. For this method, around 30 feet of rope is required to carry out following steps for casting:

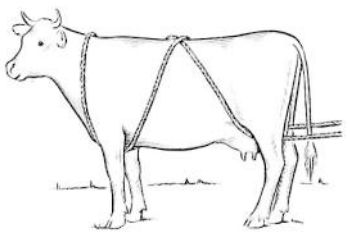
- Make a loop around animal's neck using a bowline knot.
- Throw the end of the rope over animal's back to opposite side.
- Pick the rope from under the animal, bring it around its body and near bowline to form a half hitch just behind shoulder.
- By tossing the end over animal's back, make another half hitch just in front of udder (or scrotum in case of male cattle).
- Gently pull the rope to cast the animal.



Reuff's method of Casting

2. Burley method

- In this method, the rope is divided into two equal parts.
- Middle portion of rope is placed on upper side of animal's neck and free ends of rope are crossed under neck.
- Then both free ends of rope pass between the front legs in backward direction on either side of animal.
- Each free end of rope then crosses over back of animal and subsequently passes through area between udder or scrotum (in case of males) and hind legs.
- When the rope is pulled in backward direction, animal is cast to ground.



Burley method of casting

Some equipment used for restraining farm animals

Halter: Halter made of rope or leather can be used for farm animals. A one and half cm thick and 3 to 4 metres long rope is used for preparation of the loop.

Trevis: It is used for handling animals for longer duration. It is a fixed structure constructed with steel pipes.

Halter

Trevis

Safe practices in animal handling

- Restrainer ensures personal safety by observing following practices.
- Important protective equipment are gloves, apron, gumboots and mask.
- A rigid protective helmet is also worn when required.
- Wear rubber gloves when working with sick and injured animals as well as other protective clothing.
- Observe personal hygiene by washing hands and face after handling animals.

Apron

Gloves

Mask

Gumboots

Cattle and Buffalo Breeds

Breed	Synonyms	Origin and Distribution	Skin Colour	Characteristics
Indigenous Cattle Breeds				
Gir	Kathiawari, Sorthi and Bhodali	Gir forests of Gujarat and also found in Maharashtra and Rajasthan	White with dark red or chocolate-brown patches or sometimes black or purely red	**Longest lactation period** (325 days) among Indigenous cattle. Horns are peculiarly curved, giving a **"half-moon" appearance**. Known for its hardiness and disease resistance. Milk yield ranges from 1200 to 1800 kg per lactation.
Red Sindhi	Red Karachi, Sindhi and Mahi	Karachi and Hyderabad of Pakistan regions Also reared in certain organized farms in India	Red with shades varying from dark red to light, strips of white	Bullocks despite lethargic and slow can be used for road and fieldwork. Milk yield ranges from 1250 to 1800 kg per lactation.
Sahiwal	Lola (loose skin), Lambi Bar, Montgomery, Multani and Teli	Indian states of Punjab, Haryana and Rajasthan	Reddish dun or pale red in colour, sometimes flashed with white patches	**Best indigenous dairy breed**. Heavy breed with symmetrical body having loose skin. Average milk yield is between 1400 to 2500 kg per lactation.

Breed	Synonyms	Origin and Distribution	Skin Colour	Characteristics
Hallikar	Mysore	Mysore, Mandya, Bangalore, Kolar, Tumkur, Hassan and Chitradurga districts of Karnataka	White to light grey	**Best draught breed of South India**. Best known for its draught capacity and especially for its trotting ability.
Amritmahal	Doddadana, Jawari Dana and Number Dana	Hassan, Tamkur, Shimoga, Chikmangalur and Chitradurga district of Karnataka	Usually grey but varies from white to almost black	Muzzle, feet and tail are usually black. Horns are long and end in sharp black points.
Khillari	Mandeshi, Shikari and Thillar	Solapur and Satara districts of Maharashtra	Grey-white	Long horns turn forwards in a peculiar fashion. Horns are generally black, sometimes pinkish. Bullocks are fast and powerful.
Kangayam	Kongu and Konganad	Kongu Nadu, the region surrounding Coimbatore district of Tamil Nadu	Bulls are grey with dark colour in hump, fore and hindquarters Cows are grey or white	Horns are spread apart, nearly straight with a slight curve backwards. Eyes are dark and prominent with black rings around them. Moderate size with compact bodies.

Breed	Synonyms	Origin and Distribution	Skin Colour	Characteristics
Umblachery	Jathi madu, Mottai madu, Molai madu and Therkathi madu	Thanjavur, Thiruvarur and Nagappattinam districts of Tamil Nadu	Calves are generally red or brown at birth with all the characteristic white markings on face, limbs and tail. Legs have white markings below hocks like socks.	Suitable for wet ploughing and known for their strength and sturdiness. The practice of dehorning of bullocks is peculiar in this cattle.
Pulikulam	Jallikattu madu, Kidai madu and Sentharai	Cumbum valley of Madurai district in Tamil Nadu	Grey or dark grey. Presence of reddish or brownish spots in muzzle, eyes, switch and back is the characteristic feature of this breed.	Small in size. Well-developed hump. Mainly used for penning in field. Useful for ploughing. Typical backward curving horns. Breeds are active, useful draught animals but not fast trotter.
Tharparkar	White Sindhi, Gray Sindhi and Thari	Tharparkar district (Pakistan) of undivided India and also found in Rajasthan	White or light grey	**Highest disease resistant cattle breed**. Medium sized, compact and have lyre-shaped horn. Bullocks are quite suitable for ploughing and casting. Cows yield 1800 to 2600 kg of milk per lactation.

Breed	Synonyms	Origin and Distribution	Skin Colour	Characteristics
Kankrej	Wadad or Waged and Wadhiar	Southeast Rann of Kutch of Gujarat and adjoining Rajasthan (Barmer and Jodhpur district)	Silver-grey to iron-grey or steel black	Horns are lyre-shaped. Gait is peculiar called as 1 ¼ paces (**Sawai chal**). It is valued for powerful and fast draught cattle. Useful in ploughing and carting. Cows are good milkers, yielding about 1400 kg per lactation.
Ongole	Nellore	Ongole taluka in Guntur district of Andhra Pradesh	White	**Cattle with pure white colour**. Large muscular breed with a well-developed hump. Suitable for heavy draught work. Average milk yield is 1000 kg per lactation.
Deoni	Dongerpati, Dongari, Wannera and Shevera	Marathwada region of Maharashtra	Spotted black and white	Bullocks are suitable for heavy cultivation. Milk yield ranges from 636 to 1230 kg per lactation.

Breed	Synonyms	Origin and Distribution	Skin Colour	Characteristics
Hariana	Hansi	Rohtak, Hisar, Jind and Gurgaon districts of Haryana and also popular in Punjab, UP and parts of MP	White or light grey	**Best dual purpose breed**. Cows are fair milkers yielding 600 to 800 kg of milk per lactation.
Krishna Valley	Kistna Valley	Black cotton soil of the water shed of river Krishna as Belgaum, Raichur district of Karnataka and Satara, Sangali and Solapur district of Maharashtra	White with a darker shade on fore-quarters and hind-quarters in male and adult females are more whitish in appearance	Large, having a massive frame with deep, loosely built short body. Tail almost reaches the ground. Bullocks are powerful and useful for slow ploughing. The average yield is about 900 kg per lactation.

Breed	Synonyms	Origin and Distribution	Skin Colour	Characteristics
Exotic Cattle Breeds				
Jersey	–	Jersey Island, United Kingdom	Reddish fawn	**Longest lactation period among cattle (365 days)**. **Highest milk fat among cattle (5.5%)**. Widely used in cross breeding. Average milk yield is 4500 kg per lactation.
Holstein Friesian	–	North Holland and Friesland in Netherlands	Typical marking of black and white	**Largest dairy cattle breed and Highest milk producer cattle in world (6150 kg/ Lactation).** Lowest milk fat among cattle (3.4%).
Brown Swiss	Braunvieh cattle	Mountainous region of Switzerland	Light brown with a creamy white muzzle and dark nose, dark-blue eye pigmentation	**Highest milk lactose (5%)**. Average milk yield is 5000 kg per lactation.
Red Dane	Red Danish	Denmark	Red, Reddish brown or Dark brown	A heavy breed. Lactation yield varies from 3000 - 4000 kg.

Breed	Synonyms	Origin and Distribution	Skin Colour	Characteristics
Ayrshire	Dunlop cattle or Cunningh am cattle	Scotland	Pure white to nearly all cherry red or brown	**Most beautiful dairy breed**. Less milk fat (only 4%).
Guernsey	-	Small island of Guernsey in France	Cherry red to brown	**Golden colour milk** due to an exceptionally high content of beta carotene. Produce around 6000 kg per lactation. High efficiency of milk production, low incidence of calving difficulty and longevity.
Buffalo Breeds				
Murrah	Kundi Kali and Kunni	Rohtak, Hisar and Sind of Haryana, Nabha and Patiala districts of Punjab and southern parts of Delhi	Jet black with white markings on tail, face and extremities	**Tightly curved horn. Highest milk producers in India**. Average fat varies from 7-8%. Average lactation yield is varying from 1500 - 2500 kg per lactation. Use for grading up of inferior local buffaloes.

Breed	Synonyms	Origin and Distribution	Skin Colour	Characteristics
Surti	Deccani, Gujarati, Talabda, Charator and Nadiadi	Kaira and Baroda district of Gujarat	Rusty brown to silver-grey	**Horns are sickle shaped**, moderately long and flat. Peculiarity of the breed is two white collars, one round the jaw and the other at brisket region. Milk yield ranges from 1000 - 1300 kg per lactation. Another peculiarity is very high fat percentage in milk (8-12%).
Jaffarabadi	Bhavnagri and Jaffari	Gir forests, Kutch and Jamnagar districts of Gujarat. Mostly maintained by traditional breeders called Maldharis, who are nomads.	Predominantly black with a sparse coat of coarse brown hair	**Heaviest Indian buffalo breed**. Horns are heavy, inclined to droop at each side of neck and then turning up at point (**drooping horns**). Average milk yield is 1000 - 1200 kg per lactation. Bullocks are heavy and used for ploughing and carting.

Breed	Synonyms	Origin and Distribution	Skin Colour	Characteristics
Bhadawari	Etawah	A dual purpose buffalo breed of central and northern India (Agra and Etawah district of Uttar Pradesh and Gwalior district of Madhya Pradesh)	Light or copper coloured. Eyelids are generally copper or light brown colour. Two white lines 'Chevron' are present at lower side of neck.	**Highest milk fat (14) % in buffalo**. Medium sized buffalo. Average milk yield is 800 to 1000 kg per lactation. Wedge shaped body. Bullocks are good draught animal with high heat tolerance.
Nili Ravi	Panch Kalyani	Around the river Ravi. Sutlej valley in Ferozpur district of Punjab and in Sahiwal (Pakistan) of undivided India	Black-brown and white markings on forehead, muzzle, face, leg and tail	Peculiarity of the breed is the walleyes. Head is small, elongated, bulging at top and depressed between eyes. Horns are very small and tightly coiled. Bullocks are good for heavy trotting work. Milk yield is 1500-1850 kg per lactation.
Mehsana	Mehsani	Mehsana districts in Gujarat and adjoining Maharashtra state	Black but sometime black-brown or brown	The breed is evolved out of **crossbreeding between Surti and Murrah.** Milk yield is 1200-1500 kg per lactation.

Breed	Synonyms	Origin and Distribution	Skin Colour	Characteristics
Nagpuri	Ellichpuri, Berari, Varhadi and Arvi	Nagpur, Akola and Amrawati districts of Maharashtra	Black with white patches on face, legs and tail	Horns are long, flat and curved, bending backward on each side of back. (**Sword shaped horns**). Bullocks can be used for heavy work. Milk yield ranges from 700 - 1200 kg per lactation.
Toda	-	Ancient tribe, Toda of Nilgiri Hills of south India	Fawn and Ash-grey	**Most violent buffalo breed**. Horns are set wide apart curving inward, outward and forward forming a characteristic crescent shape. Average milk yield is 500 kg per lactation with high fat content of 8%.

Indigenous Cattle Breeds

Gir

Red Sindhi

Sahiwal

Hallikar

Tharparkar

Khillar

Pulikulam

Kankrej

Deoni

Hariana

Krishna Valley

Ongole

Exotic Cattle Breeds

Jersey

Holstein Friesian

Brown Swiss

Red Dane

Ayrshire

Guernsey

Buffalo Breeds

Murrah

Surti

Bhadawari

Jaffarabadi

Nili Ravi

Mehsana

Nagpuri

Toda

Sheep and Goat Breeds

Breed	Synonym	Origin and Distribution	Skin Colour	Characteristics
Indigenous Sheep Breeds				
Mecheri	Maiylambadi and Thuvaram chambali	Salem, Karur, Namakkal, and fewer parts of Dharmapuri districts of Tamil Nadu	Pale purplish	Meat purpose breed. No horns for both sexes. Tail is smaller and slender. Average body weight of adult male is 36 kg and adult female is 22 kg.
Chokla	Shekhawati, Chhappar, Raata munda	Sikar, Churu and Jhunjhunu (Rajasthan)	White, face colour is dark tan, which may extend up to neck.	Roman nose/ Parrot mouth appearance. Also known as "**Merino of Rajasthan**". Well known for carpet quality wool production.
Chennai Red	Kattupakkam Red or Madaras Red	Chennai, Kancheepuram, Villupuram, Thiruvannamalai districts of Tamil Nadu	Red, certain animals have coloured stripes on their forehead	Meat purpose breed. Average body weight of adult male is 36 kg and adult female is 24 kg.

Breed	Synonyms	Origin and Distribution	Skin Colour	Characteristics
Ramnad White	Kilakathai Adu	Ramanathapuram, Sivagangai, and Virudhunagar districts of Tamil Nadu	White, certain hold black coloured stripes all over the body	Medium sized body. Adult males have bent horns, whereas females don't have horns. Average body weight of adult male is 31 kg and adult female is 23 kg.
Keezhakaraisal	Kalikarsal	Sivagangai and Thirunelveli districts of Tamil Nadu	Black red, Black coloured bands are found on the skin in the regions of head, stomach and legs.	Meat purpose breed. Medium sized body. Tail is smaller and slender. Adult male are found with stronger coiled horns. Majority are found with wattle, under the jaw/throat. Average body weight of adult male is 29 kg and adult female is 22 kg.

Breed	Synonyms	Origin and Distribution	Skin Colour	Characteristics
Vembur	Karan dhai and Pottu aadu	Vembur, Melakarandhai, Keezha karandhai, Nagalapuram regions, Tuticorin and Virudhunagar districts of Tamil Nadu	White colour skin with red colour spots over their body	Meat purpose breed. These are taller breeds. Ears are drooped out. Tail is smaller and slender. Adult males are found with horns and absence of horns in females. Average body weight of adult male is 35 kg and adult female is 28 kg.
Nilgiri	–	Hilly region of Nilgiri district in Tamil Nadu	White	Wool purpose breed. Medium weighed sheep. Ears are broad and drooped out. Females are without horns. Average body weight of adult male and female are of 31 kg.

Breed	Synonyms	Origin and Distribution	Skin Colour	Characteristics
Tiruchy Black	Triruchy Karunguru mbai	Tiruchirapalli, Perambalur, Dharmapuri and Salem districts of Tamil Nadu	Black	Wool purpose breed. These are smaller breeds. Adult males are found with horns and females without horns. Ears are smaller, facing forward and downwards. Average body weight of adult male is 26 kg and female is 19 kg.
Coimbatore	Kurumbai	Coimbatore and Madurai district of Tamil Nadu	White colour, with black or purple coloured bands, seen over the regions of head and neck	Wool purpose breed. Medium weighed sheep. 30% of adult females are free of horns. Average body weight of adult male is 25 kg and female is 20 kg.
Deccani	Nalla Gorre and Black Sheep	Deccan plateau of Telangana, Northern Karnataka, Maharashtra, and parts of Northern Tamil Nadu	Possesses a coloured fleece, black and grey colours being more dominant	Dual purpose breed produced for mutton and wool. Only pure black coarse wool breed in India. Average annual yield of wool is 4.54 kg per sheep. Flocks are maintained mostly for mutton.

Breed	Synonyms	Origin and Distribution	Skin Colour	Characteristics
Nellore	Palla, Jodipi and Dora	Nellore, Prakasam and Ongole districts of Andhra Pradesh	Fawn or deep red-fawn coat. White with light brown spots on head, neck, back and legs	**Tallest breed of sheep in India**, resembling goats in appearance known as "**goat like sheep**". It has long face and long and drooping ears with the body densely covered with short hair. Rams are homed and ewes are polled. Males have average body weight of 36 kg and female have 28 kg.
Mandya	Bandur and Bannur	Mandya district of Karnataka	White - sometimes face is light brown which may extend up to neck.	Best mutton type. Smallest sheep breed. Ears long, leafy and drooping. Both sexes polled. Coat extremely coarse and hairy. Adult male weighs 35 kg and adult female weighs 23 kg.

Breed	Synonyms	Origin and Distribution	Skin Colour	Characteristics
Marwari	Malpura	Marwar region of South-Western Rajasthan	White body with black face	**Triple purpose Sheep breed of India**. **Highest disease resistant**. Hardy, yielding coarser carpet variety white wool of a mixed hairy composition. Yield of wool per year is 0.90-1.81 kg per animal.
Gaddi	Bhadarwah	Kishtwar and Bhadarwah tehsils of Jammu. Kullu and Kangra valleys in HP in winter and in summer they graze the highest elevations.	Uncoloured and white. Occasionally, can be found mixed tan, brown and black.	Very sturdy and very good climber. Rams are horned, ewes hornless; fleece is generally white with brown coloured hair on face. Wool is fine and lustrous; average annual yield is 1.13 kg per sheep, clipped thrice a year. Undercoat is used for manufacture of **high quality Kullu shawls and blankets**.

Breed	Synonyms	Origin and Distribution	Skin Colour	Characteristics
Exotic Sheep Breeds				
Dorset	—	Native of United Kingdom	White	Polled and horned. Face, ears and legs free from wool. Wool yields 2.75 to 3.25 kg. Produce mutton of superior quality. Rams weight 80-110 kg and ewes weigh 50-80 kg.
Suffolk	Blackfaces, Southdon-Norfolks	England	Black face, ears and legs	**Best mutton breed**. Ewes are very prolific and excellent milkers. Both rams and ewes are polled though rams sometimes have scurs. Average wool yield is 2-3 kg. Rams weigh 100-135 kg and ewes 70-100 kg.
Merino	—	Spain	White	**Most popular fine wool breed**. Rams have spiral horns and ewes are hornless.

Breed	Synonyms	Origin and Distribution	Skin Colour	Characteristics
Rambouillet	Rambouillet Merino, French Merino	France	White hair around the nose and ears	Produces excellent fine-wool fleece. The fleece is heavy, close, compact, covering most of the body including face and legs. Rams weigh as much as 125 kg and ewes up to 90 kg.
Cheviot	–	Scotland	Clean white face and white legs, covered with short white hair. Nose, lips and feet are black.	Medium wool breed. It is small with erect ears. Rams weigh an average up to 80 kg and ewes up to 55 kg.
Karakul	–	Uzbekistan (Central Asia)	Most sheep are born black and fade to grey as they mature.	**Best pelt (good quality fur)** producing breed. Adult ram is 65 kg and ewe is 46 kg.

Breed	Synonyms	Origin and Distribution	Skin Colour	Characteristics
Indigenous Goat Breeds				
Jamunapari	The Pride Goat of India	Etawah district of Uttar Pradesh	White with tan or black markings at neck and ears	**Largest and most majestic goat breed of India**. Pronounced Roman nose having a tuft of hair, which gives **Parrot mouth appearance**. Beard in both sexes; have tuft of long hairs on buttocks. Adult male weighs 65- 80 kg and female 45- 60 kg. **Highest milk producing goat breeds of India** with ability to yield 2- 2.5 kg of milk per day with 3- 3.5% fat.
Beetal	Lahori	Punjab region	Predominantly black or brown with white spots of disturbing size	Adults mainly for milk and meat. Males usually possess beard. Adult male weighs between 50 to 70 kg and female between 40 to 50 kg.

Breed	Synonyms	Origin and Distribution	Skin Colour	Characteristics
Barbari	Bari, Wadi Bari, Titri Bari, Thori Bari, Sai Bari	Popular in urban areas of Delhi, Uttar Pradesh, Gurgaon, Karnal, Panipat and Rohtak in Haryana state	White with light brown patches	Short haired and erect-horned goat. Generally found in cities also known as **"City breed"**. Adult male weighs between 35 kg to 45 kg and female between 25 kg to 35 kg. **Indian goat with maximum milk fat (5%)**. They are usually stall-fed.
Tellicherry	Malabari	Malabar district of Kerala	White, purple and black colours	Adults mostly for meat purpose. Adult male weights from 40 to 50 kg and female from 30 to 40 kg. They have better reproductive capabilities.

Breed	Synonyms	Origin and Distribution	Skin Colour	Characteristics
Sirohi	Devgarhi, Parbatsari, and Ajmeri	Sirohi district of Rajasthan	Brown, white, and admixture of colours in typical patches	**Dual purpose breed**. Coarse and short hair. Compact and medium sized body. Tail twisted and carries coarse pointed hair. Horns are small and pointed, curved upward and backward. Average body weight of buck is 50 kg and doe is 23 kg.
Black Bengal	Khasi goat	Bangladesh, West Bengal, Assam, and Odisha	Black, brown/grey and white with soft, glossy and short hairs	**Best chevon breed of India**. **Highly prolific breed of India**. Average live weight of buck is 15 kg and doe is 12 kg. Most prolific among the Indian breeds. Multiple births are common. Its skin has great demand for high quality shoe-making.

Breed	Synonyms	Origin and Distribution	Skin Colour	Characteristics
Chegu	Pashmina goat	Lahaul-Spiti and Kinnaur in Himachal Pradesh and high altitude areas of Uttarkashi and Chamoli	Predominantly white but greyish red and mixed colours are also seen.	Average live weight of buck is 39 kg and doe is 26 kg.
Changthangi	Changra locally and Pashmina goat internationally	Changthang region of Leh district in Jammu and Kashmir	Predominantly white and the rest are brown, grey and black and white/grey undercoat.	Yields warm delicate fibre – pashmina used for making **high quality Kashmiri "Rugs or Shawl"**. Horns are large upward and inward forming a semi-circular ring. Average live weight of buck is 20 kg and doe is 20 kg.
Osmanabadi	Farmer's true breed. Also known as Deccani	Osmanabad/ Dharashiv district (Maharashtra)	Predominantly black; white, brown and spot can be seen.	Tall and large sized body and legs. It has good quality meat.

Breed	Synonyms	Origin and Distribution	Skin Colour	Characteristics
Exotic Goat Breeds				
Saanen	–	Switzerland	White or light cream in colour	Also known as **"Milk queen"**, as highest milk producing goat breed. Adult male weigh up to 85 kg and female up to 60 kg.
Angora	–	Turkey	A prominent feature of this breed is the coat colour variation, which can be dark to light brown, black, grey, or white.	**"Mohair"**(white soft silky hairs) producing breed of goat. Also known as **"Sheep like goat"**.
Anglo-Nubian	–	England	Black, red or tan are the most common colours	Roman nose, also known as **"Jersey of goat"**. Most outstanding dual purpose goat breed. Adult male weigh up to 140 kg and female up to 110 kg.

Indigenous Sheep Breeds

Mecheri

Chennai Red

Ramanadhapuram White

Keezhakaraisal

Vembur

Nilagiri

Trichy Black

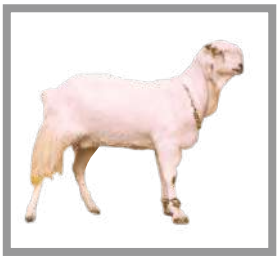
Coimbatore

Deccani

Nellore

Mandya

Indigenous Goat Breeds



Jamunapari

Beetal

Barbari

Tellicherry

Sirohi

Osmanabadi

Black Bengal

Chegu

Changthangi

Exotic Sheep Breeds

Rambouillet

Cheviot

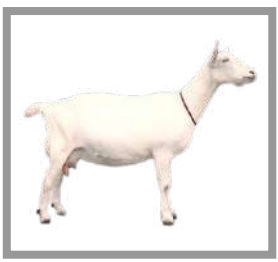
Merino

Dorset

Suffolk

Karakul

Exotic Goat Breeds



Black Bengal Chegu

Anglo-Nubian

Angora

Section – III
Veterinary Physiology

Physiological Parameters

Animal	Temperature		Heart Rate (beats/minute)	Respiratory Rate (breaths/minute)
	°F ± 1	°C ± 0.5		
Cattle	101.5	38.5	45–60	15–35
Buffalo	99–102	38.2	40–60	22–28
Sheep	102.3	39.1	60–70	20–34
Goat	102.3	39.1	60–70	20–30
Horse	100	37.8	23–70	10–14
Camel	95–101.5	35–38.6	25–32	10–15
Dog	99.5–101.5	37.5–38.0	70–90	15–25
Cat	101.5	38.6	110–140	20–30
Poultry	107.1	41.7	130–160	15–30
Pig	102.5	39.2	55–86	8–18
Rabbit	103.1	39.5	123–304	39

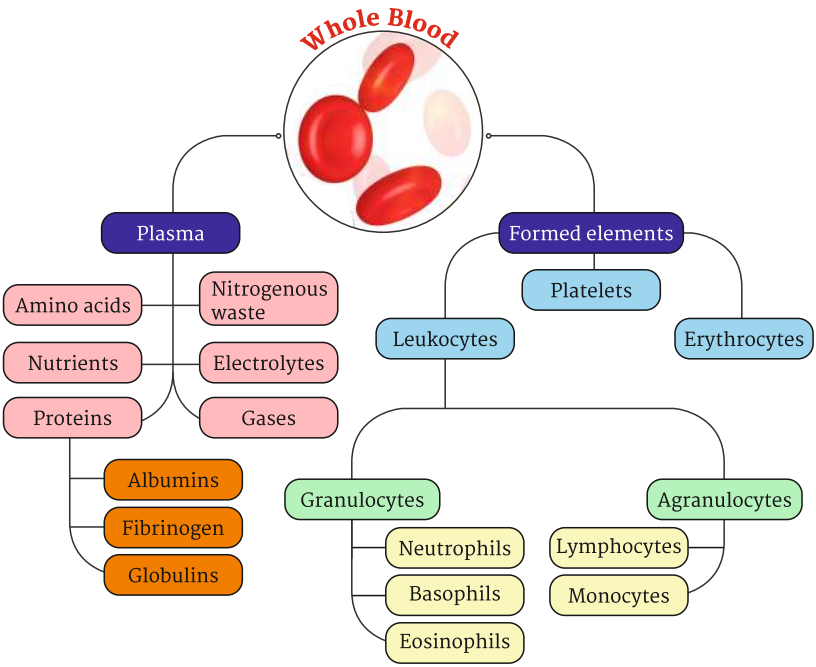
Water Intake and Output

Animal	Water Consumption (litre per day)	Urine Output (ml/kg b.wt./day)
Milking cows	38–110	17–45
Dry cows	22–66	12–30
Calves (1–4 months)	4–7	8–15
Sheep and Goat	4–5	10–40
Horse	30–45	3–18
Dog	60–80	20–40
Cat	40–60	20–40
Chicken	0.2–0.4	20–40
Pig	5 – 9	5–30

Types of Stomach in Animals

Types of Animals	Rumination	Stomach (No. of chambers)	Examples
Ruminants	Yes	4	Cattle, Buffalo, Sheep, Goat, Deer, Mithun, Giraffe, Yak, Nilgai
Pseudo-ruminants	Yes	3 (Omasum absent)	Hippopotamus, Camel, Llama
Non- ruminants/ Monogastric	No	1	Horse, Donkey, Pig, Dog, Cat, Zebra, Rabbit, Elephant

Blood Composition



Blood Volume

Animal	Blood Volume (% b. wt.)
Cattle	7.7
Buffalo	9-13.5
Sheep	8
Goat	7
Horse	9.7
Camel	8.3
Dog	8
Cat	6.5
Fowl	6-8
Pig	6.75
Rabbit	5.5

Blood Collection Site with Needle Size for Different Species

Animal	Site	Needle Size	
		Gauge	Length (Inches)
Cattle, Buffalo, Horse and Camel	Jugular vein	16-18	1.5-2
Sheep and Goat	Jugular vein	18-20	1.5-2
Dog	Cephalic, saphenous or jugular vein	20-22	1.5
Cat	Cephalic or jugular vein	22-24	1
Fowl	Wing vein or cardiac puncture	20-22	1-1.5
Pig	Anterior vena cava or ear vein	20	1.5-4
Rabbit	Cardiac puncture	19-21	1.5-2

Anticoagulants

Anticoagulant	Mode of Action (MOA)	Amount Required/ 10 ml blood	Advantages
Sodium citrate 3.8%	Binds more calcium in reagent leading to reduced concentration of calcium ions required for in vitro activation of clotting mechanism.	1 ml	• Used mainly for prothrombin time estimation. • Good for blood transfusion.
EDTA 1%	It forms insoluble calcium salt. EDTA acts as a chelating agent that takes up Ca++ ions	1 ml	• Excellent for routine haematology. • Preserve cellular material better than heparin and oxalates. • Useful for blood morphological studies.
Heparin 1%	Anti-thrombin and anti-thromboplastin	0.1 ml	• Useful for blood gas analysis, BUN and electrolytes.
Heller's and Paul's oxalate mixture (Ammonium oxalate 1.2 g and Potassium oxalate 0.8 g in 100 ml distilled water)	Forms insoluble calcium oxalates	1 ml	• Produce less distortion, haemolysis of blood cell than other oxalates. • Good for haematological studies.

Hematological and Biochemical Parameters

Parameters	Cattle	Buffalo	Sheep	Goat	Dog	Cat
Hematological Parameters						
Hb (g/dL)	8–15	9–15	9–15	8–12	12–18	10–15
PCV (%)	24–46	30–36	27–45	22–38	37–55	30–45
TEC (10^6/ µl)	5–10	5–7.3	8–16	8–18	5.5–9.5	5–10
TLC (10^3/ µl)	4–12	5–10	4–12	4–13	6–17	5.5–19.5
Neutrophils	25–45	25–35	25–50	25–50	60–77	45–64
Lymphocytes	45–75	45–65	40–75	40–75	12–30	27–36
Monocytes	2–7	3–10	0–6	0–6	3–10	0–5
Eosinophils	2–20	2–4	0–10	0–10	2–10	0–4
Basophils	0–2	0–2	0–3	0–2	0–1	0–1
MCV (μ^3)	40–60	56	28–40	16–25	66–77	39–55
MCH (pg)	11–17	19.2	8–12	5–8	21–26	13–17
MCHC (pg)%	30–36	34.1	31–34	30–36	32–36	30–36
Platelet count ($\times 10^3$/µl)	100– 800	160–300	211– 621	450–550	175–500	300– 800
Biochemical Parameters						
Glucose (mg/dL)	40–80	50–70	40–80	50–75	70–120	60–120
Total Protein (g/dL)	6.2–8.2	6–8	5.9–7.8	6.1–7.4	5.7–7.8	5.7–8
Albumin (g/dL)	2.8–3.9	3.12–4.54	2.7–3.7	2.7–3.9	2.3–3.1	2.8–3.9
Globulin (g/dL)	3–3.5	3.55–6.25	3.5–5.7	2.7–4.4	2.7–4.4	2.6–5.1
SGOT /AST (IU/L)	60–125	79	60–280	167–513	13–15	7–29
SGPT /ALT (IU/L)	6.9–35.3	16	26–34	6–19	10–109	25–97
Alkaline Phosphatase (IU/ L)	17.5–152.7	2.45	68–387	93–387	1–114	0–45
BUN (mg/dL)	10–25	5.6–7.8	8–20	10–20	10–30	19–34
Creatinine (mg/dL)	0.5–2.2	1–2	1–2	0.9–1.82	0.5–1.7	0.9–2.2
ALP (U/L)	0–488	44.5–311.5	5–131	83–98	20–200	10–50
Amylase (U/L)	14–50	–	219–1125	–	322–1310	100–1200
Lipase (U/L)	5–13	–	77–695	–	15–228	7–23
Creatine kinase (U/L)	88–292	47–287.5	59–895	116–464	64–314	20–400
GGT (U/L)	6–17.4	13–55	20–52	20–56	0–10	1–10
Calcium (mg/dL)	8– 11.4	8.55–13.4	9.1– 11.7	9.5–10.5	8–9	8.7– 11.7
Chloride (mEq/L)	97–111	–	110– 124	105–120	106–114	115– 130
Cholesterol (mg/dL)	80–120	43.5–113.5	52–76	80–130	120–270	71– 156
Magnesium (mg/dL)	1.5– 2.9	–	1.6– 2.4	2.5–3.5	1.9–2.5	1.7– 2.6
Osmolality (mOsm/L)	–	–	277–311	–	290–310	299–330
Phosphorus (mg/dL)	5.6– 8	–	2.9– 5.3	3.8–17.6	2.5–6	3– 6.1
Potassium (mEq/L)	3.6– 4.9	2.85–6.65	3.9– 5.1	3.9–6.3	3.5–5.5	3.7– 6.1
Sodium (mEq/L)	132–152	122.5–174.0	139–154	135–154	144–151	145–158

Measuring Instruments of Physiological Parameters

Parameter	Measuring Instruments
Blood pressure	Sphygmomanometer
Lung volume and capacities	Spirometer
Intra ocular pressure	Tonometer

Endocrine Gland, Hormones, Target Organs and their Functions

Endocrine Gland	Hormone	Target Organ	Functions
Hypothalamus	GnRH, GHRH, TRH	Anterior pituitary	Regulate secretion of anterior pituitary hormones
Anterior pituitary	FSH, LH, TSH, ACTH	Other endocrine glands and organs	Stimulate secretions of other hormones
Posterior pituitary	Oxytocin	Mammary gland and uterus	Milk ejection and contraction of uterus
	ADH (Anti diuretic hormone)	Kidney and blood vessels	Water re-absorption and vasoconstriction
Thyroid gland	T_3 and T_4	Most organs	Promotes growth and development, stimulates BMR, increase heart rate and respiration
	Calcitonin	Bone	Decrease blood calcium level and bone mineralisation
Parathyroid gland	Parathyroid hormone (PTH)	Bone, small intestine and kidney	Increase blood calcium level

Endocrine Gland	Hormone	Target Organ	Functions
Adrenal cortex	Aldosterone	Kidney	Re-absorption of Na^+ from renal tubules and secretion of K^+ and H^+ into renal tubule
	Cortisol	Liver and skeletal muscles	Influence glucose metabolism
Adrenal medulla	Catecholamine	Heart, bronchioles and blood vessels	Causes sympathetic actions
Pancreas	Glucagon	Liver and adipose tissue	Increase blood glucose level
	Insulin	Many organs	Decrease blood glucose level
Pineal gland	Melatonin	Hypothalamus and anterior pituitary	Affects secretion of gonadotropins
Ovary	Estradiol and Progesterone	Female reproductive tract and mammary gland	Growth and development of female reproductive system, promotes secondary sex characteristics, maintenance of pregnancy, development of mammary gland
Testis	Testosterone	Male reproductive tract	Growth and development of male reproductive system, promotes secondary sex characteristics
Adipose tissue	Leptin	Hypothalamus	Energy homeostasis by supressing appetite
Heart	ANP (Atria natriuretic peptide)	Kidney	Promote excretions of Na^+ in urine

Endocrine Gland	Hormone	Target Organ	Functions
Small intestine	Secretion and cholecystokinin	Stomach, gall bladder and pancreas	Inhibit gastric motility and emptying, pancreatic enzyme and bicarbonate ion secretion into duodenum, contraction of gall bladder to release bile
Kidney	Erythropoietin	Bone marrow	Stimulate RBC production
	Calcitriol	Bone and Small intestine	Calcium reabsorption from intestine and bone mineralisation
Liver	IGF I (Insulin-like growth factor I)	Bone and cartilage	Stimulate bone and cartilage growth and development
Stomach	Gastrin	Stomach	Stimulate gastric acid secretion
Thymus	Thymosin	Lymph node	Proliferation of T- lymphocyte

Diuretics

Major Diuretics	Site of Action	Mechanism of Action
Osmotic diuretic (Mannitol)	PCT (Proximal Convoluted Tubule)	Inhibit water and solute re-absorption increasing osmolarity of tubular fluid
Loop diuretic (Furosemide)	Ascending LH (Loop of Henle)	Inhibit Na^+ K^+ Cl^- co-transport in luminal membrane
Thiazide diuretic	Early DCT (Distal Convoluted Tubule)	Inhibit Na^+ Cl^- co-transport in luminal membrane
Carbonic anhydrase inhibitor (Acetazolamide)	PCT	Inhibit H^+ secretion and HCO_3 re-absorption and decrease K^+ secretion

Major Diuretics	Site of Action	Mechanism of Action
Aldosterone antagonist (Spironolactone)	Collecting tubules	Inhibit action of aldosterone, decrease Na^+ re-absorption and decrease K^+ secretion
Sodium channel blocker (Triamterene and amiloride)	Collecting tubules	Block entry of Na^+ into Na^+ channels of luminal membrane, decrease Na^+ re-absorption and decrease K^+ secretion

Alternations in Respiratory System

Eupnea	Ordinary quiet breathing
Apnea	Transient cessation of breathing
Tachypnea	Excessive rapid breathing
Hyperpnea	Both frequency and depth of breathing are increased
Hypopnea	Both frequency and depth of breathing are decreased
Bradypnea	Abnormal slowness of breathing
Dyspnea	Difficulty or laboured breathing
Polypnea	Rapid, shallow and panting type of breathing
Hypercapnia	Increased PCO_2 in arterial blood
Hypocapnia	Decreased PCO_2 in arterial blood
Asphyxia	Condition of hypoxia with hypercapnia
Atelectasis	Collapsing of lungs
Pneumonia	Inflammation of lung tissue

Alternations in Urinary System

Anuria	No urine output
Oliguria	Decrease urine output
Polyuria	Increase urine output
Dysuria	Difficulty or discomfort in urination
Stranguria	Slow, drop wise and painful discharge of urine

Alternations in Semen Morphology

Hypospermia	Decreased semen volume
Oligospermia	Decreased sperm concentration
Asthenozoospermia	Decreased sperm motility
Teratozoospermia	Abnormal spermatozoa
Necrozoospermia	Dead spermatozoa

Location of Chief Centres in Body

Medulla oblongata	Swallowing centre, Dorsal and Ventral respiratory group (DRG and VRG), vomiting centre, vasomotor centre, salivary centre
Hypothalamus	Appetite centre, thermoregulation centre, satiety centre
Pons	Micturition centre, apneustic centre

Type of Muscles

Skeletal Muscle	Smooth Muscle	Cardiac Muscle
Striated and un-branched	Non striated and un-branched	Striated and branched
Nuclei at periphery and multinucleated	Single centrally placed nucleus	Single centrally placed nucleus
Voluntary control	Involuntary control	Involuntary control
Susceptible to fatigue	Resistant to fatigue	Resistant to fatigue
Well-developed sarcoplasmic reticulum (SR) and transverse tubules	Poorly developed sarcoplasmic reticulum (SR) and transverse tubules	Moderately developed sarcoplasmic reticulum (SR) and transverse tubules

Section – IV
Animal Nutrition

Nutrition is the process of taking in food and converting it into energy and other vital nutrients required for life. It involves various chemical reactions and physiological processes which transforms food into body tissues and activities. It involves the ingestion, digestion and absorption of the various nutrients, their transport to all body cells and the removal of unusable elements and waste products of metabolism.

The great French chemist **Antoine Laurent de Lavoisier** is regarded as the **"Father of Nutrition"** or **"Father of Modern Chemistry"** who has introduced balance and thermometer in nutritional studies. He discovered metabolism and demonstrated that energy from food is derived due to oxidation of it. His studies let him to state, "Life is a chemical process".

Important Terminologies

Nutrient: Any food constituent or group food constituent of the same general chemical composition that aids in the support of life.

Digestibility: Proportion of feed that can be broken down and absorbed by animal.

Ration: Total amount of feed provided to an animal over a specific period.

Forage: Portion of feed for animals that is secured largely from leaves and stalks of plants, such as grasses and legumes used as hay.

Pelleted feed: A pill-like or cubical type of animal feed made by forcing the loose, bulky or dusty feeds into small, uniform pellets by the use of grinding, molding and compressing machinery.

Concentrate: Feed stuff that are high in energy (greater than 70% TDN) and low in fibre (less than 18% CF, more starch, less cellulose), less than 20% protein.

Roughages: Fibrous feedstuffs that are generally high in fibre (cellulose), less digestible and lower in energy. They primarily include materials like grasses, hay, silage and legumes. Roughages are sub divided into two major groups such as dry and green or succulent roughages based upon the moisture content.

- Green roughages contain moisture from 60-90%
- Dry roughages contain only 10-15% moisture

Additives: Products which are used in animal nutrition for purposes of improving the quality of feed and quality of food from animal origin, or to improve the animals' performance and health.

Minerals: Inorganic nutrients that are essential for various physiological functions in animals. Minerals are classified into two main categories:

- Macro-minerals: Calcium(Ca), Phosphorus(P), Magnesium(Mg), Sodium(Na), Potassium(K) and Sulphur(S)
- Micro-minerals/Trace minerals: Iron(Fe), Zinc(Z), Copper(Cu), Selenium(Se) and Manganese(Mn)

Vitamins: Organic compounds that are essential for normal physiological functions in animals. Vitamins are classified into two main groups:

- Water soluble vitamins: B-complex Vitamins and Vitamin C
- Fat soluble vitamins: Vitamins A, D, E and K

Crude Fibre (CF): Residue of plant food left after extraction by dilute acid followed by dilute alkali. It is composed of cellulose, hemicellulose and lignin.

Crude protein (CP): True protein component which is a measure of the amount of protein in a feed determined as the amount of nitrogen multiplied by 6.25.

Digestible Protein: Proportion of protein in a feed that can be digested and absorbed by an animal.

Digestible crude protein (DCP): Portion of crude protein in feed that can be digested and absorbed by an animal.

Basal Feeds: Concentrated sources of energy especially rich in starches and sugars. They include the whole group of grains (e.g. wheat, maize, oats, etc.) and their by-products. Basal feeds have a protein content that is greater than 16% and a maximum fibre content of 18%.

Creep Feed: High energy feed that is fed to young animals in special feed devices so that adult animals cannot gain access to the feed.

Total Digestible Nutrients (TDN): All the nutrients consumed by an animal that are digested and used; generally applied to proteins, carbohydrates and fats.

Emulsification: Breakdown of large fat globules into smaller parts.

Maintenance Ration: Amount of feed needed to support an animal when it is doing no work, yielding no product and gaining no weight.

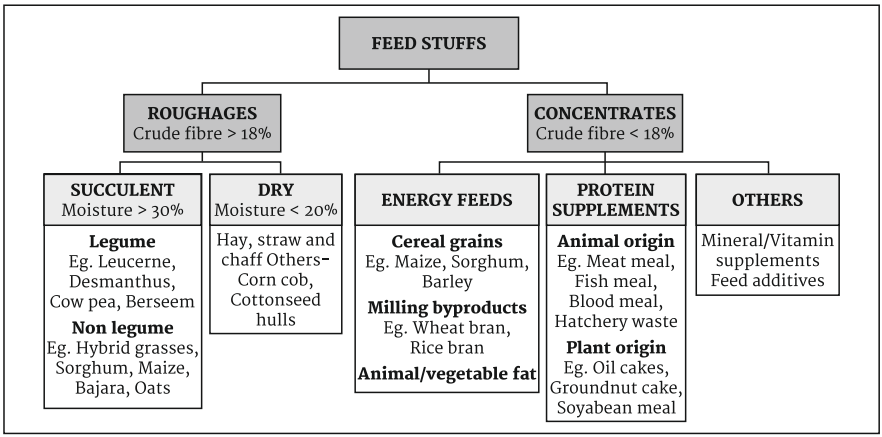
Proximate Principles

Name of Proximate principle	Estimated by	Comments
Water	Drying feed sample in Hot air oven at 100°C for 12 hours	Succulent roughage contains 80% water Silage contains 60-70% water Haylage contains 45-55% water Straw contains 10% water Hay contains 12-14% water
Ether Extract (EE)	Soxhlet apparatus	All eather soluble substances such as fat soluble vitamins, carotene, cholesterols, wax, etc.
Crude Protein (CP)	Kjeldahl method Dumas method	CP = Nitrogen (N) content of feed × 6.25
Crude Fiber (CF)	Refluxing apparatus	Portion of Carbohydrates which is not easily digestible. Ex. Cellulose, hemicellulose, ligin
Nitrogen Free Extract (NFE)	-	Portion of Carbohydrates which is easily digestable. Ex. Monosacchride, disaccharide
Ash	Muffle furnace (600°C for 2 hours)	All minerals found in animals feed like Ca, P, Mg, etc. Digestibility of ash cannot be determined because it does not contribute to energy content of a feed.

Nitrogen free extract (NFE) is estimated by calculation and not direct analysis. NFE is calculated by substracting sum of percentage of moisture, crude protein, ether extract, crude fiber and ash from 100.

NFE= 100-(Moisture% + EE% + CP% + CF% + Ash%)

Classification of Feed Stuffs



Difference Between Roughage and Concentrate

Items	Roughage	Concentrate
Crude Fiber (CF)	CF > 18	CF < 18
Total digestible nutrients (TDN)	TDN < 60%	TDN > 60%
Energy content	Low	High
Digestibility	Low	High
Density of feed	Low	High
Main function	Belly-filling	To provide energy
Examples	Dry roughage- Straw, stover Hay Succulent roughage- Silage, tree leaves, pasture, green fodder	Energy rich concentrate- Grains, seeds, brans, molasses Protein rich concentrate Animal origin (fish meal, meat meal, feather meal, blood meal) Plant origin (oil seed cakes, yeast)

Thumb Rule for Total Dry Matter Requirement

1. **Dry matter requirement (per animal per day)**

- Zebu cattle: 2–2.5 kg/ 100 kg BW
- Buffalo and Crossbred cow: 2.5–3 kg/100 kg BW
- Sheep: 2.5–3 kg per animal per day
- Lactating sheep: 4% of BW
- Meat goat: 4% of live BW
- Camel: 2% of BW

2. **Maintenance ration**

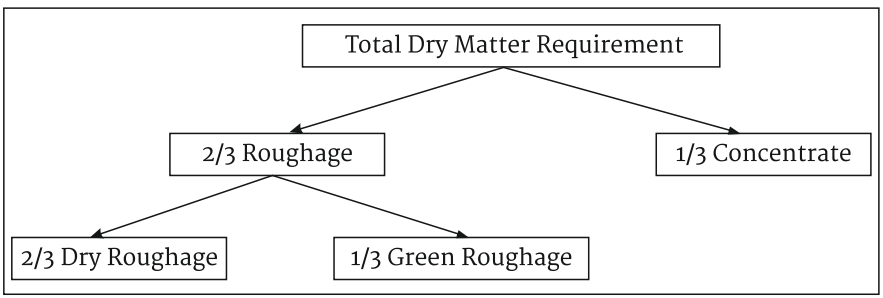
- Zebu cattle: 4 kg straw + 1 kg concentrate
- Buffalo and Crossbred cow: 4–6 kg straw + 2 kg concentrate

3. **Production ration**

- Zebu cattle: 1 kg concentrate/ 2.5 kg milk
- Buffalo and Crossbred cow: 1 kg concentrate/ 2 kg milk

4. **Gestation ration during last trimester of pregnancy**

- Zebu cattle: 1.25 kg concentrate
- Buffalo and Crossbred cow: 1.75 kg concentrate



Difference Between Hay and Silage

Particulars	Hay	Silage
Define	Sun dried forage	Method of preserving green fodder for a long period of time through anaerobic fermentation
Best crop	Oat *(Avena sativa)*	Maize *(Zea mays)*
Preferred plant	Leafy plant with thin stem	Plant with thick stem
Method of manufacturing	Hay curing	Ensiling
Harvesting time	In case of crop – flowering/ blossom stage In case of cereals – Milk stage In case of Legumes – Tender pod stage	Between flowering and milk stage
Type of roughages	Dry	Succulent

Categories of Silage Quality

Classification	Very Good	Good	Fair
pH	3.5–4.2	4.2–4.5	4.8 or above
Ammonical N_2 in total N_2	Less than 10%	10–15%	20% or above
Butyric acid	Nil	Trace	Some amount

Concentrate Feed

Straw

Hay

Silage

Non-Conventional Feed Resources (NCFR)

Non-Conventional Feed Resources (NCFR) also known as unconventional feed. All those feeds that have not been traditionally used in animal feeding and or are not normally used in commercially produced rations for livestock. NCFR include commonly, a variety of feeds from perennial crops and feeds of animal and industrial origin.

Classification of Non-Conventional Feed Resources (NCFR)

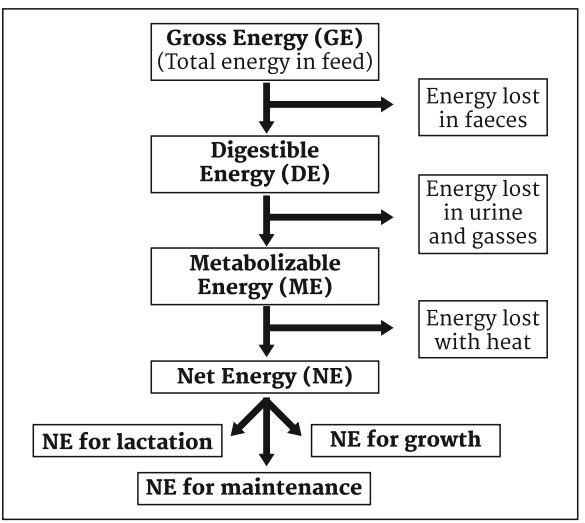
Category	Resources	Examples
By Source	Plant	By-products: Fruits, vegetable residues Aquatic plants: Algae, seaweeds
	Animal	By-product: Blood meal, bone meal, fish meal and offal's
	Industrial	Food industry waste- Spent grains, Waste Oils and Fats Biofuel by-products- Glycerol, Soybean Meal, Sugarcane Bagasse
By Nutritional Content	Protein	Leguminous plants, fish meal, blood meal
	Energy	Grains, seeds, brans, molasses
	Fiber	Sugarcane tops, wheat straw, agricultural residues
By Utilization	Direct feed	Fresh forages, by-products
	Supplemental feed	Urea, molasses
By Processing Level	Unprocessed	Fresh forages, fallen fruits
	Processed	Ensiled products, pelleted feed

Feeding Standards

Feedings standards are the values showing quantities of nutrients to be fed to the various classes of livestock for different physiological functions like growth, maintenance, lactation, egg production and wool growth.

Various Units are used for Feeding Standards

- **Gross Energy (GE):** Total energy content of a feed stuff or food before any losses occur during digestion, absorption and metabolism.
- **Digestible Energy (DE):** Proportion of energy in a feed that can be digested and absorbed by an animal.
- **Faecal Energy:** Energy content lost in faeces that is not absorbed by the animal.
- **Net Energy (NE):** Amount of energy in feed minus energy lost in faeces, urine and in heat production through digestive and metabolic processes, *i.e.* heat increment.
- **Metabolizable Energy (ME) :** It is the process of generating energy (ATP) from nutrients and comprises a series of interconnected pathways that can function in the presence or absence of oxygen.
- **Maintenance Energy:** Amount of energy required by an animal to maintain basic bodily functions, such as metabolism, temperature regulation and activity, without any growth or production.
- **Production Energy:** Energy required for an animal to grow, reproduce, or produce milk, eggs or other products.



Utilization of Feed Energy in Animals

Vitamins

Vitamins are organic compounds required in tiny amounts for essential metabolic reactions in a living organism. Absence or deficiency of vitamins causes deficiency disorders. Casimir Funk gave the name "Vitamin" to the accessory food factor in year 1912 and later it was called "Vitamin" since all vitamins were not vital amines.

Differences between Fat Soluble and Water Soluble Vitamins

Particular	Fat Soluble	Water Soluble
Classification	Vitamins A, D, E and K	Vitamin B complex and Vitamin C
Solubility	Soluble in fats and organic solvents	Water soluble
Synthesis	Vit D can be synthesized in skin on exposure to sunlight	Vit B is synthesized by ruminants. Vit C is synthesized in many animals except human, guinea pigs.
Digestion and Absorption	Requires fat and bile	Easily absorbed in intestine
Excretion	*Via* faeces	*Via* urine
Storage	Stored in the body in fat depots and in liver	Not stored in body except Vitamin B_{12}
Toxicity	An over dosage can lead to toxicity	Usually not toxic as it is readily excreted when given in excess

Vitamins, their Functions and Diseases causing due to their Deficiency

Name of Vitamin	Functions	Deficiency Diseases
Vitamin A Retinol Retinal Retonoic acid	• Formation of visual pigments Rhodopsin in retina • Essential for embryonic development during foetal development • Synthesis of glycoprotein to maintain integrity of epithelial cells	• **Nutritional roup** in poultry • **Xerophthalmia** in animals

Name of Vitamin	Functions	Deficiency Diseases
Vitamin D D_2 (Ergocalcipherol) D_3 (Cholecalcipherol) act as hormone	• Calcium absorption • Promotes bone growth and remodeling • Maintains proper blood calcium levels • Helps regulate immune responses • Supports muscle contraction and function • Regulates cell proliferation and differentiation	• **Rickets** in young ones • **Osteomalacia** in adults • **Penguin like squat** posture in hens
Vitamin E α Tocopherol Anti-oxidant Vitamin	• Act as antioxidant and protects cell membranes from oxidative damage by scavenging free radicals • Supports immune response and helps maintain immune system integrity • Essential for normal reproduction, including fertility and foetal development • neuroprotective effects • Modulates inflammatory responses in the body	• **Crazy chick disease/ Ecephalomalacia** in chicken • **Still lamb disease, White muscle disease, Mulberry heart disease** in sheep • **Syncope syndrome** in pigs • **Tying up** condition in horse
Vitamin K Phylloquinone Anti-haemorrhagic factor	• Blood clotting • Plays a role in bone metabolism • Involved in the regulation of cell growth and proliferation	• No blood clotting

Name of Vitamin	Functions	Deficiency Diseases
Vitamin B_1 Thiamine Anti-neuritic Vitamin	• Helps in energy metabolism • Required for the synthesis of neurotransmitters and maintenance of nerve cell membranes • Supports muscle contraction and coordination • Plays a role in regulating appetite and digestive function • Maintain cardiac health • Necessary for normal growth and development, particularly in young ones	• **Polyneuritis/ Star gazer** position in birds • **Polioencephalo-malacia (PEM)** or **Celebrocortical necrosis (CCN)** in ruminants
Vitamin B_2 Riboflavin	• Participates in the electron transport chain, facilitating ATP production • Acts as a cofactor for antioxidant enzymes, helping to neutralize free radicals • Contributes to the health of eyes and visual function • Supports the maintenance of healthy skin and fur • Important for reproductive health and fertility	• **Curled toe paralysis** in chicken • **Clubbed down condition** in chicks
Vitamin B_3 Niacin Nicotinic acid	• Energy metabolism • Participates in cellular respiration processes, including glycolysis and the citric acid cycle • Supports DNA repair mechanisms • Promotes the maintenance of healthy skin, hair and coat • Supports digestive system function and nutrient absorption	• **Black tongue** in dog • Poor growth

Name of Vitamin	Functions	Deficiency Diseases
Vitamin B_5 Pantothenic acid	• In energy metabolism: Essential for the synthesis of coenzyme A (CoA) • Synthesis of fatty acids • Plays a role in the synthesis of adrenal hormones	• **Goose stepping step** in pigs • Pigs causes slow growth, diarrhoea and loss of hair
Vitamin B_6 Pyridoxine, Anti-dermatitis factor	• Essential for the metabolism of amino acids, including the synthesis and breakdown of proteins • Neurotransmitter synthesis • Plays a role in haemoglobin synthesis	• **Peripheral neuropathy**
Vitamin B_7 Vitamin H, Biotin	• Plays a key role in fatty acid synthesis • Supports gluconeogenesis • Necessary for keratin synthesis • Acts as a cofactor for various enzymes involved in metabolic pathways • Influences gene expression	• **Fatty liver kidney syndrome (FLKS)** in poultry • **Parrot beak** in chicks • Sudden death syndrome in broiler
Vitamin B_9 Folate, Folic acid	• Essential for synthesis and repair of DNA • Necessary for RBC production • Vital for proper neural tube formation during embryonic development • Required for amino acids metabolism • Acts as a coenzyme in various methylation reactions	• **Neural tube defects** in new borns • Reduced fertility

Name of Vitamin	Functions	Deficiency Diseases
Vitamin B_{12} Cyanocobalamine	• Essential for synthesis of haemoglobin • Required for the maintenance of nerve cells • Crucial for cell division and production of new cells • Supports immune system activity and antibody production • Helps regulate bone formation and remodelling • Acts as a cofactor for various enzymes involved in metabolic pathways	• **Pernicious anaemia** • Immunodeficiency
Vitamin C Ascorbic acid, Anti-ageing Vitamin	• Acts as a potent antioxidant, scavenging free radicals and protecting cells from oxidative damage • Essential for the synthesis of collagen • Supports wound healing Enhancing the immune activity	• **Scurvy/ bleeding gums** • Delayed wound healing

Minerals and Diseases Causing due to their Deficiency / Toxicity

Mineral	Functions	Deficiency / Toxicity
Calcium	Important for bone formation, muscle function and nerve transmission.	• Deficiency causes **Milk fever/ Parturient paresis** (Mainly occur in high yielding cow withing 48 hours of parturition and characterize by hypothermia). • **Eclampsia** in bitch (occur just after parturition). Small breeds or toy breeds are more susceptible such as pug, pomerian, chihuahua.
Phosphorus	Plays key roles in bone formation, energy metabolism and reproduction.	• Deficiency causes **Pica/ Depraved appetite/ Allotriophagia** in cattle. • **Hypophosphatemia/ Post-parturient hemoglobinuria (PPH)** mainly in high yielding dairy cows. • Toxicity causes **Osteodystrophia fibrosa/ Big head disease/ Bran disease** in horse fed bran (low in Ca and high in P).
Magnesium	Plays a role in enzyme and nervous function and carbohydrate metabolism.	• Deficiency causes **Lactation tetany/ Grass tetany/ Winter tetany/ Wheat staggers/ Grass staggers** (Lactation tetany in all animals caused by Mg deficiency but in mare it is caused by Ca deficiency).
Copper	Role in functioning of blood cells, skin pigmentation and bones and nerves formation.	• Deficiency in Sheep shows **'steely wool/ Stringy wool'** condition (wool loses its crimp and become hair like and also loose its' colour). • **Enzootic neonatal ataxia** in lambs, kids and calves also known as 'sway back'.
Cobalt	Involved in formation of red blood cells and nerve cell functions.	• Deficiency causes Anemia, loss of appetite, progressive emaciation, rough hair coat. • **Enzootic marasmus/ Wasting disease** in Sheep • **Cattle coast** disease

Mineral	Functions	Deficiency / Toxicity
Iodine	Essential for synthesis of thyroid hormones T4 and T3, which regulate development and metabolism.	• Deficiency causes enlargement of thyroid gland (**goitre**), alopecia and affected calves show high mortality rate and adult cow's exhibit dullness and digestive troubles.
Zinc	Participates in metabolic processes related to lipids, carbohydrates and proteins.	• **Parakeratosis** in pigs • **Hyperkeratosis** in cattle • **Swollen hock syndrome** in chicken • **Frizzled feathers** in chicks.
Selenium	Protects tissues from oxidative stress and supports vitamin E absorption and function.	Deficiency causes • **Ill thrift** in lambs • **Nutritional muscular dystrophy, Mulberyy heart disease, white muscle disease** Toxicity causes • Sub-acute poisoning-**Blind stagger** • Chronic poisoning-**Alkali disease**, **Degnala disease of cattle**
Molybdenum	Require for activity of various metalloenzyme s which facilitate biochemical reactions crucial for growth and metabolism.	• Deficiency causes **Femoral head necrosis** in chickens • Toxicity causes **Teartness/ Peat scour** in cattle
Iron	Key component of hemoglobin and myoglobin, which are vital for oxygen transport and storage in the body.	• Deficiency causes **Piglet anemia** (Characterized by spasmodic breathing known as **Thumps**) • Toxicity causes **Siderosis**

Anti-Nutritional Factors

Plant	Anti-Nutritional Factors	Detoxification
Soyabean	**Trypsin inhibitor** Anti vitamin - A Anti vitamin - D	Autoclaving (121°C /15 lbs/15 min)
Castor bean	Ricin	By moist heat
Groundnut cake (GNC)	Aflatoxin	Treated with NH_3 or NH_4OH
Lucerne (Alfa-alfa)	Saponin	Mineral oil, Simethicone
Cotton seed coat	Gossypol	Iron supplement or $FeSO_4$
Subabul	Mimosin	Iron supplement or $FeSO_4$
Jowar (sorghum), Sudan grass Linseed, Cassava (tapioca) Bitter almond	Cyanide poisoning Dhurrin Linamarin Amygdalin	$NaNO_2$ (sodium nitrite) + Na-thiosulphate
Brassicaceae family plants, Mustard, Rapeseed, Cabbage, Cauliflower, Turnip	Glucosinolate (mainly as goitrogens and causing goiter)	Iodine supplement
Oat hay	Nitrate poisoning	1% solution of Methylene Blue
Mollases, Napier grass, Bajra	Oxalate	$CaCO_3$ Supplement
Neem	Nimbin, Nimbidin, Azadiractin	-
Top feeds, Khejri leaves, Babul seeds, Salseed meal	Tannin	-
Wheat	Arabinoxylans	-
Barley, Oats	β-glucans	-
Raw kidney bean	Antivitamin E	Cooking of grains
Maize, Wheat bran	Niacin	Vitamin B_3

Plant	Anti-Nutritional Factors	Detoxification
Raw fish, Bracken fern	Thiaminase (antivitamin B_1)	Vitamin B_1
Gaur meal	Saponin, Tannin, Trypsin inhibitor	–
Raw egg white (raw albumin)	Avidine (egg white injury factor)	Biotin
Sweet clover poisoning, Warfari, sulfa drug	Dicoumarol (antivitamin K)	–

Ruminal Microbiology

Index	Ruminal Ecosystem
Normal ruminal PH	6.5-6.8
Optimum temperature	39° C
Gas production	CO_2:CH_4 (65:35)
VFAs profile	Acetate: Propionate: Butyrate (65:20:10)
Ruminal microbial population (per ml of rumen liquor)	Bacteria (10^{10-11}), Protozoa (10^6), Fungi (10^3), Bacteriophage (10^9)
Ruminal bacteria	Mostly bacteria are Gram $(-)^{ve}$ and obligate anaerobes.
Ruminal protozoa	Majority are ciliate protozoa Ruminal microbial population is declined by protozoa because eat on bacteria.
Ruminal fungi	Mostly flagellated fungi Function: Substrate penetration (by breaking lingocellulosic bond of fiber diet)
Ruminal bacteriophage	Function: Lysis of bacterial cells so that bacterial protein is easily available to animals as a source of amino acids.

Digestion and Absorption of Carbohydrate, Protein and Fat

Index	Ruminants	Non Ruminants
End product of carbohydrate digestion	VFA's in rumen	Glucose
Site of absorption of carbohydrate	Ruminant wall (by passive transport)	Small intestine (by active transport)
End product of protein digestion	Amino acids	Amino acids
Site of absorption of protein	Ileum (small intestine)	Duodenum and jejunum (small intestine)
End product of fat digestion	Fatty acids	Fatty acids
Site of absorption of fat	Proximal jejunum	Proximal jejunum

Essential Amino Acids

- Pig: Lysine
- Poultry: Glycine
- Sheep: Methionine
- Cat: Taurine

Methods of Improving Nutritive Value of Poor Quality Roughages like Straw

1. **Supplementation of deficient nutrient:**

- Enrichment with urea and molasses
- Silage making
- Supplementation with green fodder
- Supplementation with legume
- Supplementation with urea-molasses liquid

2. **Treatment:**

- **Physical method-** Soaking, chopping, grinding, pelleting, irradiation, steam under pressure
- **Chemical method-** Alkali, ammonia, acids, gases, oxidizing agents
- **Physio-chemical method-** NaOH/pelleting
- **Biological method-** Enzymes, white rot fungi, mushrooms

Urea Treatment of Feed

Feed	Urea Treatment
Dry roughages	4% of straw (100 kg straw + 40 L water + 4 kg urea)
Succulent roughages	0.5% of wet material
Ration	1% of total DM of ration
Concentrate	Upto 3% total concentrate of feed

Improvement of DCP, TDN and Digestibility of Straw

Items	DCP%	TDN%	Digestibility%
Normal straw	0	40	46
Urea treated straw	4–5	50	70

Urea as an NPN Source to the Ruminants

- Most widely used NPN substance in ruminants ration is urea
- Urea is only used in ruminant ration
- Urea should never feed to young calves (upto 6 months) and monogastric animals (horse, pig, dog, etc.)

Net Gain of ATP's by Complete Oxidation of One Mole of Substance

Glucose (aerobic oxidation)	38 ATP's
Glucose (anaerobic oxidation)	2 ATP's
Glycogen (aerobic oxidation)	39 ATP's
Glycogen (anaerobic oxidation)	3 ATP's
Glycerol	22 ATP's
Acetate	10 ATP's
Propionate	17 ATP's
Butyrate	25 ATP's
Palmitic acid	129 ATP's

Uses of Volatile Fatty Acid's (VFA's) Produced during Ruminal Fermentation

- VFA's provides 70% of ruminant energy needs
- **Acetate:** It is responsible for milk fat synthesis
- **Propionate:** It is gluconeogenic which is responsible for milk sugar synthesis
- **Butyrate:** Ruminal epithelial cells convert it into ß-hydroxy butyrate (a ketone body)

Feeding Schedule for Calves up to 6 Months

Calf starter is a highly nutritious concentrate mixture containing all the nutrients in proper proportion required for optimum growth and is used as a partial substitute for whole milk in the ration of calves. Since quality of protein is very important to calves until their rumen is fully functional, animal protein supplements such as fish meal should be included in calf starters. Urea should not be included in calf starters. Feeding schedule for calves up to 6 months is mention in below table.

Age of calf	Approx. body weight (kg)	Quantity of milk (kg)	Quantity of calf starter (g)	Green grass (kg)
4 days to 4 weeks	25	2.5	Small quantity	Small quantity
4–6 weeks	30	3.0	50–100	Small quantity
6–8 weeks	35	2.5	100–250	Small quantity
8–10 weeks	40	2.0	250–350	Small quantity
10–12 weeks	45	1.5	350–500	1
12–16 weeks	55	-	500–750	1–2
16–20 weeks	65	-	750–1000	2–3
20–24 weeks	75	-	1000–1500	3–5

Feeding Schedule of Growing Animals from 6 Months Onwards

Age (months)	Approximate body weight (kg)	Concentrate mixture (kg)	Grass (kg)
6–9	70–100	1.5–1.75	5–10
9–15	100–150	1.75–2.25	10–15
15–20	150–200	2.25–2.50	15–20
Above 20	200–300	2.50–2.75	15–20

Feeding Schedule for Different Classes of Adult Cows (Approx. body weight-250 kg)

When green grass is major roughage			When paddy straw is major roughage		
Category	**Concentrate mixture (kg)**	**Green grass (kg)**	**Concentrate mixture (kg)**	**Green grass (kg)**	**Paddy straw (kg)**
Dry cows	-	25-30	1.25	5.0	5-6
Milking cow	1 kg for every 2.5-3.0 Kg of milk	30	1.25 + 1 kg for every 2.5 to 3.0 kg of milk	5.0	5-6
Pregnant cow	Production allowance+ 1 to 1.5 kg from 6th month of pregnancy	25-30	Maintenance + production + 1 to 1.5 kg from 6th month of pregnancy	5.0	5-6

Feeding Schedule of Bull

Body weight (kg)	Concentrate mixture (kg)	Green grass (kg)
400-500	2.5-3	20-25

Daily Nutrients Requirements for Maintenance of Mature Cow and Buffalo

BW (kg)	Dry Feed (kg)	DCP (g)	ME (Mcal)	TDN (kg)	Ca (g)	P (g)	Carotene (mg)	Vitamin A (1000 IU)
200	3.5	150	6.0	1.7	8	7	21	9
250	4.0	170	7.2	2.0	10	9	26	11
300	4.5	200	8.4	2.4	12	10	32	13
350	5.0	230	9.4	2.7	14	11	37	15
400	5.5	250	10.8	3.0	17	13	42	17
450	6.0	280	12.4	3.4	18	14	48	19
500	6.5	300	13.2	3.7	20	15	53	21
550	7.0	330	14.4	4.0	21	16	58	23
600	7.5	350	15.5	4.2	22	17	64	26
650	8.0	370	16.2	4.5	23	18	69	28
700	8.5	390	17.3	4.8	25	19	74	30
750	9.0	410	18.0	5.0	26	20	79	32
800	9.5	430	19.1	5.3	27	21	85	34

Nutrient Requirements per kg of Milk Production

Fat (%)	DCP (g)	ME (Mcal)	TDN (kg)	Ca (g)	P (g)
3	40	0.97	0.270	2.5	1.8
4	45	1.13	0.315	2.7	2.0
5	51	1.28	0.370	2.9	2.2
6	57	1.36	0.410	3.1	2.4
7	63	1.54	0.460	3.3	2.6
8	69	1.80	0.500	3.5	2.8
9	75	2.06	0.510	3.7	3.0
10	81	2.16	0.600	3.9	3.2
11	85	2.34	0.650	4.1	3.4

Feeding Schedules for Dairy Animals (Quantity in kg)

Milk production	Feeding during	Green fodder	Dry fodder	Concentrate
6–7 litres milk per day	Lactation days	20–25	5–6	3.0–3.5
	Dry days	15–20	6–7	0.5–1.0
8–10 litres milk per day	Lactation days	25–30	4–5	4.0–4.5
	Dry days	20–25	6–7	0.5–1.0

Bureau of Indian Standards (BIS) Specification of Mineral Mixture for Cattle

Characteristics	Maximum/ minimum	Type I (with salt)	Type II (without salt)
Moisture	Max	5	5
Calcium	Min	18	23
Phosphorus	Min	9	12
Magnesium	Min	5	6.5
Salt (Chloride or sodium chloride)	Min	22	–
Iron	Min	0.4	0.5
Iodine	–	0.02	0.026
Copper	Min	0.06	0.08

Characteristics	Maximum/ minimum	Type I (with salt)	Type II (without salt)
Manganese	Min	0.1	0.12
Cobalt	Min	0.009	0.012
Fluorine	Max	0.05	0.07
Zinc	Min	0.3	0.38
Sulphur	Max	0.4	0.5
Acid insoluble ash	-	3	2.5

Bureau of Indian Standards (BIS) Specification of Mineral Mixture for Chicken

Characteristics	Broiler Starter Feed	Broiler Finisher Feed	Chick Feed	Grower Feed	Layer Feed	Breeder Feed
Moisture (max %)	11	11	11	11	11	11
Crude Protein (min %)	23	20	20	16	18	18
Crude fibre (max %)	6	6	7	8	8	8
Acid Insoluble Ash (max %)	3	3	4	4	4	4
Salt (max %)	0.6	0.6	0.6	0.6	0.6	0.6
Calcium (min %)	1.2	1.2	1.0	1.0	3.0	3.0
Phosphorus (min %)	0.5	0.5	0.5	0.5	0.5	0.5
Lysine (min %)	1.2	1.0	0.9	0.6	0.65	0.65
Methionine (min %)	0.5	0.35	0.3	0.25	0.3	0.3
Manganese (mg/kg)	90	90	90	90	90	90
Vit A (IU/kg)	6000	6000	6000	6000	6000	6000
Vit D_3 (IU/kg)	600	600	600	600	1200	1200
Vit E (IU/kg)	15	15	15	10	10	10
Vit K (mg/kg)	1	1	1	1	1	1
Riboflavin (mg/kg)	6	6	6	3	3	3
Biotin (mg/kg)	0.2	0.2	0.2	0.15	0.15	0.15
Choline (mg/kg)	1400	1600	1300	900	800	800
Pyridoxine (mg/kg)	5	5	5	5	5	8
Aflatoxin (max p.p.b.)	50	50	50	50	50	50

Section – V
Veterinary Public Health

Important Terminologies

Epidemiology: Study of how diseases affect the health and illness of populations, focusing on distribution, patterns and determinants of health-related states.

Veterinary Epidemiology: Application of epidemiological principles and methods to animal health and diseases.

Zoonosis: Diseases or infection that can be transmitted from animals to humans or from humans to animals.

Surveillance: Continuous systematic collection, analysis and interpretation of health-related data pertaining to animal populations.

Biosecurity: Measures taken to prevent the introduction and spread of infectious diseases in animal populations.

One Health: Collaborative approach recognizing the interconnectedness of human, animal and environmental health.

Vaccination: Administration of a vaccine to stimulate an immune response and provide immunity against specific diseases.

Food Safety: Practices and policies that ensure food is safe to eat, including proper handling, preparation and storage to prevent foodborne illnesses.

Animal Welfare: Well-being of animals, encompassing their physical and mental health and the ethical treatment of animals in various settings.

Infection: Entry and development or multiplication of an infectious agent in the body of host.

Infestation: Lodgement and development of arthropodes or endoparasites on or in body.

Disease: Any deviation from a healthy or normal state in a living organism, causing a disruption in its structure, function or overall well-being.

Communicable disease: A disease resulting from infection or infestation capable of being directly or indirectly transmitted to a new host or from the environment through any vehicle.

Contagious disease: A disease that is transmitted by direct contact between an infected host and a susceptible host.

Infectious disease: A disease caused by pathogens like bacteria, virus, fungi or protozoa that can be transmitted from animal to animal or animal to a person resulting from an infection.

Notifiable disease: Occurrence of a disease which requires immediate reporting to the higher health authority to take necessary action for preventing further spread.

Eradication: Total removal or elimination of a disease or a etiological agent from a region.

Exotic diseases: Diseases that are imported to a country in which they do not otherwise occur.

Iatrogenic (physician induced) disease: Any untoward consequence of a preventive, diagnostic or therapeutic procedures that cause impairment, handicap or disability resulting from professional activity of a physician or health related personnel.

Host: Animal or man which affords lodgement or penetration of an infectious agent under natural conditions.

Reservoir: An animate or inanimate object on or in which an infectious agent usually lives, multiplies and survives in such a manner that it can be transmitted to susceptible host.

Vector: An invertebrate host or arthropod which transmit the infection by biting or by depositing of infective material on the skin or on food or other objects.

Vehicle: A non-living substance through which an infectious agent passes from source to susceptible host.

Transmission: It is the pathway by which an organism is spread from source to susceptible host.

Definitive host: Animal or man in which infectious agent attains its maturity.

Obligate host: Host which is essentially required for growth and multiplication of infectious agent, in absence of which it may die.

Non-obligatory host: Animal or man which may accidentally or occasionally provide nourishment to an infectious agent.

Intermediate host: Host which provides a medium for larval or asexual or sexual phase of life cycle of an infectious agent.

Quarantine: Separation and restriction of movement of animals that may have been exposed to infectious diseases to prevent their spread.

Incidence: Number of new cases of a disease that occur in a specified population during a defined time period.

Prevalence: Total number of cases of a disease in population at a specific point in time or over a specified period.

Endemic: Disease or condition regularly found and consistently present in a particular geographic area or population.

Epidemic: Sudden increase in the number of cases of a disease above what is normally expected in a specific geographic area.

Pandemic: Epidemic that has spread over multiple countries or continents, affecting a large number of people.

Epizootic: Epidemic in animal population.

Epornithic: Epidemic in bird population.

Sporadic: Incidence at intervals of single or scattered cases of a disease.

Morbidity: Refers to the incidence or prevalence of a disease within a population, often expressed as the number of cases per 1,000 individuals.

Mortality: Incidence of death in a population due to a specific disease, often expressed as a mortality rate.

Hazard analysis and critical control point (HACCP): It is a system of ensuring food safety by exercising control to prevent any objectionable contamination, survival of multiplication of microorganisms in production chain.

Acid rain: Sulphur and nitrogen which are present in fossil fuels and oil produce their oxides (sulphur dioxide and nitrogen dioxide) when burnt in presence of atmospheric oxygen.

Aerosol: It refers to the dispersion of solid and liquid particles in the gaseous media like smoke or fog to form a colloidal form.

Biosphere: Region of earth containing soil, air and water.(also called ecosphere).

Biota: Animal and plant lives in an area.

Dust: Solid particles that are larger than colloidal particles and that remain temporarily suspended in the atmosphere are called dust particles.

Droplet: Small liquid particles showing a tendency to settle under calm atmospheric conditions.

Emission: Sum total of substances released into the atmosphere from natural or man-made sources.

Fall out: Release of radioactivity into the atmosphere from nuclear explosions or leakages.

Fog: Aerosols in which the dispersed phase is water.

Fume: Atmospheric pollution by solid particles generated by condensation from a gaseous state following vaporization of a molten substance.

Smog: Mixture of smoke and fog.

Smoke: Small gas-borne particles mainly carbon in nature.

Smust: Smoke mixed with dust.

Vapour: Gaseous phase of matter which may remain in liquid or solid state.

Important Events

Events	Dates
World Veterinary Day	Last Saturday of April
World Health Day	7th April
World Environment Day	5th June
World Earth Day	22nd April
World Ozone Day	16th September
World Food Day	16th October
World Population Day	11th July
World Zoonoses Day	6th July
World Wildlife Day	3rd March
World Rabies Day	28th September
World Water Day	22nd March
World Milk Day	1st June
National Milk Day	26th November

International Agencies involved in Veterinary Public Health Activities

International Agencies	Role	Headquarters
Office International des Epizootics (OIE)	Sets international standards for animal health and welfare. Provides guidelines for disease surveillance and reporting.	Paris
Food and Agricultural Organization (FAO)	Focuses on improving food security through better animal health management.	Rome
World Health Organization (WHO)	Promotes the One Health approach, integrating human, animal and environmental health. Food-borne infections and intoxications and comparative medicine are other major areas of concern.	Geneva

Epidemiological Triad

Agent factors		Host factors		Environmental factors	
Living	**Non-living**	**Intrinsic**	**Extrinsic**	**Biotic**	**Abiotic**
Virus	Nutritional	Age	Physiological	Vector	Soil
Bacteria	Hormonal	Sex	Occupational	Reservoir	Humidity
Fungal	Physical	Breed	Managemental	Vegetation	Temperature
Protozoa	Chemical	Species			Solar radiation
Helminths		Genotype			Natural disaster
Arthropod					

Pasteurization

Pasteurization of milk is a process of heating milk to a specific temperature for a set period to kill harmful bacteria and extend its shelf life. This process, developed by Louis Pasteur, is a food preservation technique that effectively eliminates pathogens without significantly altering the nutritional value of the milk. There are several methods for pasteurization of milk

Pasteurization Methods for Milk

Type of Pasteurization	Description	Temperature	Duration
Ultra-High Temperature (UHT)	Extends shelf life significantly; milk can be stored without refrigeration until opened.	135-150°C (275-302°F)	2-5 seconds
High-Temperature Short-Time (HTST)	Common method for commercial milk; effectively kills pathogens while retaining flavor and nutrients.	72°C (161°F)	15 seconds
Low-Temperature Long-Time (LTLT)	Extends shelf life significantly; milk can be stored without refrigeration until opened.	63°C (145°F)	30 minutes
Batch Pasteurization	Also known as 'Vat pasteurization' and used for smaller batches.	63°C (145°F)	30 minutes
Flash Pasteurization	Similar to HTST; used for various liquid foods.	72°C (161°F)	15 seconds

Bacteriological Standards for Milk by Bureau of Indian Standards (BIS)

Grades	Direct Microscopic count per ml in lakhs	Standard Plate Count per ml in lakhs	Methylene blue reduction time in hr.	One hour resazurin disc. No.	Presumptive coliform test (in 0.01 ml) *i.e.* 1 in 100
Very good	NS	< 2 lakhs	< 5 hr.	NS	absent
Good	< 5 lakhs	2-10 lakhs	3-4 hr.	4 and above	absent
Fair	5-40 lakhs	10-50 lakhs	1-2 hr.	3.5 to 1.0	absent
Poor	40-200 lakhs	> 50 lakhs	< 1/2 hr.	0.5 to 0	Present
Very poor	> 200 lakhs	NS	NS	NS	NS

NS: Not specified

Milk Adulteration

The intentional degradation of milk quality by adding inferior substances or removing valuable components, often to increase volume or profit. This practice can reduce the nutritional value of milk and pose health risks to consumers.

Important Tests to Detect Adulterants in Milk

Adulterant	Test	Interpretation
Colouring Agents		
Annatto	10 ml milk + 10 ml Ether, shake and stand for few minutes	Separated ether yellow in colour
Coal tar dyes	5 ml milk + 5 ml concentrated HCl	Pink colour
Turmeric	Extracted colour treated with HCl resulting orange colour treated with H_3BO_3	Red colour
Preservative Agents		
Formalin	5 ml H2SO4 + few crystals of Ferric chloride + 5 ml of milk	Purple colour ring at the junction
Hydrogen peroxide	10 ml milk + 2 drops of Para-Phenylene diamine hydrochloride	Intense blue colour
Thickening Agents		
Gelatin	10 ml milk + 10 ml of Mercuric nitrate, shake + 20 ml water and shake well. Filter it. Filtrate + equal volume of saturated aqueous Picric acid	Yellow precipitate
Cane sugar	2 ml milk + 1 ml HCl + 0.1 gm Resorcinol, boil for few minutes	Red colour
Sucrose	10 ml milk + Resorcinol	Red colour
Milk powder	10 ml milk + 1 drop of Formalin. Place at 60°C for 10 min	Peculiar odour
Skim milk powder	10 ml milk + few drops of Nitric acid	Yellow colour
Calcium carbonate	10 ml milk + 1 ml concentrated HCl	Effervescence
Sodium bicarbonate	5 ml milk + 10 ml Alcohol + Rosalic acid solution (1:10)	Rose red colour
Urea	0.2 ml Urease + 0.1 ml 0.5 percent Bromothymol blue + 5 ml milk	Light blue color for urea within 10 min
	2 ml milk + 2 ml p-Dimethyleamine benzaldehyde reagent	Yellow colour

Zoonotic Diseases

A disease can be transmitted from animals to humans or from humans to animals. More than 60 percent of human pathogens are zoonotic in origin, which includes bacteria, viruses, fungi, protozoa, parasites and other pathogens. Veterinarians are more prone to suffer from zoonotic diseases. Zoonoses can be classified in many ways as follows-

On the Basis of Transmission Cycle

- **Direct zoonoses (Orthozoonoses):** Zoonotic diseases are perpetuated in nature by a single vertebrate species. Transmission is either by direct or indirect contact.

  Ex. Anthrax, Rabies, Tuberculosis, Brucellosis

- **Cyclozoonoses:** Require two or more vertebrate hosts to complete transmission cycle of an infectious agent subdivided into 2 subtypes:
  - **Obligatory cyclozoonoses -** Human is must for completion of life cycle.

    Ex. *Taenia solium, Taenia saginata*
  - **Non-Obligatory cyclozoonoses -** Human is accidentally invovled in completion of life cycle.

    Ex. Hydatid disease, Toxoplasmosis

- **Metazoonoses (Pherozoonoses):** Both vertebrate and invertebrate species are involved in the transmission of an infectious agent. In invertebrate hosts, infectious agent may multiply, develop or remain dormant.

  Ex. Yellow fever, Plague, Paragonimiasis, Clonorchiasis, Tick-borne encephalitis.

- **Saprozoonoses:** Require a non-animate substance for completion of life cycle in addition to vertebrate or invertebrate host. An infectious agent may multiply, develop or propogate in an inanimate site.

  Ex. Cutaneous larva migrans, Ancylostomiasis, Fascioliasis, Fungal infections.

On the Basis of Reservoir Hosts

- **Anthrapozoonoses:** These are diseases of domestic and wild animals which occur in nature independent of man.

  Ex. Leptospirosis, Tularemia, Rift valley fever, Hydatidosis, Rabies.

- **Zooanthroponoses:** These are diseases which normally pass from man to other vertebrate animals.

  Ex. Tuberculosis (Human type), Amoebiasis, Diphtheria (Human type)

- **Amphixenoses:** These are ubiquitous diseases for which man as well as vertebrate animals act as host.

  Ex. Streptococcosis, non-host specific Salmonellosis, Staphylococcosis.

On the Basis of Causative Agent

Disease	Etiology	Animal Host	Major Symptoms/ System or Organs Involved
Bacterial Zoonoses			
Anthrax	*Bacillus anthracis*	Cattle, horses, sheep, pigs, dogs, bison, elks, white-tailed deer, goats and mink	Skin, respiratory organs or GI tract
Tuberculosis	*Mycobacterium bovis, Mycobacterium caprae, Mycobacterium microti*	Cattle, sheep, pig, deer, wild boars, camels and bison	Respiratory organs, bone marrow
Brucellosis	*Brucella abortus, Brucella melitensis, Brucella suis, Brucella canis*	Cattle, goats, sheep, pigs and dogs	Fever, usually high in the afternoon, back pain, joint pain, poor appetite and weight loss
Bubonic plague	*Yersinia pestis*	Rock squirrels, wood rats, ground squirrels, dogs, mice, voles and rabbits	Fever, chills, abdominal pain, diarrhea, vomiting and bleeding from natural opening
Glanders	*Burkholderia mallei*	Horses, donkeys and mules	Fever, sweating, muscle aches, chest pain, muscle tightness and headache
Leprosy	*Mycobacterium leprae*	Monkeys, rats, mice and cats	Skin lesions
Leptospirosis	*Leptospira interrogans*	Wild and domestic animals including pet dogs	Fever, abdominal pain, jaundice and red eye

Disease	Etiology	Animal Host	Major Symptoms/ System or Organs Involved
Tularemia	*Francisella tularensis*	Rabbits, squirrels, muskrats, deer, sheep, bull snakes, wild rodents, beavers, cats and dogs	Joint pain, diarrhea and dry cough
Arcobacter infections	*Arcobacter butzleri, Arcobacter cryaerophilus, Arcobacter skirrowii*	Cattle, sheep, pigs and chickens	Abdominal pain, fever and vomiting
Actinomycosis	*Actinomyces bovis*	Cattle, sheep, horses, pigs, dogs and other mammals	Swelling of lymph nodes, soft tissues, skin and abscess
Bordetellosis	*Bordetella bronchiseptica*	Cats and dogs	Respiratory problem
Lyme disease	*Borrelia burgdorferi*	Cats, dogs and horses	Fever, headache, skin rash and erythema migrans
Campylobacter enteritis	*Campylobacter jejuni, Campylobacter coli*	Cattle, sheep, chickens, turkeys, dogs, cats, mink, ferrets and pigs	Enteric disorder
Campylobacter fetus infection	*Campylobacter fetus subsp. fetus, Campylobacter fetus subsp. testudinum*	Cattle, sheep and goats	Enteric disorder
Corynebacterium ulcerans and Corynebacterium pseudo tuberculosis infections	*Corynebacterium ulcerans, Corynobacterium pseudotuberculosis*	Cattle, sheep and goats Cattle, dogs and cats	Diphtheria
Enterohemorrh-agic Escherichia coli infections	*E. coli*	Cattle, sheep, pigs, deer, dogs and poultry	Enteritis and Hemolytic–uremic syndrome (HUS)

Disease	Etiology	Animal Host	Major Symptoms/ System or Organs Involved
Helicobacter infection	*Helicobacter pullorum, Helicobacter suis*	Poultry and pigs	Peptic ulcer
Vibriosis	*Vibrio parahaemolyticus*	Farm animals	Enteritis
Salmonellosis	*Salmonella enterica, Salmonella bongor*	Domestic animals, birds and dogs	Enteritis
Ehrlichiosis	*Anaplasma phagocytophilum, Ehrlichia ewingii, Ehrlichia chaffeensis, Ehrlichia canis, Neorickettsia sennetsu*	Sheep, cattle, deer, dogs and cats	Fever, headache, fatigue, muscle aches and occasionally rash
Pasteurellosis	*Pasteurella multocida*	Poultry, pigs, cattle, buffaloes, sheep, goats, deer, cats, dogs and antelope	Fever, vomiting, diarrhea and gangrene
Viral Zoonoses			
Rabies	Rabies virus, Genus - Lyssavirus Family - Rhabdoviridae	Cattle, horses, cats, dogs, bats, monkeys, wolves, skunks, rabbits	Nervous system
Newcastle disease	Paramyxovirus, Genus - Avulavirus Family- Paramyxoviridae	Poultry and wild birds	Conjunctivitis
Avian influenza	Influenza A virus Genus- Alphainfluenza virus Family - Orthomyxoviridae	Ducks, chickens, turkeys, dogs, cats, pigs, whales, horses, seals and wild birds	Flu like symptoms, diarrhea and pneumonia
Rift Valley fever	Rift Valley fever virus Genus - Phlebovirus Family - Bunyaviridae	Buffaloes, camels, cattle, goats and sheep	Influenza- like fever, muscle pain, joint pain and headache

Disease	Etiology	Animal Host	Major Symptoms/ System or Organs Involved
Ebola Hemorrhagic Fever	Ebola virus Genus - Ebolavirus Family - Flaviviridae	Monkeys, gorillas, chimpanzees, apes and wild antelopes	Fever, intense weakness, muscle pain, headache, sore throat, hemorrhage, vomiting, diarrhea, kidney and liver failure
Marburg viral hemorrhagic fever	Marburg virus Genus - Marburgvirus Family - Flaviviridae	Fruit bats and monkeys	Hemorrhage, fever, muscle pains, watery diarrhea, abdominal pain and non-itchy rash
Chikungunya fever	Chikungunya virus Genus - Alphavirus Family - Togaviridae	Monkeys, birds and rodents	High fever, severe joint pain, muscle pain and skin rash
Dengue fever	Dengue virus Genus-Flavivirus Family-Flaviviridae	Monkeys and dogs	High fever, skin rash, skin hemorrhage and shock
Hantavirus infection (Hantavirus Pulmonary Syndrome)	Hantavirus Genus - Orthohantavirus Family - Hantaviridae	Rat and white-footed mice	Respiratory problem, high fever, dizziness, chills and abdominal problems
Zika fever	Zika virus Genus - Flavivirus Family - Flaviviridae	Apes and monkeys	Fever, pain and conjunctivitis
West Nile fever	West Nile virus Genus - Flavivirus Family - Flaviviridae	Horses, birds and reptiles	Headache, skin rash, swollen lymph nodes, stiff neck, disorientation, coma, tremors, convulsions and paralysis

Disease	Etiology	Animal Host	Major Symptoms/ System or Organs Involved
AIDS	HIV Genus - Lentivirus Family - Retroviridae	Monkeys and chimpanzees	Immunosuppression, influenza-like symptoms, fever, chills, rash, night sweats, muscle aches, fatigue, swollen lymph nodes
Severe acute respiratory syndrome (SARS)	SARS coronavirus (SARS-CoV) Genus - Coronavirus Family - Coronaviridae	Bats, dogs, cats, ferrets, minks, tigers and lions	influenza-like symptoms, fever, muscle pain, severe cases progress to a respiratory disease and pneumonia
Monkey pox	Monkeypox virus Genus - Orthopoxvirus Family - Poxviridae	Squirrels, Gambian poached rats, dormice, different species of monkeys and others	Fever, pox lesions on skin
Parasitic Zoonoses			
Trichinellosis	*Trichinella* spp.	Pigs, dogs, cats, rats and other wild species	Gastrointestinal, e.g., nausea, vomiting, diarrhea, and abdominal pain
Visceral larva migrans	*Baylisascaris procyonis, Toxocara canis, Toxocara cati* and *Ascaris suum*	Birds, emus, cats, chinchillas, porcupines, dogs, rabbits and rats	Gastrointestinal, e.g., coughing, shortness of breath, fever, and abdominal pain
Cutaneous larval migrans	*Ancylostoma braziliense*	Dogs and cats	Subcutaneous tissue
Hydatidosis	*Echinococcus granulosus*	Buffaloes, sheep, goats and adult dogs	Hydatid cysts in liver, lungs, bones, kidneys, spleen, abdominal pain and respiratory problem
Cryptococcosis	*Cryptococcus neoformans*	Dogs, cattle, horses, sheep, goats, birds and wild animals	Respiratory problems, fever, nausea and vomiting

Disease	Etiology	Animal Host	Major Symptoms/ System or Organs Involved
Cryptosporidiosis	*Cryptosporidium parvum*	Cattle, sheep, pigs, goats, horses and deer	Diarrhea lasting 3–14 days. Abdominal pain, nausea and malaise are frequent. Some patients have a slight fever
Fascioliasis	*Fasciola hepatica, Fasciola gigantica*	Cattle, sheep, goats and other ruminants	Intense internal bleeding, fever, nausea, swollen liver, skin rashes and extreme abdominal pain
Mycotic / Fungal Zoonoses			
Tinea/ Ringworm infection	*Microsporum* spp., *Trichophyton* spp.	All animals like cattle, sheep, goats, cats, and dogs	Skin lesions
Aspergillosis	*Aspergillus* spp.	All domestic animals and birds	Respiratory problems
Blastomycosis	*Blastomyces dermatitidis*	Mostly dogs, cats, and less common in horses, ferrets, deer, wolves, African lions, bottle-nosed dolphins and sea lions	Fever, malaise, pneumonia, verrucous skin lesions, subacute meningitis, gait abnormalities and seizures
Coccidioidomycosis	*Coccidioides immitis, Coccidioides posadasii*	Dogs, horses, pigs and ruminants	Hypersensitivity reaction, fever, erythema multiform, arthralgia, pleuritic chest pain and dry cough
Cryptococcosis	*Cryptococcus neoformis*	Cats, dogs, cattle, horses, sheep, goats, birds and wild animals	Meningitis, fever, malaise, headache, neck stiffness, photophobia, cough, nausea and vomiting

Disease	Etiology	Animal Host	Major Symptoms/ System or Organs Involved
Sporotrichosis	*Sporothrix schenckii*	Dogs, cats, horses, cows, camels, dolphins, goats, mules, birds, pigs, rats and armadillos	Erythematous papulonodular lesions, cough, low-grade fever, weight loss, pulmonary dysfunction and lung abscess
Malassezia infection	*Malassezia* spp.	Dogs and cats	Pityriasis versicolor, seborrheic dermatitis, atopic eczema, folliculitis and dandruff
Histoplasmosis	*Histoplasma capsulatum var. capsulatum*	Cats, dogs, rabbits and rats	Often asymptomatic, fever, productive cough, chest pain, weight loss, hepatospleno-megaly and hematologic disturbances
Rickettsial Zoonoses			
Q-Fever	*Coxiella burnetti*	Cattle, sheep, goats, dogs, cats, chickens and wild animals	Fever and skin rash
Epidemic typhus	*Rickettsia prowazekii*	Dogs, lambs, goat kids, calves, donkeys and young camels	High fever, headache, malaise, myalgia, arthralgias, rashes, CNS manifestations, petechiae and cough
Rocky mountain spotted fever	*Rickettsia rickettsii*	Rodents and dogs	Fever, headache, rash, malaise, myalgia, anorexia, nausea, vomiting, abdominal pain and photophobia

Disease	Etiology	Animal Host	Major Symptoms/ System or Organs Involved
Queensland tick typhus	*Rickettsia australis*	Bandicoots, rodents, cattle, wombats and companion animals	Mild fever, macular, papular, or maculopapular rash, rigors, myalgia, arthralgia, acute renal failure, headache and lymphadenopathy
Scrub typhus	*Orientia tsutsugamushi*	Rodents	Fever, rash, myalgia, diffuses lymphadenopathy, necrotic eschar, cough and headache, diarrhea
Chlamydial Zoonoses			
Enzootic abortion	*Chlamydia abortus*	Cattle, horses, sheep, pigs, cats and rabbits	Abortion
Psittacosis	*Chlamydia psittaci*	Parrots, cockatoos, cattle, sheep and goats	Cough, dyspnea, pleuritic chest pain, epistaxis, sore throat, hemoptysis, fever, malaise, anorexia, chills, nausea, vomiting, myalgias, arthralgias, headache and abdominal pain
Chlamydiosis	*Chlamydia felis, Chlamydia trachomatis*	Cats and mice	Conjunctivitis, urethritis, cervicitis, pelvic inflammatory disease, ectopic pregnancy, tubal factor infertility, epididymitis, proctitis and reactive arthritis (sequelae)

Disease	Etiology	Animal Host	Major Symptoms/ System or Organs Involved
Protozoal Zoonoses			
Trypanosomiasis	*Trypanosoma brucei*	Antelopes, cattle, camels and horses	Chronic and intermittent fever, headache, pruritus, lymphadenopathy, hepatosplenomegaly and sleep disturbance
Leishmaniasis	*Leishmania infantum*	Cats, dogs, horses and bats	Skin lesions, hepatosplenomegaly and wasting
African sleeping sickness	*Trypanosoma brucei*	Antelopes, cattle, camels and horses	High fever, headache, nausea, vomiting and erythematous plaque formation
Chagas disease	*Trypanosoma cruzi*	Domestic pigs and cats, wildlife reservoirs include opossums, armadillos, raccoons and woodrats	Severe myocarditis, meningoencephalitis, swelling or redness of skin, fever, swollen lymph nodes, head or body aches, fatigue, nausea, vomiting and diarrhea
Giardiasis	*Giardia lamblia*	Dogs, cats, ruminants and pigs	Diarrhea, abdominal cramping, bloating, flatulence, malaise, nausea and anorexia
Toxocariasis	*Toxocara canis, Toxocara cati*	Dogs and cats	Fever, anorexia, hepatosplenomegaly, rash, pneumonitis, asthma and visual impairment

Disease	Etiology	Animal Host	Major Symptoms/ System or Organs Involved
Toxoplasmosis	*Toxoplasma gondii*	Pigs, sheep, goats, poultry and rabbits	Lymphadenopathy, fever, malaise, night sweats, myalgia, sore throat
Balantidiasis	*Balantidium coli*	Ruminants, pigs, guinea pigs and rats	Chronic diarrhea, occasional dysentery, nausea, foul breath, colitis, abdominal pain, weight loss and deep intestinal ulcerations
Disease Caused by Acellular Non-viral Pathogenic Agents			
Mad Cow Disease, also known as BSE (Bovine spongiform encephalopathy). In human known as Creutzfeldt-Jakob disease (CJD)	*Prion protein*	Cattle, sheep, goats, mink, deer and elks	Ataxia, jerky movements, seizures, dementia, memory loss and personality changes

Section – VI
Veterinary Pharmacology and Toxicology

Important Terminologies

Pharmacology: is the scientific study of drugs and their use in medicine. It deals with interaction of exogenously administered chemical molecules (drugs) with living organism.

Pharmacodynamics: What drug does to the body. It includes physiological and biochemical effects of drugs and their mechanism of action at organ/system/molecular level.

Pharmacokinetics: What body does to the drug. It includes absorption, distribution, metabolism and excretion of drug.

Pharmacognosy: Study of sources and identification of drugs.

Chemotherapy: Branch of pharmacology which deals with use of therapeutic agents in treatment of diseases caused by pathogens (viruses, bacteria, fungi and parasites).

Toxicology: Study of toxicity or adverse effects of drugs or chemical, physical and biological agents on living organisms.

Poison: It is defined as an agent either solid, liquid or gas which when applied to animal's body outwardly or in any way introduced into it can destroy life without acting mechanically.

Toxins: A naturally occuring poison produced by metabolic activities of living cells or organisms.

Venom: A toxic substance produced by an animal and actively delivered to target through a specialized mechanism like bite, sting or spray.

Posology: Study dealing with drug dosage determination.

Prodrug: It is a drug after metabolic activation produces the therapeutic effect, where the parent drug molecule is ineffective or inert, but its metabolite is pharmacologically active.

Placebo: It is referred to an agent/ substance/ preparation consisting of an inert pharmacological agent (dummy drug) to stimulate the real drug therapy in exerting psychological impact of medication.

Pharmacopoeia: It is a drug compendium consisting of officially recognized drug preparations/ formulation.

Affinity: Strength of the interaction between a drug and its receptor. A drug with high affinity binds more readily to its receptor, producing a stronger effect at lower concentrations.

Agonist: A substance that activates a receptor to produce a biological response.

Antagonist: A substance that binds to a receptor but does not activate it, preventing other substances (such as agonists) from binding and exerting their effect.

Efficacy: Ability of a drug to produce a maximum effect.

Potency: Amount of drug needed to produce a given effect.

Therapeutic index: Ratio of toxic dose to therapeutic dose; a measure of drug safety.

Half-life ($t_{1/2}$): Time required for concentration of a drug in the plasma to decrease by half.

Ceiling Dose: A drug refers to the maximum dose of the drug beyond which no additional therapeutic effect is achieved, even if the dose is increased further.

Loading Dose: A higher initial dose of a drug given to quickly achieve therapeutic levels, followed by a maintenance dose to maintain these levels.

Maintenance Dose: A dose of a drug given regularly to maintain a desired therapeutic level in the bloodstream.

Overdose: Ingestion or administration of a drug in an amount that exceeds the body's capacity to metabolize and excrete it, leading to toxic effects or life-threatening conditions.

C_{max} (Maximum Concentration): Highest concentration of a drug in the bloodstream after administration, indicating peak drug exposure.

Dependence: Physical or psychological need for a drug, which can lead to withdrawal symptoms if the drug is discontinued.

Addiction: A chronic, relapsing disorder characterized by compulsive drug-seeking behaviour and use despite harmful consequences.

Tolerance: A reduced response to a drug after repeated administration, requiring higher doses to achieve the same effect.

Reverse Tolerance (Sensitization): An increased response to a drug after repeated administration, as opposed to the typical development of tolerance.

Bioavailability: The proportion of a drug that enters the bloodstream when administered and is made available to the target tissue.

Therapeutic Window: The range of drug doses that produces a therapeutic effect without causing adverse effects.

Non-prescription (OTC) Drugs: Medications available without a prescription.

Prescription Drugs: Medications that require a doctor's prescription.

Drug Dose Calculation:

Dose is the quantity of drug to be administered at one time and expressed in mg/kg or IU/kg.

Required Dose Calculation (Equals drug volume in ml or cc)

$$= \frac{\text{Animal weight (kg) x Dosage (mg/kg)}}{\text{Concentration of drug (mg/ml)}}$$

Pharmaco-Therapeutic Classification of Drugs

Drugs Acting on Digestive System

- **Sialics or Sialagogues:** Agents that increase volume of saliva.
- **Anti-sialics or Anti-sialagogues:** Agents that decrease volume of saliva.
- **Emmolients or Demulscents:** Agents that soothen and protect GI mucosa against ingested irritants.
- **Stomachics:** Agents that increase gastric secretion.
- **Antacids:** Agents that neutralize gastric hyperacidity.
- **Emetics:** Agents that cause vomition.
- **Antiemetics:** Agents that prevent vomition.
- **Carminatives:** Agents that prevent formation of gases and help in their expulsion from stomach and intestine.
- **Antizymotics:** Agents that prevent bacterial fermentation and arrest further gas production in rumen.
- **Purgative/Luxative:** Agents that help in easy evacuation of bowel.
- **Astringents:** Agents that protect inflammed intestinal mucosa by precipitating superficial proteins and help in reducing intestinal irritation and stop bleeding.
- **Hepatotonics:** Agents that increase hepatic function.

Drugs Acting on Cardiovascular System

- **Haematinics:** Agents that increases formation of haemoglobin in RBC.
- **Haemostatics/Styptics:** Agents that stop bleeding.
- **Coagulants:** Agents that promote blood clotting.
- **Anticoagulants:** Agents that prevents blood coagulation.
- **Antiarrhythmics:** Agents that prevents cardiac arrhythmia.
- **Vasoconsrictors:** Agents that decreases blood pressure through constriction of blood vessels.

- **Vasodilators:** Agents that decreases blood pressure through dilatation of blood vessels.
- **Antihypertensives:** Agents that decrease elevated blood pressure.
- **Cardiotonics:** Agents that reduce size of enlarged heart by increasing force of myocardial contraction, without much increase in corresponding oxygen consumption by myocardium.

Drugs Acting on Urogenital System

- **Diuretics:** Agents that promote formation and excretion of urine.
- **Ecbolics/Oxytocics:** Agents that cause contraction of uterus and expels the contents.
- **Galactagogues:** Agents that increases milk secretion.
- **Emmenaggues:** Agents that help in appearance of heat in animals or regulate oestrous cycle.
- **Tocolytics:** Agents that relax uterus.

Drugs Acting on Nervous System

- **Anaesthetics:** Agents that cause reversible loss of consciousness or sensations.
- **Analgesics:** Agents that cause relief of pain or suppress pain sensation without altering consciousness.
- **Narcotics:** Agents that cause deep sleep.
- **Hypnotics:** Agents that cause a condition similar to normal sleep.
- **Sedatives:** Agents that reduces CNS excitation without inducing sleep.
- **Tranquilizers:** Agents that calm down an excited animal.
- **Anticonvulsants:** Agents that counteract convulsions or CNS hyperexcitability.

Drugs Acting of Skin

- **Diaphoretics:** Drugs that increase sweating.
- **Anhydrotics:** Agents that decrease sweating.
- **Keratolytics:** Agents that are used to destroy excessive granulation growth on the skin/warts.
- **Antipruritics:** Agents that reduces irritation and itching.
- **Emollients:** Agents that soothen, lubricate and protect the skin.
- **Astringents:** Agents that exert a protective action on skin by precipitating proteins in superficial layers.

Routes of Drug Administration

Oral administration: Administered through mouth. Solid dosage forms (powders, tablet, capsules, pills, etc.) and liquid dosage forms (syrups, emulsion, mixture, drench, electrolytes, etc.).

Topical or local application: It refers to external application of drug to the body surface for localized action at accessible site, such as skin, eyes, body orifices, body cavity.

Parenteral administration: It refers to a drug administration by injection directly in to the tissue fluid or blood without having to cross intestinal mucosa. Parenteral administration further classified as follows:

- **Intravenous route (IV):** Administered in vein, allows rapid modification of dose and is used for emergency treatment. Jugular vein is the common route of drug administration in large animals (horse, cattle, sheep and goat), in pig-ear veins, in dog and cat-cephalic vein and recurrent tarsal vein.
- **Intramuscular (IM):** Absorption occurs either haematogenous or *via* lymphatic and is usually fairly rapid except for long acting preparation. Neck and thigh muscles are the most common sites.
- **Subcutaneous (SC):** Preferred when slow and continuous absorption of drug is required. The injected drug disperses through the loose connective tissues. They dissolve in tissue fluid before it can enter either capillaries or lymphatic.
- **Intradermal (ID):** Administration of drug in dermis just below epidermis.
- **Epidural:** Refers to deposition of drug up on or outside the dura matter e.g. introduction of local anaesthetics between the first and second coccygeal vertebra and lumbosacral to eliminate straining.
- **Subconjunctival:** Disposition of a pharmaceutical preparation beneath conjunctiva.

Antimicrobials

An antimicrobial is an agent that kills microorganisms or stops their growth. It is used to prevent and treat infections caused by microorganisms. Antimicrobial medicines can be grouped according to microorganisms they act primarily against. For example,

- Antibiotics (also known as antibacterials) are used against bacteria
- Antifungals are used against fungi
- Antivirals are used against virus
- Antiparasites are used again different parasites
- Antiprotozoals are used against protozoa

Antimicrobial Spectrum: The range of microorganism that an antimicrobial agent/drug can inhibit or kill.

Antimicrobial agents are also classified as:

- **Disinfectants:** which kill a wide range of microbes on non-living surfaces to prevent spread of illness. These are non-selective agents, e.g. bleaching powder.
- **Antiseptics:** which are applied to living tissue and help reduce infection during surgery.
- **Antibiotics:** which destroy microorganisms within body. The term antibiotic originally described only those formulations derived from living microorganisms but is now also applied to synthetic agents, such as sulfonamides or fluoroquinolones.

Antimicrobial Resistance (AMR)

Overuse or misuse of antimicrobials can lead to the development of antimicrobial resistance (AMR). Antimicrobial resistance threatens the effective prevention and treatment of an ever-increasing range of infections caused by bacteria, parasites, viruses and fungi.

AMR occurs when bacteria, viruses, fungi and parasites change over time and no longer respond to medicines making infections harder to treat and increasing risk of disease spread, severe illness and death. As a result, the medicines become ineffective and infections persist in body, increasing risk of spread to others.

Group of Antibiotics with their Mode of Action

Penicillins

Mode of Action: Penicillin kills bacteria through binding of beta-lactam ring to DD-transpeptidase, inhibiting its cross-linking activity and preventing new cell wall formation. Without a cell wall, a bacterial cell is vulnerable to outside water and molecular pressures, which causes the cell to quickly die.

Natural, narrow-spectrum penicillins (beta lactamase-sensitive penicillins)

- Benzylpenicillin
- Penicillin procaine etc.

Aminopenicillins (without beta-lactamase inhibitors)

- Amoxicillin
- Ampicillin

Aminopenicillin + Betalactamase inhibitor

- Cloxacillin
- Dicloxacillin
- Nafcillin
- Oxacillin

Sulphonamides

Mode of Action: They are competitive antagonists and structural analogues of p-aminobenzoic acid (PABA) in synthesis of folic acid, which is essential for further production of DNA in bacteria.

- Sulfadiazine
- Sulfadimidine
- Sulfadimethoxine
- Sulfanilamide
- Sulfaquinoxaline etc.

Cephalosporins

Mode of Action: Similar penicillins, they bind to penicillin binding proteins and interfere with cell wall enzymes.

- Cefalexin
- Cefazolin
- Cefuroxime
- Cefoperazone
- Ceftiofur

- Ceftriaxone
- Cefquinome etc.

Aminoglycosides

Mode of Action: They inhibit protein synthesis of microorganisms by binding, with high affinity, to A-site on 16S ribosomal RNA of 30S ribosome.

- Streptomycin
- Dihydrostreptomycin
- Framycetin
- Kanamycin
- Neomycin
- Gentamicin
- Amikacin etc.

Lincosamides

Mode of Action: They bind to 50S ribosome in which they inhibit protein synthesis of microorganisms

- Lincomycin

Fluoroquinolones

Mode of Action: They target DNA gyrase and topoisomerase IV in bacteria and inhibit their control of supercoiling within the cell, resulting in impaired DNA replication and cell death.

- Ciprofloxacin
- Danofloxacin
- Enrofloxacin
- Marbofloxacin
- Norfloxacin
- Orbifloxacin etc.

Tetracyclines

Mode of Action: They specifically inhibit the 30S ribosomal subunit, hindering the binding of the aminoacyl-tRNA to the acceptor site on the mRNA-ribosome complex. When this process halts, a cell can no longer maintain proper functioning and will be unable to grow or further replicate.

- Chlortetracycline
- Doxycycline
- Oxytetracycline
- Tetracycline

Macrolides

Mode of Action: They inhibit bacterial protein synthesis by binding the bacterial 50S ribosomal subunit.

- Erythromycin
- Tilmicosin
- Tylosin etc.

Antiparasitic Drugs

Antiparisitics	Form/Route	Spectrum	Animals	Dose
Thiabendazole	Oral preparation; oral paste	GI worms, lung worms (sheep), fungicidal (crop), cestode, trematodes, *Ascaris suum* and *Trichuris* (pigs)	Horse, cattle, sheep and goat	66–110 mg/kg
Albendazole	Bolus, tablet and suspension	Tapeworms, abomasal and intestinal nematodes, liver fluke and lungworms, ovicidal and antigiardial	Cattle and sheep	7.5 mg/kg for cattle; 5 mg/kg for sheep; 10 and7.5 mg/kg for liver fluke treatment in cattle and sheep respectiv-ely; 20 mg/kg to treat giardiasis for 3 days

Antiparisitics	Form/Route	Spectrum	Animals	Dose
Febantel	Paste, suspension, tablets	Hookworms, tapeworms and nematodes	Ruminants, horses, dogs, cats and pigs	10 mg/kg (Ruminant), 6 mg/kg (Horse), 10 mg/kg (Dog and cat for 3 days), 20mg/kg (Pig)
Fenbendazole	Available as Bolus and suspension	Tapeworms (head and segments), abomasal and intestinal nematodes, lungworms, hookworms in dogs, Strongyle spp. in horses. It has ovicidal activities	Cattle, sheep, goat, horse, pig and dog	10 mg/kg (cattle), 5 mg/kg (sheep goat and horse), 50 mg/kg (hookworms in dog)
Pyrantel Pamoate	Available as tablets and suspension	Treatment and control of roundworms *(Toxocara canis, Toxascaris leonina)* and hookworms *(Ancylostoma caninum, Uncinaria stenocephala, Ancylostoma braziliense)*	Dogs and horses	5 mg/kg PO

Antiparisitics	Form/Route	Spectrum	Animals	Dose
Praziquantel	Available as tablets and suspension	Effective against cestodes of ruminants (eg, Moniezia spp, Stilesia), horses (*Anoplocephala perfoliata*), dogs, cats, and poultry (*Taenia pisiformis, T. hydatigena, T. taeniaformis, Dipylidium caninum, Mesocestoides corti, Echinococcus granulosus*)	Dogs and Cats	5 mg/kg PO, 5.8 mg/kg SC or as spot-on (cats, 12 mg/kg)
Oxfendazole	Oral suspension and bolus	Type 1 and type 2 ostertegiasis	Only in cattle, sheep and horse	4.5 mg/kg (cattle), 5 mg/kg (sheep), 10 mg/kg (horse)
Oxibendazole	Oral suspension and paste	Adult and larva stage of GI nematodes	Pigs, cattle, sheep and horses	10 mg/kg sheep and cattle while 10-15 mg/kg in horses

Antiparisitics	Form/Route	Spectrum	Animals	Dose
Mebendazole	Available as paste, tablets, granules, drench and as premixed for medicated feed	Strongyles, large round worms, mature and immature larval stages of pinworm in horse. Treatment of hookworms, whipworms and tapeworms in dogs at 22 mg/kg for 3 consecutive days	Horse, sheep, goat, game birds, pigs, deer, dog and poultry	8.8 mg/kg (Horse) 15 mg/ kg (sheep and goat)
Closantel	Available as bolus or suspension	Broad spectrum endectocide for treatment of round worms, liver flukes and external parasites like ticks, lice and mites	Cattle and sheep	10 mg/kg PO or 5 mg/kg SC
Oxyclozanide	Available as bolus and suspension	Used in the treatment and control of fascioliasis in ruminants mainly domestic animals such as cattle, sheep and goats	Cattle and sheep	10–15 mg/ kg PO

Antiparisitics	Form/Route	Spectrum	Animals	Dose
Rafoxanide	Available as suspension and powder	Treatment and control of adult and immature liver flukes *(Fosciola gigentica, and fasciola hepatica)* and adult worms of *Haemonchus* spp.	Cattle and sheep	7.5 mg/kg PO or 3.5 mg/kg SC
Ivermectin	Available as tablet, bolus, suspension and injection	Used to treat multiple species of internal and external parasites	Cattle, buffalo, sheep, goat, horse and dog	200 mcg/ kg of b. wt. PO/SC

Antifungal Drugs

Antifungals	Mechanism of Action	Antimicrobial Spectrum	Doses
Amphotericin B	Increases permeability of cell membrane by binding to ergosterol	*Aspergillosis, Candida, Rhodotorula* Spp., *Cryptococcus neoformans*	Dog: 0.25–0.50 mg/kg, 3 times weekly Cat: 0.1–0.50 mg/kg, 3 times weekly
Ketoconazole	Inhibit steroid synthesis in host	*Trichophyton verrucosum, T. equinum, T. mentagrophytes, Microsporum canis, M. nanum and Malassezia pachydermatis*	Dogs: 5 - 20 mg/kg, 2 times daily, Cats: 5 - 20 mg/kg, 2 times daily
Itraconazole	It is a potent inhibitor of ergosterol (a main membrane lipid of fungi) synthesis. Fungal cells are thus unable to maintain the integrity of plasma membranes, which leads to cell wall rupture.	Synthetic, broad spectrum effective for Dermatophytes, *Malassezia, Candida, Cryptococcus, Histoplasma, Blastomyces* and *Sporothrix* spp. as well as the protozoans Leishmania and Trypanosoma	For dermatophytosis in dogs @ 5 mg/kg, PO, every 24 hours until mycological cure For systemic mycoses @ 5–10 mg/kg, PO, every 24 hours for 60 days
Fluconozole	Drug of choice for fungal meningitis because can cross blood brain barrier (BBB)	*Cryptococcus, Histoplasma* and *Blastomyces* spp.	Dogs: 5 - 10 mg/kg, 1 to 2 times daily

Antifungals	Mechanism of Action	Antimicrobial Spectrum	Doses
Terbinafine	Terbinafine inhibits ergosterol synthesis by inhibiting squalene epoxidase, an enzyme that is part of the fungal cell membrane synthesis pathway	*Trichophyton*, *Microsporum* and *Epidermophyton* spp.	Dog and Cat: 3 - 10 mg/kg, PO, once daily
Flucytocine	It is converted to 5 furouracil, which inhibit thymidylate synthetase enzyme. It inhibits transcription as 5FUTP (5 flurouracil ribose triphosphate)	*Cryptococcus neoformans* and *Candida* spp.	Dogs and Cats: 25 - 50 mg/kg, PO, Every 6-8 hours for 42 days
Griseofulvin	Inhibit mitosis by interfering spindle fiber formation	*Microsporum*, *Trichophyton* and *Epidermophyton* spp.	Dog and Cat: 10-50 mg/kg/day, PO Horse: 5-10 mg/kg/day for 3-6 weeks

Antifungals	Mechanism of Action	Antimicrobial Spectrum	Doses
Benzoic acid and Salicylic acid	Antifungal action of benzoate is caused by an accumulation of benzoate at low external pH, which lowers the intracellular pH into the range where phosphofructokinase is sensitive. Salicylic acid is capable of inhibiting 90 percent of the fungal germination after 30 min, causing damage to the conidial plasma membrane and leading to protein leakage	*Microsporum*, *Trichophyton* and *Epidermophyton* spp.	Dog and Cat: 10-50 mg/kg/day, PO Hourse: 5-10 mg/kg/day for 3-6 weeks

Antiprotozoal Drugs

Antiprotozoals	Indications	Doses
Buparvaquone	Treatment of theileriosis	2.5 mg/kg, IM (once) only
Diminazine Aceturate	Treatment of Babesiosis, Theileriosis and Surra	3.5 - 7 mg/kg b. wt. or 1 ml/10-20 kg b.wt., deep IM route
Isometame-dium HCL	Prevention and treatment of surra	0.5 mg/kg for treatment and 1 mg/kg for prevention, deep IM route
Qunapyramine compound	Prevention and treatment of Surra	5 mg/kg, SC
Imidocarb dipropionate	Treatment and control of Babesiosis and Treatment of Anaplasmosis	Babesiosis treatment 1 ml/100 kg For prevention 2.5 ml/100kg Anaplasmosis treatment in horse 2.5 ml/100 kg b. wt. IM/SC
Oxytertra-cycline injection	Theileriosis, Ehrlichiosis and Anaplasmosis	10-20 mg/kg for 5 days
Doxycycline	Ehrlichiosis	Dog and Cat 5-10 mg/kg b. wt. orally daily for 2 weeks
Amprolium powder	Coccidiosis	Cattle and Buffalo: 5 - 10 mg/kg orally, Sheep and Goat: 15 mg/kg orally daily for 5-7 days

ANS Pharmacology

Autonomic nerves control the involuntary function of the body through their innervations to smooth muscles of visceral organs and cardiac muscles. As the visceral organs exhibit a degree of autonomy and their nerve supply is named as autonomic nervous system (ANS). Autonomic nervous system regulates certain body processes, such as blood pressure, digestion, respiration, urination and metabolism. This system works automatically (autonomously), without animal's conscious effort. ANS relies heavily on neurohumoral transmission.

Neurohumoral Transmission (NHT)

The functions of body, both voluntary or involuntary are regulated by stimuli from different centers in CNS and impulse thereof are conveyed through nerve junctions (synapses) and between nerves and organs by a process is called Neurohumoral Transmission (NHT). It is electrochemical process involving impulse conduction and impulse transmission. The passage of impulse along the length of an axon is called conduction, whereas passage of an impulse through nerve-nerve junction or neuro-effector junction is called as impulse transmission. NHT is classified as noradrenergic and adrenergic transmission.

Noradrenergic Neurotransmission

Norepinephrine is a chemical messenger that transmits signals across the synapse, the junction between neurons and is also involved in the "fight-or-flight" response. Noradrenergic neurotransmission system is classified into sympathomimetic and sympatholytic drugs.

1. Sympathomimetics: These drugs are agents which in general mimic responses due to stimulation of sympathetic nerves. These agents are able to directly activate adrenergic receptors or to indirectly activate them by increasing norepinephrine and epinephrine (mediators of the sympathoadrenal system) levels.

Classification of Sympathomimetic Drugs

- **Direct acting:** Epinephrine, Norepinehrine, Isoprenalins, Phenylephrine, Dopamine and Dobutamine
- **Indirect acting:** Amphetamine, Tytramine, Cocaine
- **Dual acting:** Ephedrine, Pseudoephedrine

2. Sympatholytics: These are the drugs that oppose the effects of the sympathetic nervous system by inhibiting its action. They can work by reducing the release of norepinephrine, blocking adrenergic receptors, or even by interfering with the brain's control of sympathetic activity.

Classification of Sympatholytic Drugs

- **α receptor blockers**
  - **Non selective α blockers:** Phenoxybenzamine, Phentolamins, Tolazoline, Ergotamine and Ergotoxine
  - **Selective α1 blockers:** Prazosin, Doxazocin and Terazocin
  - **Selective α2 blockers:** Yohimbine
- **β receptor blockers**
  - **Non selective β blockers:** Propranolol, Sotalol, Nadolol, Timilol and Alprenolol
  - **Selective β1 blockers:** Atenolol, Metoprolol, Acebutolol and Esmolol
  - **Selective β2 blockers:** Butoxamine

Adrenergic Neurotransmission

Transmission mediated by noradrenaline or norepinephrine at post ganglionic sympathetic nerve terminals and that norepinephrine and dopamine in CNS is called adrenergic transmission. Adrenergic neurotransmission system is classified into parasympathomimetic and parasympatholytic drugs.

1. Parasympathomimetics: These are the cholinergic receptor stimulating agents, that stimulates the parasympathetic nervous system. These drug cause effects similar to acetylcholine (ACh) stimulation of post-ganglionic parasympathetic nerves or stimulation of cholinergic receptors.

Classification of Parasympathomimetic Drugs

- **Direct Acting (Cholinergic agonists) -** Drugs that produce effects through direct stimulation of cholinergic receptors (both muscarinic and nicotinic) hence also generally called muscarinic agonists.
  - **Choline esters:** Acetylcholine (ACh), Methacholine, Bethanechol and Carbachol
  - **Cholinomimetic alkaloids:** Pilocarpine, Nicotine, Arecholine and Muscarine
  - **Synthetic analogues of cholinomimetic alkaloids:** Aceclidine and Oxotremorine
- **Indirect acting (Anticholinesterases) -** Drugs that stimulate cholinergic transmission indirectly by inhibiting the enzyme AChE, which hydrolyzes and inactivates ACh in the synaptic clefts of autonomic nervous system, central nervous system and neuromuscular junction of the somatic nervous system.
  - **Short acting:** Edrophonium
  - **Intermediate acting:** Neostigmine, Physostigmine, Pyridostigmine
  - **Long acting:** Ecothiophate, Organophasphate insecticide (Parathion, Malathion)

2. Parasympatholytics: These drugs prevent effects of stimulation of parasympathetic post-ganglionic nerves and/ or effects of ACh or Cholinergic drugs, mainly the muscarinic actions.

Classification of parasympatholytic drugs

- **Based on sources**
  - **Natural alkaloids:** Atropine, Hyoscine
  - **Synthetic/Semisynthetic compounds:** Homatropine, Eucatropine, Cyclopentolate, Tropicamide, Glycopyrrolate, Methantheline, Propantheline, Dicyclomine and Oxybutynine
- **Based on chemical structure**
  - **Teritiary amines:** Atropine, Benzatropine, Oxybutyrin, Dicyclomine and Scopolamine
  - **Quarternary amines:** Glycopyrrolate, Ipratropium and Propantheline

Autocoids: An autacoid is a locally produced modulating factor, influencing locally the function of cells and/or tissues, which is produced on demand and which subsequently is metabolized in the same cells and/or tissues. It is collectively called as self remedial agents. Sometimes they are also called 'local hormones'. The major functions of autocoids are mediation of reactions of inflammations, allergy, blood clotting, for maintenance of hemodynamic, electrolyte balance, GI motility and neurotransmitters.

Classification of Autocoids

- **Amine autocoids:** Histamine and 5-hydroxytryptamine
- **Peptide autocoides:** Bradykinin, Angiotensins
- **Lipid autocoids:** Eicosanoids (Prostaglandins and Leutrienes)

Antihistamines: These drugs antagonize (competitive antagonists of histamine at receptors) the effects of histamine released in the body. Sympathomimetics (epinephrine, norepinephrine) are physiological antagonists of histamine.

Classification of Antihistamines

- **Basing chemical structure**
  - **Ethanolamine derivatives:** Diphenhydramine and Dimenhydrinate
  - **Ethylenediamine derivatives:** Tripelennamine, Mepyramine and Pyrillamine
  - **Alkylamine derivatives:** Chlopheniramine and Triprolidine
  - **Piperazine derivatives:** Cetrizine, Meclizine and Chlorcyclizine
  - **Phenothiazine derivatives:** Promethazine and Trimeprazine
  - **Piperidine derivatives:** Fexodenadine and Ioratidine

- **Based on pharmacological action**
  - **Potent anti-histaminic action and sedation:** Promethazine, Diphenhydramine and Dimenhydrinate
  - **Potent anti-histaminic action but less sedation:** Tripelennamine, Chlorcyclizine and Chlorpheneramine
  - **Less potent anti-histaminic sedation:** Mepyramine and Phenindamine

Antihistamine action but nosedation: Loratadine and Terfenadine

- **Based on receptor specificity**
  - **H1 blockers:** Diphenhydramine, Promethazine, Triplennamine, Mepyramine, Pheniramine, Cetrizine, Meclizine
  - **H2 blockers:** Cimetidine, Ranitidine, Nizatidine and Famotidine
  - **H3 blockers:** Thioperamide

Emergency Drugs and Their Antagonists

Drugs	Antagonists/Antidote
Atropine	Physostigmine
Morphine	Nalloxone
Pentabarbitol sodium	Yohimbine
Organo-phosphorus compound	Pralidoxime (2-PAM)
5-OH Tryptamine	Methysergide, Ergot alkaloid
Kallikrien	Aprotonin
Angiotensin	Saralosin
Heparin	Toluidine potamine
Vitamin K	Coumarine
Alcohol	Sodium bicarobonate ($NaHCO_3$)/ Sodium citrate
Aercoline	Atropine sulphate
Aspirin	Sodium bicarobonate ($NaHCO_3$)
Barbiturate	Amphetamine
Barium	Magnesium sulfate ($MgSO_4$)
Belladona	Tannic acid
Benzoic acid	Siquil, Diuretics
Bromides	Chlorides
Camphor	Siquil, Saline diuretics
Castor oil	Lavage, Atropine sulphate
Ephydrine	Lavage, Emetics
Chloroform	Oxygen (O_2), Coramine, Calcium borogluconate
Formaldehyde	Lavage, Nacarbonate
Coumarine	Vitamin K
Iron toxicosis	Deferoxamine
Inroganic phosphorus	Copper sulfate ($CuSO_4$)

Poisoning and its Antidote

Poisoning	Antidote
Organophosphate	Atropine, 2-pyridine aldoxime methyl chloride) or 2-PAM
Carbamate	Atropine
Lead, Mercury, Arsenic	Dimercaprol, or British anti-Lewisite (BAL)
Lead, Zinc	Calcium Disodium EDTA
Cyanide	Sodium nitrite, Sodium thiosulfate
Alkaloids	Tannic acid
Nitrate, Nitrite, Chlorate	Methylene blue
Warfarine (Caumarin Anticoagulants)	Vitamin K
Morphine	Nalorphine, Naloxone
Copper	D-Penicillamine
Barbirurates	Bemegride
Fluorides, Oxalates	Calcium gluconate
Iron	Deferoxamine
Benzodiazepines	Flumazenil
Silver nitrate	Sodium chloride
Strychnine, Nicotine	Potassium permanganate
Curare	Neostigmine
Carbon Monoxide	Oxygen
Venom	Anti-venom

Chemotherapeutic Drugs

Drug Action	Class of Drug	Examples
Antiarrhythmic	Sodium channel blockers	Quinidine, Moricizin, Lignocaine, Phenytion, Flecainide
	Beta adrenoceptor antagonists	Propanolol and Carazol
	Potassium channel blockers	Amiodarone and Brettylium
	Calcium channel blockers	Verapamil, Diltiazem, Nifedipine
Vasodilators	Direct acting arterial vasodilators	Hydralazine and Minoxidil
	Calcium channel blockers	Verapamil, Diltiazem, Nifedipine and Amlodipine
	Potassium channel blockers	Pinacidil and Cromokalim
Haemostatics	Coagulants	Thromboplastin, Thrombin and Fibrinogen
	Vasoconstrictors	Adrenaline and Nor-adrenaline
	Styptics/Astringents	Ferric sulphate, Silver nitrate and Zinc chloride
	Fibrinolytic inhibitors	Aminocaproic acid, Tranexamic acid and Aprotinin
	Vitamin K and analogues	Phytonadione and Menadione
Antianemic	Minerals	Iron, Cobalt, Copper
	Vitamins	Vitamin B_{12}, Folic acid and Ascorbic acid
	Erythroid growth factor	Erythropoietin
	Anabolic steroids	Nandrolone
Anticonvulsants	Barbiturates	Phenobarbitone, Methabarbital
	Benzodizepines	Clonazepam
	Hydantoins	Phenytoin, Mephenytoin
	Oxazolidine diones	Trimethadione, Paramethadione

Drug Action	Class of Drug	Examples
Myocardial stimulants	Cardiac glycosides	Digoxin, Digitoxin and Ouabain
	Phosphodiesterase inhibitors	Aminophylline, Theophyllin and Amrinone
	Beta-adrenoceptor agonists	Adrenaline, Isoprenaine and Dopamine
Diuretics	Loop diuretics	Frucemide, Ethacrynic acid and Bumetanide
	Osmatic diuretics	Mannitol, Glycerine, Sorbitol
	Xanthine diuretics	Aminophylline and Theophylline
	Acidifying salts	Ammonium salt and Sodium chloride
	Alkalinising salts	Potassium acetate and Potassium citrate
Anti-emetics	Demulcents and protectants	Kaolin, Pectin and Bismuth salts
	Gastric antacids and local anaesthetics	Magnesium hydroxide, Aluminium hydroxide and Benzocaine
	Anticholinergics	Glycopyrronium, Methscopolamine and Propantheline
	Prokinetics	Domperidone and Cisapride
	Muscarinic receptor antagonists	Hyosine, Dicyclomine and Aminopentamide
Bronchodilators	Sympthomimetics	Adrenaline, Ephedrine, Salbutamol, Terbutaline
	Anticholinergics	Atropine, Glycopyrronium and Ipratropium
	Methylxanthines	Theophylline, Aminophylline and Diprophylline

Section - VII
Clinical Diagnosis

Diagnosis is an art of precisely knowing the cause of a particular disease. (Dia= thorough, gnosis= knowledge). The diagnosis is based on accurate history, careful examination of animal, collection of material for laboratory examination, correlation and interpretation of findings.

Collection, Preservation and Dispatch of Specimen for Laboratory Diagnosis

Tissue samples are collected from live or dead animal for laboratory examination to confirm the tentative diagnosis.

Purpose:

1. Diagnosis of disease
2. Prognosis
3. To observe effect of treatment and give direction for future therapy

General Considerations for Collection of Specimens:

1. All materials collected should be accompanied by full history of disease outbreak namely, species affected, duration of disease, clinical signs, morbidity and mortality rates, disease suspected etc.
2. Collected biological specimens should be transported on ice to the nearest laboratory as early as possible.
3. Materials collected for bacteriological examination should be kept at refrigeration temperature (4°C) in case of delay of transportation. If a viral etiology is suspected, the material can be stored at -20°C to -80°C.
4. If death is reported, the post-mortem examination should be conducted at the earliest as putrefied materials are unfit for laboratory examination and detailed post-mortem report should be attached along with the samples collected during post-mortem.
5. For Histopathological studies, tissues should be preserved in 10% formalin. The volume of formalin used should be approximately 10 times the volume of material.
6. Specimen bottles with wide mouth should be used for collecting tissues.
7. All the impression smears before packing, should be fixed in methanol for 1-5 minutes unless otherwise specified.

Specimens and Collection Procedures:

Name of Specimen	Collection Procedure
Blood	Blood is collected and examined for different purposes as: • Preparation of blood smears for microscopic examination. • For cultural examination, transmission experiments and other studies, blood is collected in sterile blood collection tube containing anticoagulant or without anticoagulant (for serum testing).
Milk	Milk for bacteriological examinations should be collected in sterile container after discarding the first few streams of milk.
Faeces	Sample for examination of parasitic eggs or coccidial-oocysts are collected from the rectum or at the time of defecation.
Urine	Urine is collected at the time of micturition or obtained with the help of a clean and sterile catheter.
Pus	Smear is made on a clean glass slide. For cultural examination, it should be obtained directly from the abscess in a sterile container, or sterile swab is used.
Nasal/throat/ uterine discharges	Samples should be collected on sterile cotton swabs and then placed in sterile screw cap test tubes.
Exudates/ transudates and body fluids	Collection has to be made with the help of sterile pipettes or syringes and to be despatched in leak proof sterile screw cap containers.
Tissue, blood and exudates smears	Tissue smears are to be prepared from cut surfaces of organs and fixed over a flame. Blood/exudates smears are drawn as thin film and fixed over a flame or in methyl alcohol.

Cap Indicators of Blood Vials

This are the small, sterile containers used for the collection, storage, and transportation of blood samples for diagnostic testing. They come in various types, typically differentiated by colour-coded caps that indicate the type of additive inside (e.g., anticoagulants or clot activators). Different tests and biochemical assays require varying types of sample collection tubes.In-vitro analysis of blood samples can be performed in clinical laboratories. Testing procedures can require any of the following blood sample types: serum or plasma.

Light Blue Tube

Also referred **Citrate tube/Prothrombin time (PT) tube** specifically designed for collecting blood samples for coagulation tests, such as prothrombin time (PT), activated partial thromboplastin time (APTT) and D-dimer tests. It contains **3.2% sodium citrate** as its anticoagulant.

Red Tube

Also known as **clot activator tube.** There is **no anticoagulantor additive** inside the tube. Because of thecontact of blood with the surface of tube, coagulation cascade becomes activated. Blood is allowed to clot for 10 to 15 minutes before subjecting to centrifugation to separate the clot from the serum further. Clotting time differs between specimens and may range from 10 minutes to almost an hour (60 minutes).

Lavender Tube

Also referred to as **EDTA tubes** because it uses **ethylene-diamine-tetra-acetic acid.** Primary role of EDTA in anticoagulation is by chelating calcium ions in the blood to prevent it from coagulation. Since the blood did not clot and liquid portion (without the red cell) is a plasma. It is commonly used for complete blood count (CBC) tests, blood typing and other hematological investigations.

Grey Tube

Also called **glucose tube** which contain **potassium oxalate** that binds to calcium, thus, inhibiting coagulation. Another substance, **sodium fluoride,** is also contained in the tubes, which serve as an antiglycolytic agent. It is used for plasma glucose and lactic acid testing.

Specimens Collection and Preservatives Used

Specific Examination	Preservatives Used
Bacteriological/ Mycological	Blood and exudates: are to be collected aseptically with sterile Pasteur pipettes/ syringes and to be transported over ice. Tissues: Pieces of affected organs with lesions should be collected in sterile condition and should be transported under cold chain.
Virological	Blood and exudates: to be collected aseptically without any chemical preservative and to be stored and transported on ice. In some viral infections (e.g. Blue Tongue and Classical Swine Fever), blood may be collected in vials/vacutainer containing EDTA. Tissues: Pieces of affected organs are to be collected under aseptic condition and transported on ice. For FMD, 50% buffered glycerine saline is the preferred transport medium.
Parasitological	For identification of parasite and helminth ova 10% formalin is the preferred transport medium to preserve the integrity of the ova. For coccidialoocysts, 2.5% Potassium dichromate solution is the preferred transport medium.
Serological tests	After collection, serum samples have to be stored at -20°C and should be transported strictly under cold chain.
Histopathological	For routine and general histopathological examination, tissue pieces are to be collected in 10% formal saline with ten times volume as tissue piece.
Toxicological (Forensic laboratory)	For chemical analysis, fresh tissues and fluids should be sent as soon as possible and on ice. Avoid addition of preservatives to the samples. Use 95% ethanol @ 1ml per gram of sample when necessary.

Dispatch of Samples to Animal Diagnostic Laboratories:

Following points must be kept in mind while dispatching material to laboratory for diagnosis:

- Describe clinical signs, lesions, tentative diagnosis and treatment given to animal in your letter; also mention type of test you want with your tentative diagnosis.
- Mark the parcel "Biological Material", "Handel with Care", "Glass Material" etc. in order to avoid damage in parcel, also mark the side to be kept on upper side with arrows.

- Seal the container so that it should not leak in transit.
- A separate specimen box should preferably be used for each case so that they do not contaminate each other or leak in transit.
- Try to send material as soon as after collection from animal.
- Put a frozen coolant pad into each tin when packing the specimens for despatch.
- In poisoning cases, the address of Forensic Laboratory should be clearly written and the following points to be considered:
  - Bottle or container should be sealed and labelled properly indicating the name of owner, identification of animal (species/breed/age/sex/tag no/mark/colour), type of tissue collected and preservative used (if any). The examination requested and disease or poisoning suspected should also be written.
  - A copy with details of post-mortem report and containing above information should be sent separately under separate cover.
  - All the container should be packed with cloth and sealed with sealing wax and should be sent through a person in order to avoid any breakage in transit.

Samples Collection in Different Diseases

Name of Disease	Ante-mortem Sample	Post-mortem Sample
Anthrax	Smear from ear vein, discharges or from swelling. Whole blood with and without EDTA.	Smear of blood from ear vein or caudal vein. Whole blood should be collected from ear vein/caudal vein. Exudate or blood mixed soil should be placed in sealed pack. Pieces of ear, or muzzle should be placed in sterile container for Ascoli's test.
Haemorrhagic Septicaemia	Smear from ear vein, fluid of swelling of throat. Whole blood from jugular vein with or without EDTA.	Blood smears or exudates obtained with the help of sterile syringe and fluid from oedematous swelling. Heart blood with and without EDTA. Portion of lungs, spleen and mediastinal lymph nodes, liver on ice. Lungs and other affected tissue in 10% formalin.

Name of Disease	Ante-mortem Sample	Post-mortem Sample
Black Quarter	Smear from affected muscle or swab from the swelling of the affected quarter by making small incision. Whole blood from jugular vein with or without EDTA.	Smear from swelling. Affected muscle piece on ice.
Actinomycosis/ Actinobacilosis	Pus from mandible and maxilla and pus smear. Slides from pus for sulphur granules.	Tissue from affected parts in 10% formalin. Pus in sterile test tube from edge of lesion. Portion of swelling mass on ice.
Brucellosis	Serum after 3 weeks of abortion. Vaginal mucus, seminal plasma, uterine discharge.	Foetal stomach pieces, liver, placenta, aborted foetus on ice.
Tuberculosis	Sputum in a sterile swab, sample of milk from infected udder. Faeces in a sterile container.	Smear from lymph glands showing nodular lesions. Lungs, lymph glands, intestine, mesenteric lymph glands should be collected if lesions are seen on ice.
John's Disease	Rectal pinch, swab or smear.	Bowel washing in sterile bottle. Smear from rectal mucosa. Mesenteric lymph node in 10% formalin. Smear from thickened areas of intestine. Small portion of bowel showing gross lesions.
Glanders	Nasal discharge; pus from skin lesions.	Smear from discharge. Lung, liver and spleen in 10% formalin. Serum.
Strangles	Smears from pus of abscess; smears from discharge from nasal cavity.	Smear from pus of affected part. Pieces of affected lymph nodes, lungs, spleen and trachea on ice.

Name of Disease	Ante-mortem Sample	Post-mortem Sample
Salmonellosis	Blood is collected from wing vein. Faeces in sterile container.	Intestinal content from ileum and large intestine on ice. Mesenteric lymph nodes, kidney and gall bladder on ice.
Leptospirosis	Serum 21 days after abortion. Blood (at febrile stage) on ice. Milk/ urine in vials (1 drop of formalin in 20 ml sample).	Portion of kidney and liver on ice.
Listeriosis	Cerebrospinal fluid (CSF). Whole blood with and without EDTA.	Half brain in ice and half brain in 10% formalin.
Colibacillosis	Faeces in sterile container.	Abdominal viscera; heart blood, fresh intestinal tissue in sterile vial.
Tetanus	Smear from exudates/ wound.	Muscles, spinal cord and brain on ice.
Enterotoxaemia	Whole blood with or without EDTA.	Small intestinal contents, intestinal smear.
Mycoplasmosis/ CCPP/CBPP	Swabs from sinus/ trachea. Nasal and vaginal swabs preferably in Amies transport medium on ice. Serum samples (paired serum).	Piece of lung preserved in 10% formalin and on ice separately.
Rabies	Saliva on ice if possible.	Brain on ice for demonstration of viral antigen, viral inclusions and isolation of virus.
Foot and Mouth Disease	Vesicular fluid. Tongue epithelium from areas of ruptured vesicles in sterile vials containing 50% buffered glycerine. Oesophageal and pharyngeal fluid, collected by probang with mouth gag.	Lymph nodes, kidney, adrenal gland, heart and thyroid gland on ice.

Name of Disease	Ante-mortem Sample	Post-mortem Sample
Peste des Petits Ruminants	Ocular, buccal, rectal, nasal swabs on ice (no preservative should be added) Paired serum samples.	Pieces of spleen, lymph nodes, lungs, liver on ice. Lungs, liver, spleen, tonsil in 10% formalin for histopathology.
Pox	Pox scab on ice.	Pieces of skin and other organ with lesion in 10% formal saline.
Classical Swine Fever	Whole blood in EDTA on ice is the most preferred sample.	Pieces of spleen, mesenteric lymph glands, intestine especially ileocecal region in 50% glycerol saline for isolation. Pieces of brain, lung, intestines, ileocecal region and kidney for histopathology.
Ehrlichiosis	Blood smear, whole blood in EDTA.	Spleen and lungs on ice.
Ring worm	Skin scrapings from lesions, including some hair roots, unpreserved in a tight container.	Skin scrapings from the lesions, including some hair roots, unpreserved in a tight container.
Mange	Scabs and deep skin scrapings.	Portion of skin showing lesion.
Poisoning Cases	Blood samples on ice. Stool, vomitus and urine sample on ice	Stomach and intestinal contents should be sent in ice after proper ligation at both the ends. Liver spleen, kidneys should be sent in separate container on ice. Feed sample should be sent in separate container on ice.

Guidelines for Tissue Sample Preparation

It involves the proper collection, handling and preservation of tissue specimens to ensure accurate analysis. Following specific steps/guidelines helps maintain sample integrity and reliability of results.

Step 1: Fixation

- Fixation is where the tissue sample is preserved and stabilised to prevent decay and maintain cellular structures. Fixatives such as **formalin** are used to achieve this.
- Sample is immersed in a liquid fixing agent (fixative) the most used being a **10% buffered formalin solution.**
- Specimens remain in the fixative solution long enough for the fixative to penetrate every part of the tissue, plus an additional period to allow the chemical reactions of fixation to reach equilibrium, generally around 6 and 24 hours.

Step 2: Dehydration

- After fixation, the sample needs to be dehydrated to remove water and replace it with a solvent that is miscible with the embedding medium (paraffin wax).
- Tissue is passed through a series of increasing concentrations of alcohol (e.g., 70%, 80%, 95% and 100%) to gradually remove water from the tissue.
- An example dehydration sequence for specimens no more than 4 mm thick would be:
  - 70% ethanol 15 mino90% ethanol 15 min
  - 100% ethanol 15 min
  - 100% ethanol 30 min
  - 100% ethanol 45 min
- Following this, all but a tiny residue of water will have been removed from the specimen.

Step 3: Clearing

- Following dehydration, tissue is immersed in a clearing agent (xylene) to remove the alcohol and render the tissue transparent.
- Clearing helps to improve the penetration of embedding medium.

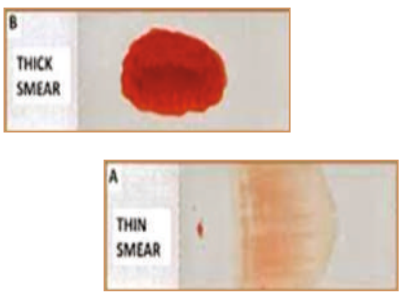
Step 4: Infiltration

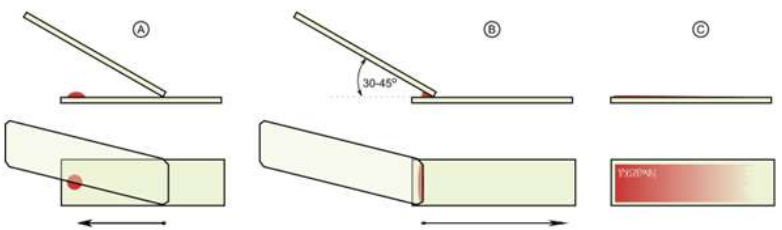
- Infiltration involves impregnating the dehydrated and cleared tissue with an embedding medium, typically paraffin wax.
- Tissue is placed in melted paraffin wax, and through a process called impregnation, paraffin replaces the clearing agent (xylene or a xylene alternative), ensuring the tissue is embedded uniformly.

Step 5: Embedding

- Infiltrated tissue is now ready to be formed into a "block" which is transferred to an embedding centre.
- Infiltrated tissue sample is placed into a tissue mold (mold size dependent on the sample size) containing fresh molten paraffin wax. Paraffin is allowed to solidify, forming a "block" that contains tissue.
- Place the tissue sample in a histology tissue mold, ensuring that it is positioned appropriately based on desired orientation. Mold should be large enough to accommodate the tissue and provide support during processing.
- Fill the mold with molten paraffin wax ensuring that tissue is completely submerged in the wax and properly orientated using forceps or heated forceps for easier orientation.
- Let the wax solidify around the tissue sample. This can be achieved by cooling the mold on a cold plate.
- A cassette is placed on top, and an embedding bead is placed in the corner of cassette before mold is topped up with molten paraffin wax and again placed on cold plate or put in fridge to solidify.
- Choosing the right embedding medium (paraffin wax) is crucial in this process to obtain the best sections. Embedded tissue block is now ready to cut into thin sections using a precision microtome.

Blood Smear Preparation

	Place a small drop of blood in the centre of pre-cleaned, labelled slide. Using the corner of another slide or an applicator stick, spread the drop in a circular pattern until it is the size of a dime (1.5 cm^2).
	A small drop of blood is placed near the frosted end of a clean glass slide. A second slide is used as a spreader. The blood is streaked in a thin film over the slide. The slide is allowed to air-dry and is then stained. EDTA anticoagulated blood is preferred.



Interpretation of Hematological Estimation

Erythrocytosis	**Increased total erythrocyte count** is reported in conditions like dehydration, hemoconcentration, exercise, occlusion of vein for a longer period, brucellosis, campylobacteriosis, leptospirosis, rinderpest, pasteurellosis, acute poisoning, chronic heart disease, pulmonary fibrosis, shock, vomiting, diarrhoea, hypoxia, etc.
Erythropenia	**Decreased total erythrocytic count** occurs in anemia, anaplasmosis, babesiosis, leptospirosis, copper, lead and phenothiazine poisoning, equine infectious anemia, defective blood formation, leukaemia, haemorrhage, aflatoxicosis, coccidiosis, fasciolosis, etc.
Leucocytosis	**Increase in number of leucocytes** and is observed in disease conditions like bacterial infections, uremia, diabetes, gout, malignancy, blood protozoan infections, colibacillosis, chronic enteritis, bovine, immunodeficiency syndrome, acidosis, burn, gangrene, etc.
Leucopenia	**Decrease in total leucocyte count** and is observed in viral infections, chronic intoxication of lead, bismuth, arsenic, mercury, pesticides, prolonged antibiotic therapy, copper deficiency, aflatoxicosis, bovine herpesvirus-1 (BHV-1) infection, bracken fern poisoning, etc.
Lymphocytosis	**Increased number of lymphocytes** is observed in viral infections, tuberculosis, brucellosis, hypothyroidism, following vaccination, leukemia, adrenal insufficiency, etc.
Lymphopenia	**Decrease number of lymphocytes** is observed in canine distemper, infectious canine hepatitis, corticosteroid therapy, hypothyroidism, BHV-1 infection, Q-fever, foot and mouth disease, mucosal disease, etc.
Neutrophilia	**Increased number of neutrophils** is observed in septicemic diseases, uremia, gout, coronary thrombosis, pyogenic infections, acute inflammation, cancer, arthritis, pyometra, post-surgical operation, coronary thrombosis, pregnancy, etc.
Neutrophilia (Shift to left)	**Increased number of neutrophils** with immature cells is observed in leptospirosis, traumatic reticulopericarditis (TRP), metritis, canine distemper, glanders, endocarditis, synovitis, etc.
Neutropenia	**Decrease number of neutrophils** is observed in pasteurellosis, bovine viral diarrhoea, infectious canine hepatitis, etc.
Eosinophilia	**Increase number of eosinophils** is observed in allergy, parasitic infection, skin disease, anaphylactic reaction, convalescence, eosinophilic myositis and granulocytic eosinophlic leukemia.
Basophilia	**Increase in number of basophils** is observed in Pox infections, spleenectomy, cirrhosis, Hodgkin's disease, introduction of foreign protein, etc.

Monocytosis	**Increase in number of monocytes** is observed in tuberculosis, brucellosis, trypanosomiasis, convalescence, monocyticleu-kemia, carbonate and chloride poisoning, systemic fungal diseases (histoplasmosis, blastomycosis, cryptococcosis, coccidioidomycosis, aspergillosis)
Hyperhemo-globinemia	**Increase in hemoglobin** is observed in polycythemia, dehydration, leptospirosis, equine influenza, acid indigestion.
Hypohemo-globinemia	**Decreased in hemoglobin content** is observed in anemia, theileriosis, strangles, anaplasmosis, Degnala disease, fasciolosis.
Erythrocyte sedimentation rate (ESR)	ESR are increased in tuberculosis, carcinoma, nephritis, gout, heavy metal toxicity, rheumatoid arthritis, pleurisy, canine distemper, pyometra, pericarditis, peritonitis, leptospirosis, filariasis, pneumonia, fracture, trypanosomiasis, equine infectious anemia and parasitic diseases. Decreased erythrocyte sedimentation rate has been recorded in hemolytic jaundice, sickle cell anemia and in brucellosis.

Poisoning and Specimen to be Collected for Diagnosis

Suspected Poison	Specimen to be Collected
Antimony	Liver, thyroid, kidneys, urine, stomach and gut contents, milk
Arsenic (acute)	Liver, kidneys, stomach and gut contents, urine, suspected feed
Arsenic (chronic)	Hair, liver, urine, spleen
Alkaloids	Liver, urine, brain, stomach and gut contents
Ammonia	Whole blood or serum, urine, rumen contents
Barbiturates	Blood, brain, liver, adipose tissue
Cadmium	Kidney, liver, hair
Copper	Liver, Blood, kidney, faeces, urine
Cyanide (HCN)	Stomach and gut contents, liver, muscles, oxalated blood, brain, suspected feed
Fluorides	Altered parts of bone, teeth, urine, stomach contents, liver, kidney, feed and/or drinking water
Insecticides (chlorinated)	Fat, liver, stomach contents brain

Suspected Poison	Specimen to be Collected
Insecticides (Organophosphorus)	Oxalated blood, whole blood, liver, stomach and gut contents
Lead (Chronic)	Hair, liver, kidneys, bone faeces, urine
Molybdenum	Feed, liver, altered organs (bone), hair
Nitrate and Nitrite	Stomach and gut contents, whole blood, urine, suspected feed
Oxalates	Fresh forage, kidneys
Phenol and Cresol	Liver, stomach and gut contents, kidneys
Phosphide	Stomach and gut contents, suspected material (grain, flour etc)
Phosphorous	Stomach and gut contents, liver, kidney and brain
Urea	Feed, stomach contents
Warfarin	Whole blood, liver, feed
Zinc	Liver, kidney, pancreas, faeces, bone (humerus)
Zinc phosphide	Liver, gastric contents, feed

Bovine Diseases, Specimen to be Collected and Laboratory Procedure

Diseases Suspected	Specimen to be Collected	Laboratory Procedure
Actinomycosis	Abscessed tissue and exudate	Histopathology, Tissue stains
Bovine herpes virus 1 (IBRV 1)	Lung, Trachea, Nasal swabs	PCR, Virus isolation, Histopathology
Bovine viral diarrhea	Lung, Illeum, Cecum, Spleen, Whole blood	PCR, Virus isolation, Histopathology
Calf diptheria	Lesion material, Swab from lesion	Anaerobic bacterial culture
***Clostridium perfringens* Type A, C, D, E**	Small intestine, Abomasum, liver Note: Do not submit fecal samples	Anaerobic bacterial sensitivity, Toxin PCR testing
Coccidiosis	Small intestine, feces	Fecal examination, Histopathology
Colibacillosis	Small intestinSmall intestine, feces from calves less than 7 days olde, feces	Histopathology
Corona virus (Respiratory)	Lung, nasal swab	PCR, Virus isolation

Diseases Suspected	Specimen to be Collected	Laboratory Procedure
Enteritis	Intestine, feces	PCR, Virus isolation, sequencing
Foot rot	Swab from lesion	Culture
Paratuberculosis	Illeum, feces	Fecal examination, PCR
Mastitis	Milk sample from affected quarter	Culture sensitivity, CMT
Parainfluenza virus	Lung, nasal swab	PCR, Virus isolation, histopathology
Salmonellosis	Samll intestine, Spleen, lung, liver, mesenteric lymph node, fresh feces	Culture sentivity, gene sequencing, histopathology

Staining of Bacteria

A Technique used to enhance contrast and visualize bacterial cells under microscope it involves using dyes to colour the cells, making them easier to observe and differentiate.

Objectives

- Classification of Gram-positive and Gram-negative bacteria
- Identification and diagnosis of infections
- Assessing the effectiveness of antimicrobial agents

Gram Stain

Principle

When the bacteria is stained with primary stain and fixed by mordant, some bacteria are able to retain the primary stain by resisting the decolourization while other decolorized. The cell wall composition of gram-positive bacteria consists of high content of peptidoglycan and low content of lipid and so it has a thicker cell wall than negative bacteria and so it retains the color of dye. Those bacteria which retain the primary stain are Gram positive and those that don't and get counterstain are Gram negative.

Procedure

1. Take a clean, grease free slide.
2. Prepare the smear of suspension on the clean slide with a loopful of sample.
3. Air dry and heat fix.
4. Crystal violet was poured and kept for about 30 seconds to 1 minutes and rinse with water.

5. Flood the Gram's iodine for 1 minute and wash with water.
6. Then, wash with 95% alcohol or acetone for about 10-20 seconds and rinse with water.
7. Add safranin for about 1 minute and wash with water.
8. Air dry, blot dry and observe under microscope.

Acid Fast Stain

Principle

Acid-fast Mycobacteria contain mycolic acid in their outer membrane, making the cells waxy and resistant to staining with aqueous based stains such as the Gram stain. The primary stain, carbolfuchsin is applied to the cells. Heat and phenol are used to allow the stain to penetrate into the waxy surface of acid-fast microorganisms. The excess stain is removed with treatment by acid alcohol (ethanol and hydrochloric acid). A secondary stain, methylene blue, is then applied to the cells.

Reagents Used

Carbolfuchsin as primary stain, acid alcohol as decolourizer and 0.3% methylene blue as counterstain.

Procedure

1. Prepare and fix the specimen smear prior to staining.
2. Place a small strip of blotting or filter paper over the top of the specimen, and place the slide over a boiling hot water bath on a mesh surface.
3. Cover the filter paper with the primary stain, carbolfuchsin. Leave the slide on the water bath for 3-5 minutes. Continue to apply stain if the filter paper begins to dry.
4. Remove the filter paper and rinse the slide with water until the solution runs clear.
5. Run acid-alcohol decolorizer over the slide for approximately 10-15 seconds.
6. Rinse the slide with water.
7. Cover the smear with the secondary or counterstain, methylene blue for 1 minute.
8. Gently rinse the slide with water.
9. Blot the slide dry with bibulous paper.

Result Interpretation

- **Acid fast:** Bright red to intensive purple, red, straight or slightly curved rods, occurring singly or in small groups, may appear beaded.
- **Non-acid fast:** Blue color; In addition, background material should stain blue.

Concept of Faecal Examination

Collection of Faeces

Feces should be collected in plastic/container from rectum unless the animal is observed in act of defecation when the sample may be collected from ground. Refrain from collecting feces from the floor or ground as it may be old feces, which may have eggs already larvated.

Direct Faecal Smear

Procedure

1. Place a small amount of feces on glass slide.
2. Add a drop of liquid to the feces and mix thoroughly. (Liquid may be saline for live protozoa or may be water/ iodine for helminth eggs and protozoan cyst).
3. Cover with cover slip.
4. Examine the slide using the 10X objective and then go over it with the 40X objective.

Faecal Sedimentation Technique

Procedure

1. Add 5 g of faeces to 200 ml water in a 250 ml beaker and mix thoroughly.
2. Filter the faecal suspension through a tea strainer or double-layer of cheesecloth into a second beaker.
3. Allow to sediment for 30 minutes.
4. Remove the supernatant very carefully with a pipette.
5. Add 200 ml water to the sediment and mix thoroughly.
6. Repeat steps three to five at least 3 times until the supernatant is clear.
7. After removing the supernatant for the last time transfer the sediment to a Petri dish, add a drop of methylene blue, and examine for parasitic eggs using a dissecting microscope (the methylene blue stains the background).

Faecal Flotation Technique

Flotation method involves the use of a flotation solution that has a specific gravity, greater than 1.2, such as a salt or sugar solution.

Procedure for Simple Floatation

1. About one gram of faeces is taken and grinded and mixed with saline water. Then filter it through a fine sieve or muslin cloth or gauze in to test tube or cylinder until it form meniscus (up to top of tube).
2. A clean glass slide or cover slide is placed on the mouth of test tube or cylinder.
3. Then left it for 10-15 minute at room temperature without disturbance, then remove coverslide/ slide and examine under10 x of microscope.

Procedure for Centrifugation Floatation

1. Mix the contents and centrifuge at 1500 rpm for 5 minute, the tube is taken out and placed without disturbance.
2. Transfer the small amount of superficial contents of the tube on a clean and dry glass slide.
3. Place the cover slip on a slide and examine it under a microscope to observe ova of parasite.

Clinical Identification of Urinalysis

Parameter	Clinical Pathological Condition
High specific gravity (>1.035)	Nephrotic syndrome, dehydration, acute glomerulonephritis, heart failure, liver failure
Low specific gravity (<1.005)	Diabetes insipidus, nephrotic diabetes insipidus, acute tubular necrosis
Protein in urine	Renal disease, fever, congestive heart failure (CHF), hypertension, tumours
Glucose in urine	Sugar level are obviously important in diagnosing diabetes
Ketone in urine	Ketonuria occurs in diabetes mellitus and starvation
Bilirubin	Liver damage or disease
Blood	Haemoglobin or myoglobin, kidney damage, infection, kidney or bladder stones
RBC in urine	Haematuria
WBC in urine	Infection, urinary tract infections
Crystals	Hypercalcemia

Change of Urine Colour in Various Abnormalities

Abnormality of Urine	Colour of Urine
Haematuria	Red colored urine
Hemoglobinuria	Brown to red colored
Icterus	Yellow brown to greenish yellow
Pyogenic infections of kidney	Yellow green colour
Azoturia in horse	Brown to black colour of urine
Phenothiazine treatment	Red colored urine
Diabetes insipidus	Pale
Increased water intake	Pale
Pyometra	Pale
Chronic interstitial nephritis	Pale
Acriflavin treatment	Green colored urine

Skin Scraping

There are two types of skin scrapings, superficial and deep. Superficial scrapings do not cause capillary bleeding and provide information from surface of epidermis. Deep skin scrapings collect material from within hair follicle; capillary bleeding indicates that the sampling was deep enough. Skin scrapings are used primarily to determine the presence or absence of mites.

Superficial skin scraping

Superficial scraping used to identify surface mites and multiple scrapings should be taken to increase the likelihood of ectoparasites (Cheyletiella, Sarcoptes, Psoroptes, Otodectes and Demodex mites, fleas and lice) detection.

Procedure

1. Remove hair coat in area by gentle clipping and sterilize the area with antiseptics (chlorhexidine, soap).
2. A few drops of liquid paraffin can be applied and spread over the skin scraping site, then scraping with a blunt scalpel blade.
3. Holding the blade perpendicular to the skin or slightly deviated away from the direction of scraping, the blade is gently passed over large areas of the skin in a sweeping pattern.

4. Take the scraped hair and skin content into petri dish.
5. Emulsion of scant material (superficial epidermis) is spread over a microscope slide or petri dish.
6. Add 2-3 drops of 10% KOH into scraped sample and mix it (don't apply 10% KOH directly to skin).
7. It is warmed for about 3 minutes
8. Covered with a cover slide and the slide is examined under microscope at 10x low power, to see adult, larvae, nymph and egg of parasite.

Deep skin scraping

Deep skin scraping is important in the diagnosis of burrowing and deep follicular mites such as Sarcoptesscabiei and Demodex spp. The technique is repeated until capillary blood oozes out and multiple sites should be scraped to maximize detection of ectoparasites.

Procedure

1. Hair should be clipped with scalpel blade. Holding the blade perpendicular to skin, it is gently passed over a small area of skin with lesion in a sweeping pattern. The skin should be pinched firmly between the thumb and forefinger to help extrude the parasite from deeper epidermal layer.
2. Place the scalpel blade with material removed into petri dish or other container.
3. Collected material is mounted onto glass slide in liquid paraffin or potassium hydroxide.
4. Cover slide should be applied into sample collected on slide and examine it under low power objective of microscope to observe mite structure.

Trichography (Hair Plucks)

It is the examination of hair under microscope in which a hair pluck (about 10 to 20 hairs) is obtained using a haemostat (tips covered with drip set tubing to prevent damage to hair shaft) and mounted onto a slide with liquid paraffin. Laying all the hairs facing in one direction makes examination easier and faster.

The examination of the hair should be performed systematically. Changes to hair bulb, hair shaft and hair tip are all of interest. When combined with the history and clinical examination, they can help make a tentative diagnosis or give an indication of the relevant differential diagnosis.

Procedure

1. Apply a few drops of mineral oil (liquid paraffin) to a glass microscope slide.
2. To pluck hairs, grasp about 10 to 20 hairs at a time, just about the surface of skin and pull with a quick and deliberate motion in the direction perpendicular to skin surface (this will help minimize patient discomfort).
3. Place hairs on microscope slide with mineral oil.
4. Evaluate the entire shaft of the hair for such conditions as dermato phytosis or color-dilution alopecia.
5. Examine hair bulb region for alopecia areata.
6. Assess the area just above the bulb region for Demodex mites.
7. Follicular casts i.e. accumulatio of keratosebaceous substance around the hairs is an indication of a follicular disorder associated with abnormal follicular keratinisation. They can be seen in diseases such as folliculitis, demodicosis, etc.

Flea Combing

Flea combs are easy to use and allow direct evaluation for mites, such as Cheyletiellaspp., fleas and flea excrement.

- Place few drops of mineral oil on a glass microscope slide.
- With the comb, use long, broad strokes from cranial to caudal to collect hair and debris. The material is collected on the tines of the comb.
- Remove the material from the comb and visually inspect it for fleas and flea debris.
- Place the hair onto the microscope slide containing mineral oil and evaluate it microscopically for mites.
- Place suspected flea excrement on a moistened piece of paper towel or gauze; dissolution into a reddish-brown color indicates flea excrement.

Milk Ring Test (MRT)

- Milk ring test is a type of agglutination test that detects Brucella antibodies in milk samples and is recommended as a screening test for bovine brucellosis by OIE. MRT test is cheap, simple and requires no specialised equipment to perform. It detects anti Brucella IgM and IgA bound to milk fat globules.
- MRT antigen is prepared from concentrated, killed Brucella abortus strain 99 or 1119-3 cell suspension. It is centrifuged at 23,000 g for 10 minutes at 4°C, followed by resuspension in haematoxylin-staining solution. It consists of *B. abortus* cells stained with haematoxylin.

Procedure

1. Collect milk from an animal and give identification mark on the sample tube.
2. Gentle mix the milk in sample tube to ensure distribution of cream.
3. Place 1 ml of milk in a plastic agglutination tube to give a column of milk about 2 cm height.
4. Add 1 drop of milk ring test antigen or B. abortus suspension by pipette into test tube.
5. Gently mix thoroughly the contents within 1 minutes of adding antigens and avoiding frothing.
6. Incubate the mixture at 370C for 39-40 minutes and then examine.
7. The interpretation should be observed as:
    - **Positive test result:** cream layer is deeply coloured and beneath cream layer is white.
    - **Negative test result:** cream layer is white, milk beneath is white colored.

California Mastitis Test (CMT)

CMT is a diagnostic tool to aid in quick diagnosis of mastitis in dairy animals and for an udder health management program. It is a simple cow-side indicator of the somatic cell count of milk. It operates by disrupting cell membrane of any cells present in milk sample, allowing DNA in those cells to react with test reagent, forming a gel.

CMT is performed to:

- Detect the presence of subclinical infections at beginning of or during lactation as part of an udder health management program.
- Additional diagnostics for cows with clinical signs of mastitis.
- Mastitic milk tends to gel when tested by CMT procedure. Degree of gelling indicates the presence and severity of mastitis. Change in colour indicates the pH variation of milk and therefore, the level of inflammation.

Materials required:

- Stripping cup
- CMT paddle
- Reagent
- Glove

1. **Collecting milk into CMT paddle:**
   - After wearing the gloves discard the first streams of milk, draw the next milk into the shallow cups on the paddle from each quarter of udders (the paddle has four shallow cups marked in different to identify individual quarter from which milk sample was obtained).
2. **Add an equal amount of reacting solution:**
   - Form pools of milk in cups by tilting paddle.
   - Pour equal amount of test solution to each cup in the paddle over milk. Avoid making bubbles.
3. **Mix the reagent and milk:**
   - Gently rotate the paddle in horizontal plane, swirling the mixture for 10-20 seconds.

4. **Interpretation of CMT Results as Below:**

	Score	Meaning	Description of reaction	Individual Quarter Sample	Bucket Milk Sample
	N	Negative	Mixture remains liquid. No slime or gel form. It can drip out of the paddle well	No Mastitis	No Mastitis
	T	Trace	Mixture becomes slimy or gel like. It's seen to best advantage by tipping paddle back and forth, observing mixture as it flows over the bottom of cups.	Trace of mastitis	Mastitis in one or more quarters
	1	Weak Positive	Mixture distinctly forms a gel.	Mastitis	Define mastitis – Check quarters
	2	Distinct Positive	Mixture thickens immediately, tends to form jelly. Swirling cup moves mixture in toward center exposing outer edges of the cup.	Mastitis	Serious Mastitis – Check quarters

Physical Examination of Milk

Milk can be examined physically by observing the colour, odour and consistency. It can be summarized as follows:

Colour

- **Normal:**
  - White in buffalo and whitish yellow in cow.
  - Yellow: Ration containing carotene; colostrum; some breed like Jersey cow.
- **Abnormal:**
  - Blood stained: Highly produced animal's pathological discoloration, trauma to udder and teat.
  - Red: Dicumarol toxicity, Leptospirosis, Stapyylococcosis, Bacterium erythrogene.
  - Green: Corynebacterium infection.
  - Yellow: Most of bacterial mastitis, *Pseudomonas synxantha infection.*

Odour

- **Normal milk:** milky odour
- **Abnormal:**
  - Fetid (putrefied) odour: Gangrenous mastitis, dry cow
  - Faecal odour: Coliform mastitis
  - Rancid odour: Milking in bad ventilated place or leaving milk for 2 days in environment
  - Antiseptic odour: Excessive dipping of teat
  - Acetone odour: Ketosis

Consistency

- **Normally:** milk consistency
- **Abnormally:**
  - Watery milk (decrease consistency): Streptococcal mastitis
  - Increased consistency: Corynebacterial mastitis

Serological and Immunological Test

Agglutination Test

Agglutination is the clumping of particulate antigens, such as bacterial cells, in presence of an immune serum or antibody or complements. For agglutination, the antigen should be in particulate form of suspension and antigen-antibody reacting sites must be present on the surface of the particles. The interaction between antibody and a particulate antigen results in visible clumping called agglutination. Agglutination reactions are more sensitive than immune precipitation.

Application:

- In diagnosis of bacterial diseases such as brucellosis, salmonellosis, yersiniosis
- Blood typing prior to transfusion
- Diagnosis of rickettsia, diseases like Q-fever
- Diagnosis of viral diseases like influenza

Slide Agglutination

Procedure

1. Take a clean, dry glass slide and place a drop of antigen suspension over the middle area of slide. Add one drop of test serum and mix properly with the help of a clean glass rod or toothpick.
2. If the homologous antibodies are present, clumps of bacterial cells will occur through agitation.
3. Clumping can be seen by naked eyes or by using a light microscope.
4. A saline-antigen control should also be used for comparison of the results.
5. Test is mostly used for identification of salmonella organisms or pullorum disease in poultry.

Tube Agglutination

Procedure

1. For diagnosis of Brucellosis, a 0.5% Carbol saline is used in cattle and buffaloes and 5.0% Carbol saline for sheep and goats. For this test two fold serum dilutions are made in Carbol saline as 1:5, 1:10, 1:20, 1:40.., and so on.
2. An equal amount of Brucella antigen is added into tubes and kept at 37°C in incubator for 24 hours.
3. If agglutination occurs, clumps of antigen and antibody complexes are formed.
4. In case of no agglutination, the turbid suspension remains same.
5. The tube agglutination test is used for the diagnosis and screening of herds for brucellosis in animals.

ELISA Test in Veterinary Laboratory Practice

ELISA **(Enzyme-linked immunosorbent assay)** is an antigen antibody reaction. It is a common laboratory technique, which is usually used to measure the concentration of antibodies or antigens in blood. A number of enzymes have been used for ELISA such as alkaline phosphatase, horse radish peroxidase and beta galactosidase. Specific substrate such as ortho-phenyldiaminedihydrochloride (for peroxidase), paranitrophenyl phosphate (for alkaline phosphatase) are used which are hydrolyzed by above enzymes to give colored end product. Antibodies or antigens present in serum are captured by corresponding antigen or antibody coated on to the solid surface.

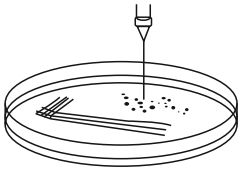
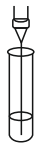
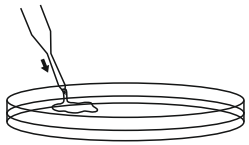
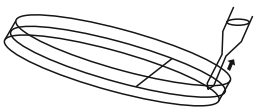
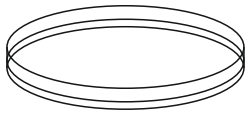
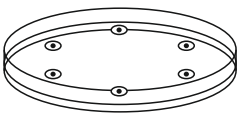
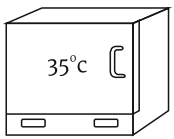
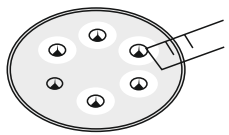
Direct ELISA	Indirect ELISA	Sandwich ELISA	Competitive ELISA
Direct ELISAs involve attachment of antigen to solid phase, followed by an enzyme-labelled.	Antigen is coated in micro titre well.	Antibody is coated in micro titre well.	Antigen-antibody mixture is added to the micro titre well which is coated with antigen.
A buffered solution of antigen to be tested is added to each well of a microtiter plate; where it is given time to adhere to plastic through charge interactions.	Block all unbound sites to prevent false positive results. Add sample containing antibody (e.g. rabbit monoclonal antibody) to wells and incubate the plate at 37°c.	Prepare a surface to which a known quantity of antibody is bound. Add the antigen-containing sample to the plate and incubate the plate at 37°c.	Antibody is incubated with sample containing antigen.
A solution of non-reacting protein, such as bovine serum albumin or casein, is added to well (usually 96-well plates) in order to cover any plastic surface in the well which remains uncoated by the antigen.	Wash the plate, so that unbound antibody is removed.	Wash the plate, so that unbound antigen is removed. Add the enzyme-linked antibodies, which are also specific to the antigen and then incubate at 37°c.	Antigen-antibody complex are added to the microtitre well which are pre-coated with the antigen.

Direct ELISA	Indirect ELISA	Sandwich ELISA	Competitive ELISA
Primary antibody with an attached (conjugated) enzyme is added, which binds specifically to the test antigen coating the well.	Add secondary antibody conjugated to an enzyme (e.g. anti- mouse IgG).	Wash the plate, so that unbound enzyme-linked antibodies are removed.	Wash the plate to remove unbound antibody. Enzyme linked secondary antibody which is specific to the primary antibody is added.
A substrate for this enzyme is then added. Often, this substrate changes color upon reaction with the enzyme.	Wash the plate, so that unbound enzyme-linked antibodies are removed.	Add substrate which is converted by the enzyme to produce a colored product.	Wash the plate, so that unbound enzyme-linked antibodies are removed.
Higher the concentration of primary antibody presents in the serum, the stronger the color change. Often, a spectrometer is used to give quantitative values for color strength.	Add substrate, which is converted by the enzyme to produce a colored product.	Reaction of a substrate with the enzyme to produce a colored product.	Add substrate which is converted by the enzyme into a fluorescent signal.

Other Important Tests

Tuberculin Skin Test	Johnin Test	Mallein Test
Tuberculin test based on a delayed type hypersensitivity to mycobacterial tuberculo-protein. In single intradermal test, 0.1 ml of tuberculin or PPD is injected intradermally in the middle portion of neck of bovines, a site preferred due to maximum sensitivity.	This test is used to diagnose paratuberculosis in bovines. First restraint animals and clean and shave the area of cervical region. Inject 0.1 ml of johninintradermally into cervical shaved area.	Mallein test is routinely used test to screen the equines for glanders and is considered quite specific. As the glanders is a communicable and notifi able disease, the test has its significance in detecting positive reactors in eradication programme of disease.
Prior to tuberculin injection, the skin should be cleaned, shaved and thickness of skin fold measured using a Vernier calliper.	If tuberculin and Johnin test done at the same time, just inject Johnin in opposite side of neck. An increase of 5 mm or more in thickness of skin fold after 72 hours is considered positive for Johne's disease.	Inject 0.2 ml of mallein intradermally into skin of lower eyelid using tuberculin syringe.
Reaction can be read after 72 hours of injection; positive reaction is characterized by a hot, red and painful swelling with an increase of 4 mm or more in skin fold. However, some diagnostic consider that skin thickness should be double to declare a positive.	This test is not able to detect cases of minimal sensitivity such as in the early or late stages of disease, in old cows and in cow, which have recently calved.	After 48 hours, the positive reaction like edema of eyelid, blepharospasm and severe purulent conjunctivitis will be marked.

Antibiotic Susceptibility Test

 1. Stab a fresh colony with a straight wire.	 2. Rotate the straight wire in 2.5ml saline.	 3. Inoculate the pre-dried plate.
4. Distribute inculum by rocking.	 5. Remove excess inoculum.	 6. Dry uncovered at room temperature (max. 30 min.)
 7. Load plate with antibiotic discs.	 8. Incubate for 18 hours.	 9. Measure annula radil.

Section – VIII
Veterinary Medicine

History Taking

History taking or anamnesis is the process of collecting information on animal patient from owners about its illness, onset of illness and feeding practice thorough careful questioning to the owner. In order to get accurate and complete history of animal, points to be considered are patient data, present history, past history and environmental history. Patient data is essential to identify patient and it includes: Owner's name, address, telephone, species, breed, sex, age, name, ID No., body weight, description including color, marking, polledness and other identification marks of animal.

Parameters Denoting Animal Status

Health: Denotes physical, physiological and mental wellbeing of an individual.

Disease: Any deviation from normal state of health.

Parameters	Healthy	Disease
Appetite	Normal	Reduced or absent
Water intake	Normal	Usually reduced
Milk yield	Normal	Decreased
Rumination	More frequently	Less frequently or stops
Body condition	Normal	Mostly emaciated (weak)
Look of animal	Active	Dull
Gait	Move freely and with ease	Move slowly and with difficulty
Head	Forward and raised	Downward
Eyes	Bright	Dull
	Wet	Dry or profuse lacrimation
	Wide open	Partially or completely closed
Mouth	Erect and move frequently	Drooping and move less frequently
	Wet and without odour	Dry or profuse salivation, usually bad odour

Nose	No discharge	May be some discharge
Muzzle	Moist	Dry
Skin/ Hair coat	Smooth and glossy	Rough and dull
Dung	Semisolid	Hard or loose
Urine	Slightly yellowish	Dark yellow, coffee coloured or pinkish
Tail movement	Quite frequently	Less frequently
Temperature	Normal	Mostly increased
Respiration	Normal	Increased, laboured
Pulse rate	Normal	Usually increased

Site of Recording Pulse and Blood Collection

Animals	Site of Recording Pulse	Site of Blood Collection
Cattle and Buffalo	Coccygeal or Maxillary or Facial artery	Jugular vein
Sheep, Goat	Femoral artery	Jugular or ear vein
Dog and Cat	Femoral artery	Recurrent tarsal vein or cephalic vein
Horse	External maxillary artery	Jugular vein

Checklist for General Clinical Examination

Tail End 1

- Record temperature
- Record pulse from coccygeal artery
- Check colour of mucous membrane
- Examine skin and coat
- Assess condition score
- Fecal staining on hind limbs

Tail End 2

- Examine udder, teats and milk
- Penis, prepuce, testes
- Rectal examination
- Vaginal examination

Left side

- Palpate and ascultate the heart
- Ascultate and percuss lung field
- Check the abdominal shape and contour
- Palpate and ascultate the rumen motility
- Percuss and ascultate the body wall
- Ballot the lower flank

Limbs

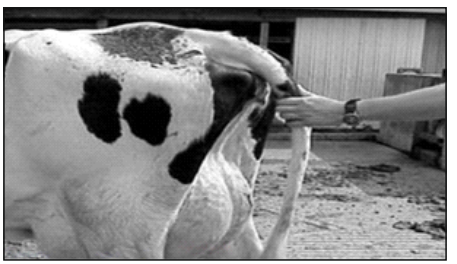
- Observe for signs of lameness
- Palpate the limbs
- Raise and examine the feet

Right side

- Palpate and ascultate the heart
- Ascultate and percuss the lung field
- Check abdominal shape
- Check the position and size of liver

Head and Neck

- Check symmetry of head
- Lymph nodes of head
- Check eyes, ears, muzzle and nostrils
- Examine the mouth, palpate the tongue
- Check mandibular and prescapular lymph nodes
- Check jugular vein, brisket
- Airflow



Examination of pulse from coccygeal artery

Examination of rumen motility

Eye ball examination

Sunken eyeball in dehydrated calf

Fluid Therapy

General Clinical Examination

- Cold extremities
- Weak pulse
- Dry mucous membrane
- Moderate to severe depression

Percent Dehydration

Condition	Dehydration (%)	Eyeball position	Skin tenting time (seconds)	Mucous membrane
Normal	Normal	Normal	<1	Moist
Mild	1–5	Normal	1–4	Moist
Moderate	1–6	Slightly sunken	5–10	Tacky
Severe	9–10	Gap between eyeball and surrounding tissue	11–15	Tacky to dry
More than 8 percent dehydration is severity beyond which oral fluid therapy will not suffice				

Calculating fluid deficit from dehydration

Fluid deficit (Litres)	% Dehydration × Body eight (kg)/ 100
Daily maintenance requirement for fluid	Body weight (kg) × 100 ml/kg
Total fluid needs for next 24 hours	Fluid deficit + Daily maintenance requirements

Flow rate:
For 1st one hour: 40–80 ml/kg/hour
Next 2–3 hours: ≤ 20 ml/kg/hour

Intravascular Volume Replacement

IV fluids	Definition	Examples	Indications
Isotonic	A solution with the same solute concentration as the body's cells, causing no net movement of water	RL, Normal saline	Dehydration, Electrolyte loss, Fluid imbalance
Hypotonic	A solution with lower solute concentration than the body's cells, causing water to enter cells.	5% Dextrose, DNS	Ketosis, Hypoglycemia
Hypertonic	A solution with higher solute concentration than the body's cells, causing water to enter cells.	7.5% Saline	Acid indigestion, Calf scours
Colloids	Solutions containing large molecules that do not pass through cell membranes, often used to expand blood volume.	Hetastarch, Dextran 70	Volume expansion, Hypovolemic shock, Edema management

Different Fluids and Their Indications

Type of Fluids and its Composition		Indications
Normal Saline	Sodium Chloride 0.9%	Expand circulating blood volume. Severe sweating, vomiting, pyloric obstruction and abomasal disorder
Dextrose Normal Saline	Sodium Chloride 0.9% and Dextrose 5%	Expand circulating blood volume. Severe sweating, vomiting, pyloric obstruction and abomasal disorder
Balanced Electr-olyte Solutions	Ringer's Solution (NaCl 0.9 g + KCl 0.03 g CaCl2 0.03 g + Distilled water 100 ml)	Dehydration, acidosis, alkalosis and electrolyte losses

Type of Fluids and its Composition		Indications
Balanced Electr-olyte Solutions	**Lactated Ringer's** Solution (As for Ringer's solution + Sodium lactate)	Mild to moderate acidosis with dehydration
	Dextrose 20 g + NaCl 0.6 g + KCl 0.04 g + CaCl2 0.027 g + Na lactate 0.31 g	Dehydration, Ketosis and mild to moderate acidosis
Sodium bicar-bonate solutions	Sodium bicarbonate 1.3% **(isotonic)**	Acidosis
	Sodium bicarbonate 5% **(hypertonic)**	Severe acidosis
Dextrose Solutions	Dextrose 5% **(isotonic)**	High fever, Starvation, decreased water intake
	Dextrose 20% and 25% **(hypertonic)**	Parenteral nutrition, Ketosis, Hypoglycaemia and Surra
Amino acid solution	Essential Amino Acids	Parenteral nutrition, liver disorders, hypo-proteinemia and extensive burns
Plasma expan-ders	6% Hydroxyethyl Starch in 0.9% Isotonic Sodium Chloride. **Large Animals (Cattle and Horse)** 8-10ml/kg body weight/day, up to maximum 20 ml/kg b.wt./day **Small Animals (Dog, Cat, Pig, Sheep and Goat)** 10-20 ml/kg b.wt./day	Hypovolemic shock, Hemorrhage, Burns and endotoxic shock, severe dehydration and surgery
Mannitol 20%	Dose @0.5 g/ kg IV	Cerebral oedema

Common Abnormal Conditions and Management

Hemorrhage

Key Points

- **Hemorrhage**-Escape of blood from an artery, vein or capillary to extravascular space.
- Heavy blood loss can be life threatening.
- Stabilize the animal with intravenous fluid.

General Clinical Examination

- Swelling over bony prominences and joints
- Bleeding from injured blood vessel
- Skin and mucous membrane become pale, cold and moist
- Patient feels thirsty
- Air hunger
- Thready pulse
- Hypotension
- Low hemoglobin and red blood cells
- Severe bleeding leads to shock

History

Trauma
Secondary manifestations

Internal hemorrhage

- Immovable, painless swelling underneath skin at the site of blood vessels rupture
- On aspiration, collection of serosanguinous fluid

Treatment

For major blood vessels:

- Ligation: on the ruptured major blood vessels
- Tourniquet: proximally to the wound

For minor blood vessels:

- Pressure hemostasis: using pressure pads or gauge mops

For capillary bleeding:

- Topical application (Vasoconstrictors):
  - Application of Tincture Benzoin, ice, cold water etc. can be successfully used for controlling bleeding from small vessels.
  - Adrenalin, a vasoconstrictor agent when applied topically controls bleeding especially from a small bleeding vessel.
- Parenteral administration:
  - Vitamin K: 1.1 mg/kg b.wt.
  - Botrophase: 0.5-1 ml
  - Etamsylate: 5-10 mg/kg b.wt.
  - Adrenocrome: Dog @ 5-10 mg/kg b.wt., Cattle, Buffalo: 20-25 mg /kg b.wt.

Diarrhea

Key Points

- Diarrhea- passing of loose voluminous feces two or three times per day in adults.

General Clinical Examination

- Diarrhea
- Malabsorption
- Dehydration
- Colic, Pain on deep palpation
- Rise in temperature in acute case
- Partial or complete loss of appetite
- Feces may have foul odour or fishy odor
- Dark green or tarry colored or black colored feces
- Melena presence of occult blood in feces Fluid or semisolid feces with undigested foods, mucus, epithelial, fibrin and blood

History

- Ingestion of lush green pasture
- Cobalt or Selenium deficiency

Prevention

- Balanced diet
- Maintain deworming status
- Spray insecticides in and around shed

Treatment

Withheld food for first 24 hours

Fluid Therapy

- Mild dehydration: Electrolyte solution orally
- Moderate dehydration: Ringers lactate 1.3% IV
- Severe dehydration: Sodium bicarbonate 5% IV

Antibiotics - Oral (3-5 days)

- Sulphadimidine @ 100-200 mg/kg b.wt. or
- Amoxycillin @ 10 mg/kg b.wt. or
- Metronidazole @ 20 mg/kg b.wt.

Antibiotics - Parenteral

- Ciprofloxacin **(Cflox)** @ 15 ml/ 300 kg b.wt. daily for 3-5 days IM/IV
- Enrofloxacin @ 2.5-5 mg/kg

Antiprotozoal

- Metronidazole @ 20 mg/kg b.wt. IV

Anthelminthic

- Albendazole @ 10-15 mg/kg PO SID
- Fenbendazole @ 5-10 mg/kg PO SID

Anti-diarrheal powder

- Astringent mixture- Kaolin 30 g + creta preperation 30 g + pulv. catechu 30 g should be drenched twice daily.

Vit-B complex injection (Tribivet)

LA: 5-10 ml and SA: 1-2 ml IM for 3-5 days

Pyrexia

Key Points

- Pyrexia/fever may indicate infectious, inflammatory, immune mediated or neoplastic disease.
- Characterized by Increased body temperature, thirst, anorexia and depression.

General Clinical Examination

- Temperature:>102°F
- Pulse: bounding pulse
- Respiration rate:>16/min
- Muzzle: Dry

History

- Anorexia
- High body temperature

Treatment

Pyrexia of unknown origin (PUO)

Antihistaminics

- Chlorphenaramine maleate **(Anistamin)** LA: 5-10 ml and SA: 1-2 ml IM

Pyrexia of known origin

Specific therapy based on the disease diagnosed

Prevention

- Regular deworming
- Maintain hygiene and sanitation
- Ensure sufficient ventilation

Difference between Diarrhoea and Dysentery

Diarrhoea	Dysentery
Voluminous fluid faeces	Scanty sticky faeces
Dietary changes, infections	Specific pathogens (e.g., bacteria, parasites)
Blood, mucus or fibrin in faeces: Absent	Present
Less pus cells	Abundant pus cells
Less straining	More straining
intestinal inflammation is mild or absent	intestinal inflammation is significant
Generally less severe	More serious, poses higher health risks

Edema

Key Points

- Abnormal accumulation of fluids in the intercellular spaces.
- Edema is a condition and manifestation of many diseases- Traumatic reticulo pericarditis, salmonellosis, hemorrhagic septicemia, liver flukes etc.

General Clinical Examination

On palpation

- Fluid thrills
- Soft and painless
- No clear outline

History

- Fluid filled mass

Differential Diagnosis

On paracentesis-

- Abscess: Pus
- Cyst: Clear watery fluid
- Hematoma: Blood
- Hygroma: False bursa developing on joints

Treatment

- **Specific treatment** for the underlying disease condition
- **Diuretics**
  - o Frusemide @ 500 mg once daily or 250 mg twice daily (12 hours interval) IM/IV

Prevention

- Provide balanced ration
- Periodic deworming

Bloat

Key Points

- Over distension of the rumeno-reticulum with gases of fermentation
- Primary or frothy bloat-persistent foam mixed with the ruminal contents, secondary or free gas bloat-free gas separated from the ingesta.

General Clinical Examination

- Dyspnea, Grunting
- Open Mouth breathing, Protrusion of the tongue
- Extension of the head
- Distension of left flank
- Protrusion of paralumbar fossa above vertebral column.
- Rumen motility decreases only in severe cases
- Death within 1 hour after grazing and most commonly in 3-4 hour after onset of clinical signs.
- Secondary bloat/Free-gas bloat:
- Excess gas on top of ruminal contents
- Tympanic resonance on percussion

History

Distended abdomen

Differential Diagnosis

- Acid indigestion: Ruminal pH <5.5
- Alkaline indigestion: Ruminal pH >7.5

Prevention

- Restrict pasture intake by limiting grazing time

Treatment

- Withdrawal of food and water
- Keep the animal with its anterior portion at elevated position
- Place a wooden stick in the mouth to stimulate salivation
- Insert a large-bore needle into the rumen to relieve gas
- **Antibloat agents**
  - o Vegetable oils (e.g. peanut, corn, soybean) @ 250-500 ml intraruminal or PO
  - o Dimethocone suspension orally
- **Rumen pH Buffers (Bufzone)**
  LA: 200 gm and SA: 50 gm daily for 3-4 days orally.
- **Anti Histaminics**
  - o Chlorphenaramine maleate **(Anistamin)** @ 0.5-2ml IM for 3 days
- **Saline purgative -** Magnesium sulphate @ 200-300 g PO single dose
- **Rumenotorics (Rumentas) @** LA: 2 boli and SA: 1 boli orally
- **Vit-B complex injection (Tribivet)**
  LA: 5-10 ml and SA: 1-2 ml IM for 3-5 days
- Rumenotomy in severe cases

Heat Stress

Key Points

- Exposure to high temperature and humidity leads to physiological changes that affect milk production, reproduction and general health.

General Clinical Examination

- Dehydration
- Rapid breathing
- Panting (open mouth breathing)
- Protrusion of tongue
- Frothy discharges from mouth and nostrils
- Congestion of mucous membranes of conjunctiva
- Tachycardia
- Elevated body temperature (106–110°F)

History

- Hot humid weather
- Stress
- Reduced feed and water intake
- Decreased milk production

Treatment

- **Fluid therapy**
  - DNS or RL
- **Corticosteroids**
  - Dexamethasone @ 5–20 mg/kg b.wt., IM/IV
- Provide ice blocks to lick

Prevention

- Provide balanced ration
- Keep animal in a well ventilated shady area
- Ensure feeding should be in colder hours of the day
- Provide cold water
- Open all doors and windows
- Cold water bath
- Cold water enema

Calf Scours

Key Points

- Calf diarrhea/Scours a multi-factorial disease characterized by mild to profuse diarrhea without systemic disease.
- Common in new born calves, lambs and kids.
- Common Causative agents- *E.coli*: 1 week, *Salmonella* spp.: 2-12 weeks, Rota virus: 5-15 days, Corona virus: 3-15 days, Cryptosporidium: 5-35 days of age.

General Clinical Examination

- Temperature Hypothermic
- Percentage of dehydration
- Capillary Refill Time
  - Dietary diarrhea - Voluminous pasty feces
  - *E.coli* - Profuse amounts of liquid feces
  - *Salmonella* spp. - Foul smelling feces with blood, fibrin and copious amounts of mucus
  - *C. perfringens* - Bloody diarrhea with abdominal pain
  - Rotavirus and Corona virus- Soft liquid feces with large amounts of mucus
- Dehydration
- Depression
- Profound weakness
- Recumbency

History

- New born
- Deworming
- Duration of signs

Prevention

- Without milk up to 24 hours
- Provide warm and hygienic surface
- Continue Oral antibiotic powder and anti-diarrheal powder for 3-5 days
- Provide colostrums Immediately after birth
- Provide fresh clean water

Treatment

- **Warm IV fluids**
- **Antibiotics:**
  - Oxytetracycline @ 5-10 mg BID to TID, Orally
- **Anti diarrheal powder (3-5 days)** PO
- **Anti Histaminics**
  - Chlorphenaramine maleate **(Anistamin)** @ 0.5-2ml IM for 3 days

Acidic Indigestion

Key Point

- Acid indigestion/grain overload is an acute disease of ruminants characterized by rumen hypomotility to atony, dehydration, acidemia, diarrhea, depression, in coordination, collapse and in severe cases death.
- Access to large quantities of readily digestible carbohydrates, grains (e.g: wheat, barley, corn, apples, grapes, sour wet brewer's grain, etc.) or when cattle are introduced to heavy grain diets too quickly.

General Clinical Examination

- Sub-normal body temperatures 98-101°F (36.5-38.5°C)
- Enlarged rumen- On palpation resilient
- rumen with excessive fluid
- Reduced rumen movements
- Abdominal pain (belly kicking or treading of the hind limbs)
- Diarrhea
- Recumbency in 24-48 hours
- Dehydration

History

- Anorexia
- Bloat
- Recent changes in diet
- Grain overload

Differential Diagnosis

- Acid indigestion: Ruminal pH <5.5
- Alkaline indigestion: Ruminal pH >7.5

Treatment

- To correct acidic pH, give alkalisers as Sodium bicarbonate 1-3% solution solution IV
- **Rumen pH buffers (Bufzone)**
  LA: 200 gm and SA: 50 gm daily for 3-4 days orally
- **Rumenotorics (Rumentas)**
  LA: 2 boli and SA: 1 boli orally to restore motility of rumen
- **Anti Histaminics**
  - Chlorphenaramine maleate **(Anistamin)**
    LA: 5-10 ml and SA: 1-2 ml IM
- **Vit-B complex injection (Tribivet)**
  LA: 5-10 ml and SA: 1-2 ml IM for 2-5 days
- IV access (Fluid therapy)
- Rumenotomy in severe cases
- Rumen cud transplantation/probiotics

Prevention

Avoid accidental access of animals to excess digestible carbohydrates

Alkaline Indigestion

Key Points

- Ingestion of protein rich foods characterized by anorexia, dullness and depression along with atony of rumen (pH>7.5).
- Excess intake of soyabean, barseem, urea, exclusive paddy straw feeding for a prolonged period of time, ingestion of oil cakes etc., contributes to alkaline indigestion.

General Clinical Examination

- Constant drooling of saliva
- Increased pulse and respiratory rate
- Gnawing and kicking at the belly
- Depressed rumen motility
- Dark brown watery ruminal contents smelling slimy and putrid
- Passage of semisolid feces
- Tremor, ataxia and convulsions

History

- Feeding on protein rich feeds
- Anorexia
- Bloat

Differential Diagnosis

- Acid indigestion: Ruminal pH <5.5
- Alkaline indigestion: Ruminal pH >7.5

Treatment

- For correction of ruminal pH
  - Acetic acid 10% (Vinegar) @ 5-10 ml/kg orally
- **Rumenotorics (Rumentas)**
  LA: 2 boli and SA: 1 boli orally to restore motility of rumen
- **Anti Histaminics**
  - Chlorphenaramine maleate **(Anistamin)**
    LA: 5-10 ml and SA: 1-2 ml IM
- **Vit-B complex injection (Tribivet)**
  LA: 5-10 ml and SA: 1-2 ml IM for 2-5 days
- IV access (Fluid therapy)
- Rumenotomy in severe cases
- Rumen cud transplantation/probiotics

Prevention

Avoid accidental access of animals to protein rich feed

External Parasitism

Key Points

- External parasites-lice, ticks, mites and fleas transmits many diseases.
- Reduces the productivity and profitability of livestock.
- Ensure proper head restraint of animal and scene safety.
- Follow appropriate PPE guidelines- apron, gumboots and gloves.

General Clinical Examination

- Decrease in milk yield
- Lesions on skin
- Toxicosis- sweating sickness,
- Tick paralysis
- Anemia and death
- Hyper keratitis
- Severe itching
- Lesion found in the ear, face, elbow, root of tail

History

- Itching
- Skin infection
- Alopecia

Temperature

If body temperature is normal

- Observe for visible external parasites-mites, fleas, ticks.
- If no visible parasites, perform skin scrapings for mites (under microscope in 10X or 40X.

If body temperature is elevated

High body temperature >106°F (suspect tick infestation and associated hemoprotozoan infections).

Blood smear examination for

- Anaplasma
- Babesia
- Theileria
- Trypnosomes

Treatment

Manual removal–

- Remove ticks from the skin with forceps
- Grasp the tick as close to the skin surface as possible
- Pull upwards with steady pressure (take care to remove mouthparts)
- Don't twist the tick
- Avoid crushing/squashing the tick (contents of the tick can transmit disease thorough skin abrasions)
- Clean the bite area and hands with rubbing alcohol/ iodine scrub/soap after tick removal

Ectoparasiticides

- Amitraz spray/dip: 1 lit/500 lit of water
- Ivermectin **(Neomec)** @ 1 ml/50 kg b. wt. SC

Prevention

- Regular use of ectoparasiticides
- Maintain clean housing
- Pasture management
- Isolate new or infected animals

Leaky Teats

Key Points

- Leakage of milk from the udder prior to calving.

General Clinical Examination

- Udder examination
- Examination of teat orifices

History

- Lead toxicity
- Oxytocin stimulation
- High udder pressure in high milk yielding cows

Treatment

Phosphorus **(Novizac)** @ 25 ml reconstituted solution on day 1 and 2, IM/IV/SC

Prevention

- Provide balanced ration
- Ensure proper feeding practices during last trimester of pregnancy
- Proper milking technique
- Udder massage

Pica

Key Points

- Pica is an eating disorder, le which animal develops an abnormal appetite to eat unusual non-food substances (E.g. cloth, bone, leather, metal, wood, stone, soil, sand, feces, paper, etc.).
- Vitamin-B_6 deficiency, mineral (Phosphorus, magnesium, sodium chloride, copper, cobalt, iron, etc.) deficiency, poor nutrition, protein deficiency, viral disease like rabies-contributes to pica.

General Clinical Examination

- Temperature, pulse
- Decreased rumen motility
- Loss of body condition
- Observe feeding habits

History

- Abnormal eating behaviour

Treatment

Mineral mixture
Sodium acid phosphate
Phosphorus **(Novizac)** @ 25 ml reconstituted solution on day 1 and 2, IM/IV/SC
Salt licks
Calcium Injection
Vit B complex (Tribivet)
LA @ 5-10 ml, SA @ 1-2 ml, IM for 3-5 days
Indigenous preparations- (anabolic drugs) for 3 days

Prevention

- Balanced ration
- Mineral and salt supplementation
- Good quality roughages
- Periodical deworming

Envenomation

Key Points

- Introduction of venom into the body by means of the bite or sting of a poisonous animal.
- Poisonous snake bite–two puncture wounds are found.

General Clinical Examination

- Redness and swelling
- Vomiting
- Salivation
- Sweating Puncture wounds

Elapid snake bite

- Minimal pain and swelling
- Neurological signs

Crotalid snake bites

- Local tissue discoloration
- Blood tinge fluids from puncture wounds

History

- Puncture wounds on body
- Sudden recumbency/ fall without any illness

Treatment

First aid

- Apply tourniquet above the bite (release with 20 min interval)
- Clean the bite area and apply anti septic

Polyvalent antivenin

10–20 ml/animal IV along with normal saline (slow IV)

Antibiotic therapy

- Penicillins @ 4.4–11 mg/kg b. wt. IM
- Ceftriaxone **(Intacef)**
  LA @ 5–10 mg/kg b.wt., SA @ 10–15 mg/kg b.wt. IM/IV

NSAIDs

- Flunixin meglumine **(Unizif)** @ 1–2 ml/45 kg b.wt. IM/IV
- Meloxicam **(Melonex)** @ 30 ml/300 kg b.wt. IM/IV/SC
- Tolfenamic acid **(MAXXTOL)** @ 4 mg/kg b.wt. IM/IV

Tetanus toxoid (especially in horses)

Fluid therapy (in case of shock) - DNS, RL

Pneumonia

Key Points

- Pneumonia inflammation of the lung parenchyma usually accompanied with the inflammation of the bronchioles (broncho-pneumonia) or with pleura (pleuro pneumonia).

General Clinical Examination

- Faecal Examination
- Temperature, pulse
- Decreased rumen motility
- Loss of body condition
- Observe feeding habits
- Difficulty in breathing

History

- Nasal discharges, cough
- Recent drenching (Aspiration pneumonia)
- Exposure to cold environment

Treatment

Oxygen therapy

- 100% O, ventilation flow by hood

Expectorants

- Bromhexine hydrochloride-20-50 ml, PO

Antibiotics

- Penicillins @ 4.4 mg/kg b.wt. IM/ IV
- Ceftiofur **(Xyrofur)**
  - For Cattle, Sheep, Goat @ 1.1-2.2 mg/kg b. wt. IM
  - For Buffalo and Horse @ 2.2-4.4 mg/kg b. wt. IM for 3 days
  - For Dog @ 2.2 mg/kg b. wt. SC

NSAIDs

- Flunixin meglumine **(Unizif)** @ 1-2 ml/45 kg b.wt. IM/IV
- Meloxicam **(Melonex)** @ 30 ml/300 kg b.wt. IM/IV/SC
- Tolfenamic acid **(MAXXTOL)** @ 4 mg/kg b.wt. IM/IV

Antihistaminics

- Chlorphenaramine maleate **(Anistamin)**
  LA: 5-10 ml and SA: 1-2 ml IM

Vitamin C and calcium therapy to rejuvenate pulmonary parenchyma

Neonatal Hypothermia

Key Points

- Neonatal hypothermia is a condition of new born calves characterized by sudden fall in body temperature and is major cause of mortality.
- Predisposing factors- Premature births with low birth weight, exposure to wind, wetting of birth coat, starvation, sparse hair coat, cold exposure.

General Clinical Examination

- Temperature below 98°F
- Pulse
- Cold extremities

History

- Subnormal body temperature- 98°F
- Birth in winter season

Treatment

If Animal Stable

Re warming

- Provide warm dry surroundings (infrared heat lamps)
- Drape the calf with blankets
- Feed Warm colostrum or milk

If Animal Recumbent

Fluid therapy

- Warm intravenous Fluids 1 ml of 50% dextrose/kg b. wt.

Notes: Check the rectal temperature for every 30 minutes throughout the treatment period

Prevention

- Avoid exposure to cold environment
- Provide warm colostrum
- Maintain dry warm conditions

Photosensitization

Key Points

- Results when skin (especially areas exposed to light and lacking protective hair, wool, or pigentation) becomes more susceptible to ultraviolet light in the presence of photodynamic agents.
- Indigenous cattle less susceptible.

General Clinical Examination

- Photophobia- appears agitated and uncomfortable
- Scratching or rubbing lightly pigmented, exposed areas of skin (eg., ears, eyelids, muzzle)
- Lesions on nose and udder
- Vesicles, ulceration, scab formation and skin necrosis
- Skin sloughing- Final stage
- Corneal edema and blindness

History

- Photophobic nature of animal
- Dermatitis

Treatment

Antibiotics

- Ceftriaxone **(Intacef)** @ 5 mg/kg b.wt. IM or IV

NSAIDs

- Flunixin meglumine **(Unizif)** @ 1-2 ml/ 45 kg b.wt. IM/IV
- Meloxicam **(Melonex)** @ 30 ml/ 300 kg b.wt. IM/IV/SC
- Tolfenamic acid **(MAXXTOL)** @ 4 mg/kg b.wt. IM/IV

Antihistaminics

- Chlorphenaramine maleate **(Anistamin)**
  LA: 5-10 ml and SA: 1-2 ml IM

Liver supplements

- **Livotas** @ 30-40 ml daily, Orally

Purgatives - Magnesium sulphate 50 g and salt 50 g

Cyanide Poisoning

Key Points

- Ingestion of plants containing cyanogenic glycosides (eg. sorghum, corn), accidental ingestion of pesticides leads to cyanide poisoning.

General Clinical Examination

- Bounding pulse
- Ruminal atony
- Dehydration
- Tachycardia
- Dyspnea
- Bitter almond breath smell
- Red to cyanotic mucous membranes
- Bright cherry red colored blood
- Dilatation of pupil nystagus

History

Ingestion of

- Immature jowar, linseed, corn plants
- Fertilizers
- Sudden collapse in grazing area

Differential Diagnosis

- **Nitrite/ Nitrate toxicosis:** Chocolate coloured blood
- **Organophosphorous/ Carbamate Poisoning:** Gastrointestinal imitation and neurological signs

Treatment

Fluid therapy

- RL or DNS

Antidote

- Sodium nitrite 20 mg/kg BW IV mixed in notonic saline (8 to 10 g for 400 kg animal
- 20% sodium thiosulphate >500 mg/kg IV, repeated as per need
- Sodium thiosulphate 30 g/cow PO to detoxify ruminal hydrogen cyanide

Oxygen supplementation

Organophasphate Poisoning

Key Points

- Neonatal hypothermia is a condition of new born calves characterized by sudden fail in body temperature and is major cause of mortality.
- Predisposing factors - Premature births with low birth weight, exposure to wind, wetting of birth coat, starvation, sparse hair coat, cold exposure.

General Clinical Examination

- Hyperemia, Hypothermia
- Excessive sweating, Frequent urination, diarrhea
- Watery nasal discharges, broncho constriction
- Dyspnoea, respiratory muscle paralysis
- Miosis (pupil constriction)
- Twitching, fasciculation, cramps, tremors
- Convulsion, ataxia, seizures
- Muscular weakness

History

- Recent insecticides sprayed in and around the shed
- Chemical factories in surrounding area

Treatment

Antidote

- Atropine Sulphate @ 0.02-0.05 mg/kg, IM/IV/SC

Fluid therapy

- DNS or RL

Oxygen supplementation

Metabolic Diseases

Mastitis

Key Points

- Mastitis inflammation of the parenchyma of mammary gland regardless of cause.
- It is a multi-etiological disease caused due to various bacteria, virus, fungi as well as environmental factors.
- Characterized by hot painful swollen udder.
- Mastitis causes major economic losses to dairy industry.

General Clinical Examination

- Temperature- 104-107 °F
- Pulse
- Rumen motility

History

- Drop in Milk yield
- Hot swollen udder
- Teat blockage

Milk Examination

- **Per-acute:** swollen and painful udder, pyrexia. Drop in milk production, blood stained milk.
- **Acute:** Milk become yellow or brown fluid like with flakes or clot.
- **Sub-acute:** variable changes in milk but no changes in udder.
- **Chouronic:** fibrosis of udder, clots or flakes in milk

Udder Examination

- Consistency of teats
- Udder swelling
- Change in color

Treatment

Systemic antibiotics

- Ceftriaxone **(Intacef)**
  LA @ 5-10 mg/kg b.wt., SA @ 10-15 mg/kg b.wt. IM/IV
- Amoxycillin + Cloxacillin **(Intamox)**
  6-10 mg/kg b.wt. daily for 3-5 days

Intramammary antibiotics

- Cefuroxime sodium **(Mammitas)**: One syringe per affected quarter. Treatment should be given at every twelve hours interval for 3-4 consecutive times.
- Cefoperozone **(Mammicef)**: One syringe per affected quarter only once

NSAIDs

- Flunixin meglumine **(Unizif)** @ 1-2 ml/ 45 kg b.wt. IM/IV
- Meloxicam **(Melonex)** @ 30 ml/ 300 kg b.wt. IM/IV/SC
- Tolfenamic acid **(MAXXTOL)** @ 4 mg/kg b.wt. IM/IV

Antihistaminic

- Chlorphenaramine maleate **(Anistamin)** @ LA: 5-10 ml and SA: 1-2 ml IM

Prevention

- Hygienic milking practices
- Healthy quarters should be milked first
- Periodical screening of herd for mastitis
- Empty udder and discard milk for a specific period post therapy
- Isolation of affected animal

Milk Fever

Key Points

- Metabolic disease of mature dairy cows that occurs at or soon after parturition and is characterized by severe muscular weakness, lateral or sternal recumbency.
- Also known as parturient paresis, hypocalcaemia.
- Excessive loss of calcium in colostrum and milk leads to milk fever.
- Mature cows of 5-10 years age group are mostly affected.

General Clinical Examination

- Temperature- 97°F-101°F
- Sternal Recumbency
- Kinked neck (s-curve in neck)
- Weak and dull with paraparesis

History

- Within 72 hours of parturition

Prevention

- Balanced diet
- Oral calcium preparation for 5-10 days

Treatment

- 25% Calcium borogluconate solution
  LA @ 400-800 ml, SA @ 50-100 ml slow IV
- Administer Ca gel orally at the time of parturition
- Warming the calcium solution to body temperature, especially in cold weather.
- Provide prepartum diet with DCAD (Dietary Cation Anion Difference).

Downer Cow Syndrome

Key Points

- It is a group of syndromes noticed as a complication to milk fever in high yielding dairy animals and is characterized by prolonged recumbency despite treatment with intravenous calcium preparation.
- Traumatic injury to limb muscles and nerves prior to parturition or at the time of parturition.

General Clinical Examination

- Temperature: 97°F-101°F
- Lateral Recumbency
- Kinked neck (s-curve in neck)
- Weak and dull with paraparesis

History

- Within 72 hours of parturition

Treatment

- Isotonic Ringer's lactate
- Calcium and magnesium infusions
- Ca, Mg, P preparations.
- Use of nervine tonics
- Massage/infrared therapy
- Providing comfortable bedding and to roll the animals from side to side several times daily to avoid decubital ulcers.

NSAIDs

- Flunixin meglumine **(Unizif)** @ 1-2 ml/ 45 kg b.wt. IM/IV
- Meloxicam **(Melonex)** @ 30 ml/ 300 kg b.wt. IM/IV/SC

Prevention

- Prompt treatment of animals for milk fever
- Providing proper bedding material

Post-parturient Haemoglobinuria

Key Points

- A sporadic condition, most commonly affects high-yielding dairy animals at the onset of lactation.
- Haemoglobinuria leading to potentially life-threatening anaemia.

General Clinical Examination

- Temperature: 97°F-101°F
- Dark red colour urine
- Pale mucous membrane

History

- Anemia
- Hypophosphatemia

Treatment

- Whole blood transfusion (~5 litre of blood initially sufficient up to 48 hours) in severe cases.
- Administer phosphorus in acute cases (60 g sodium acid phosphate in 300 ml of distilled water IV initially, followed by SC injections at 12 hour intervals for three days).
- Sodium acid phosphate (40.3% @ 50 ml, IV once in 12 hours for 3 times).
- Phosphorus (Novizac) @ 50-100 ml reconstituted solution on day 1 and 25 ml reconstituted solution to be continued from day 2 onwards until symptoms disappears, IM/IV/SC.
- Provide dicalcium phosphate supplementation (100-120 g twice daily for 5 days).
- Haematinics (iron dextran) are recommended during the recovery period.

Prevention

- Ensure adequate intake of phosphorus according to the requirements for maintenance and milk production.

Ketosis

Key Points

- Common metabolic disease of lactating cows, occurs in early lactation.
- Characterized by partial anorexia and depression.
- Common in high yielding animals and Immediately after parturition.

General Clinical Examination

- Temperature, pulse
- Decreased rumen motility
- Loss of body condition
- Acetone odour in breath
- Urine examination- Dip stick test

History

- Recent Parturition
- Drop in milk yield
- Anorexia

Treatment

Fluid Therapy

- Dextrose (25 percent, 500-1,000 mL, IV for 2-3 days)
- **Propylene glycol** @ 225 g, every 24 hours for 3-5 days, Orally
- **Sodium propionate** @ 110-225 g, for 3-6 days, Orally

Hormonal therapy

- Glucocorticoids such as dexamethasone sodium phosphate @ 40 mg/kg b.wt., IV for 4 to 6 days along with IV glucose therapy

Vit-B complex injection (Tribivet)

LA @ 5-10 ml and SA @ 1-2 ml IM for 3-5 day

- Feeding of mineral mixture containing phosphorus and cobalt postpartum

Prevention

- Avoid starvation of overfeeding at calving
- Provide extra concentrated ration (1.5 kg/day) during advance pregnancy
- Prevent physical injuries, abrasions
- Provision of uncrowded, shaded areas
- Fly control

Common Infectious Diseases

Bacterial Diseases

Actinobacillosis

Key Points

- Also known as Wooden tongue characterized by granulomas of tongue with discharge of pus containing yellow to white granules.
- Zoonotic disease caused by *Actinobacillus lignieresii*.

General Clinical Examination

- Wounds in oral mucosa
- Palpation of tongue- feel very hard
- Swollen local lymph nodes

History

- History of recent feeding
- Oral mucosal wounds

Differential Diagnosis

- Impacted feed/foreign bodies
- Pharyngeal traume
- Actinomycosis - Affects bones
- Orf (Contagious ecthyma) - Crusty, proliferative lesion around mouth

Prevention

- Avoid coarse, steamy feeds
- Avoid grazing near fencing areas
- Isolate infected animal

Treatment

Iodine therapy

- Sodium iodide 10% @ 1 g/14 kg. b. wt. IV, 5 dosage at the interval of 7 days (Caution - Stop administering of IV Iodine - If signs of iodine toxicity lacrimation, anorexia, cough, diarrhea are observed.)

Antibiotic therapy

- Streptomycin @ 10-25 mg/kg b.wt. IM
- Penicillin @ 4.4-11 mg/kg b.wt. IM

NSAIDs

- Flunixin meglumine **(Unizif)** @ 1-2 ml/45 kg b.wt. IM/IV
- Meloxicam **(Melonex)** @ 30 ml/300 kg b.wt. IM/IV/SC
- Tolfenamic acid **(MAXXTOL)** @ 4 mg/kg b.wt. IM/IV

Actinomycosis

Key Points

- Commonly known as Lumpy jaw caused by *Actinomyces bovis*.
- Characterized by localized, chouronic progressive Granulomatous Osteomyelitis involving Mandible, maxillae and other soft tissues in mouth.

General Clinical Examination

- Wounds in oral mucosa
- Palpation of hard immovable masses
- Pharyngeal trauma
- Foul smell from mouth

History

- History of recent feeding
- Oral mucosal wounds

Prevention

- Avoid coarse, steamy feeds
- Avoid grazing near fencing areas
- Isolate infected animal

Differential Diagnosis

- Impacted feed/foreign bodies
- Pharyngeal trauma
- Foul smell from mouth
- Actinobicillosis- Affects soft tissues

Treatment

Iodine therapy

- Sodium iodide 10% @ 1 g/14 kg. b. wt. IV, 5 dosage at the interval of 7 days
  (Caution - Stop administering of IV lodine - If signs of iodine toxicity lacrimation, anorexia, cough, diarrhea are observed.)

Antibiotic therapy

- Streptomycin @ 10-25 mg/kg b.wt. IM
- Penicillin @ 4.4-11 mg/kg b.wt. IM

NSAIDs

- Flunixin meglumine **(Unizif)** @ 1-2 ml/45 kg b.wt. IM/IV
- Meloxicam **(Melonex)** @ 30 ml/300 kg b.wt. IM/IV/SC
- Tolfenamic acid **(MAXXTOL)** @ 4 mg/kg b.wt. IM/IV

Anthrax

Key Points

- Acute fatal septicemic bacterial disease caused by *Bacillus anthracis* characterized by hemorrhagic lymphadenitis.
- Zoonotic disease – Humans may acquire the infection after exposure to spores
- Proper disposal of needles and syringes.

General Clinical Examination

- Temperature– 107°F
- Subcutaneous edema
- Blood oozing from the natural orifices

History

- Vaccination status

Differential Diagnosis

- Acute Toxicity – History of accidental/ malicious ingestion of poisonous materials
- Black Quarter – Necrotizing myositis

Prevention

- Post mortem of carcass strictly prohibited and disposal of carcass (in case of death of animal).
- Deep burial (6 feet trench) of dead animal and fumigation of the sheds.

Treatment

Antibiotic therapy

- Oxytetracycline @ 5–10 mg/kg b.wt. IV
- Penicillin @ 4.4–11 mg/kg b.wt. IM

NSAIDs

- Flunixin meglumine **(Unizif)** @ 1–2 ml/45 kg b.wt. IM/IV
- Meloxicam **(Melonex)** @ 30 ml/300 kg b.wt. IM/IV/SC
- Tolfenamic acid **(MAXXTOL)** @ 4 mg/kg b.wt. IM/IV

Black Quarter

Key Points

- Acute fatal bacterial disease characterized by emphysematous swelling and necrotizing myositis in heavy muscles caused by *Clostridium chauvoei*.
- On palpation, swollen area emits crackling or crepitating sound due to emphysema.

General Clinical Examination

- Temperature- 104-106°F
- Crepitating sounds of affected muscle- cattle only
- Emphysematous swelling in muscles

History

- Age
- Recent wounds
- Vaccination status

Differential Diagnosis

- **Anthrax-**Blood oozing from natural orifices
- **Poisoning-**history of accidental/ malicious ingestion of poisonous materials
- **Snake bite-**fang marks and local inflammation at the site

Treatment

Antibiotic therapy

- Oxytetracycline @ 5-10 mg/kg b.wt. IV
- Penicillin @ 4.4-11 mg/kg b.wt. IM

NSAIDs

- Flunixin meglumine **(Unizif)** @ 1-2 ml/ 45 kg b.wt. IM/IV
- Meloxicam **(Melonex)** @ 30 ml/ 300 kg b.wt. IM/IV/SC
- Tolfenamic acid **(MAXXTOL)** @ 4 mg/kg b.wt. IM/IV
- Make skin incisions on the affected muscles to allow oxygen flow

Prevention

- Clostridia vaccinations for other animals in the herd
- In case of death of animal, carcass buried or destroyed by burning

Brucellosis

Key Points

- Acute bacterial disease caused *Brucella abortus* characterized by abortion (In third trimester), retained placenta in females, orchitis and permanent infertility in males.
- Sexually mature and pregnant animals are more susceptible.
- Zoonotic disease-Undulant fever in humans characterized by arthouritis, orchitis and sterility.
- Rose bengal plate test (RBPT), Brucella Milk Ring Test (BMRT) used for diagnosis.

General Clinical Examination

- Abortion in last trimester
- Orchitis in males
- Retained placenta
- Metritis
- Synovitis

History

- Previous abortion
- Previous herd infection
- Stage of pregnancy
- Sexual maturity
- Vaccination status

Differential Diagnosis

- Bovine Viral Diarrhea (BVD)- Early embryonic death
- Campylobacteriosis- Early Abortions
- Rhinotracheitis (IBR)- Mucopurulent nasal discharges, Pustules on vulval
- Blue tongue (BT) (Sheep)- Still births, Fetal malformation

Treatment

- No effective treatment
- Report to concerned government authorities

Prevention

- Foot bath and mouth wash with KMnO
- Vaccinate other animals of the herd
- Provide soft gruel diet and rest
- Spray insecticides in and around the farm

Enterotoxaemia

Key Points

- Classical disease of Sheep characterized by sudden death.
- Caused by *Clostridium perfringens* type D.
- Highest incidence is in lambs age of 3-5 weeks.

General Clinical Examination

Lambs

- Neurological signs- Opisthotonos, circling and pushing of head against hard walls
- Sudden death

Kids

- Temperature- 105°F
- Profuse diarrhea

History

- Feeding on Carbohydrates rich feeds
- Age of animal
- Vaccination status
- Out breaks

Treatment

Antitoxins - *C. perfringens* type D antitoxin

Broad spectrum antibiotics

- Oxytetracycline @ 5-10 mg/kg b.wt. IV

Prevention

- Restricted feeding
- Vaccinate other animals

Foot Rot

Key Points

- Foot rot is an infectious and contagious disease of the hooves of goats and sheep caused by *Fusobacterium necrophorum.*
- Overgrown hooves, ulcers, abscesses, abrasion, fractures and inflammation of the foot.
- Wet soils, muddy pens and filth, moist, humid weather conditions predisposes to foot rot.

General Clinical Examination

- Elevated body temperature
- Limping, lameness
- Swelling of inter-digital tissues
- Separation of horn from the hoof
- Foul odour from the affected foot

History

- Wet humid weather
- Entry of new animals into the herd

Differential Diagnosis

- Arthritis - all the joints of four legs are involved
- Blue Tongue - oral lesions along with foot lesions
- FMD - oral lesions
- PPR - Necrotic stomatitis
- Foot abscess - large swelling, foul odour and necrosis are absent

Treatment

Trimming affected hoof

- Remove the dead, rotten foot tissue with shears or a sharp knife
- Until the healthy tissue is found and some bleeding will occurs

Foot soaking in 10% v/v zinc sulfate

- After trimming, the animals should be forced to walk through a zinc sulfate or 10% formalin foot bath solution
- Repeat footbath treatment 2 to 4 times at weekly intervals
- Foot soaking for approximately 30 minutes, allow the solution to dry on hooves (another 30 minutes)
- Affected area treated with non irritant bactericidal ointments

Antibiotic Therapy:

- Pencillins @ 4.4-11 mg/kg b. wt. IV/IM

NSAIDs

- Flunixin meglumine **(Unizif)** @ 1-2 ml/45 kg b.wt. IM/IV
- Meloxicam **(Melonex)** @ 30 ml/300 kg b.wt. IM/IV/SC
- Tolfenamic acid **(MAXXTOL)** @ 4 mg/kg b.wt. IM/IV

Hemorrhagic Septicemia

Key Points

- Acute, highly fatal disease of cattle and buffalo, sheep and goat characterized by septicemia caused by *Pasteurella multocida*.
- Stress, exposure to cold environment predisposes to the disease.
- Brisket edema-characteristic clinical sign.
- Buffalos are more susceptible.

General Clinical Examination

- Temperature-106-107°F
- Salivation
- Brisket edema
- Dyspnea

History

- Rainy season
- Age
- Out breaks
- Vaccination status
- Stress-transportation

Treatment

Antibiotic therapy

- Sulphadimidine 33.3% @100 mg/kg BW IV or
- Sulphatrimethoprim @ 30 mg/Kg BW IM/IV SID or
- Ceftiofur **(Xyrofur)** @ 1.1-2.2 mg/ Kg BW SID IM for 3-5 days

NSAIDs

- Flunixin meglumine **(Unizif)**: 1-2 ml/ 45 kg b.wt. IM/IV
- Meloxicam **(Melonex)**: 30 ml/ 300 kg b.wt. IM/IV/SC

Loop diuretics for edema

- Furosemide @ 1-2 mg/Kg BW SID IM/SC.

Bronchodialator

- Aminophyline @ 6 mg/Kg BW BID IM

Prevention

- Isolate the infected animal
- Vaccination for other animals
- Good farm management practices

Tetanus

Key Points

- Neurotoxin produced by *Clostridium tetani* in necrotic tissues causes Tetanus toxenia.
- Birds are resistant while Horses are mostly susceptible.
- Tetanus is usually sequel of wounds, such as nail pricks, castration, docking, shearing or those received during parturition and accidental injuries on roads as well as injuries due to grazing of rough fibrous feeds.

General Clinical Examination

- Muscle spasms
- Lock law
- Stiffness of the hind limbs
- Examine for any wounds
- Prolapse of third eye lid

History

- Vaccination history
- History of wounds

Treatment

- Wound debridement
- In Horses, Tetanus antitoxins administered in high doses of 300,000 units twelve hourly for 3 days.
- In large ruminants, dosage is 10,000 - 50,000 units which is given twelve hourly for 3 days.
- Supportive therapy includes isotonic balanced electrolyte solution.
- Combination of chlorpromazine or diazepam may be administered to reduce the hyperesthesia.

Prevention

- Antitoxin @ 1,500–3,000 IU may be injected subcutaneously in horses for passive immunity.
- Proper disinfection of instrument used for castration, docking and shearing.

Strangles

Key Points

- Also known as equine distemper – a highly contagious disease of the upper respiratory tract in horses and other equines is caused by *Streptococcus equi.*
- Young horses are mostly susceptible
- Transmitted by direct contact of infected horses

General Clinical Examination

- Swelling of the submandibular and retropharyngeal lymph nodes
- Bronchopneumonia due to aspiration of pus from the upper airways.

Treatment

Antibiotics

- Procaine penicillin G @ 22,000 IU/kg IM every 12 hours or
- Sodium penicillin G @ 22,000 IU/kg IV every 6 hours or
- Sulphonamide-trimethoprim combinations @ 15-30 mg/kg orally or IV every 12 hours

NSAIDs

- Flunixin meglumine **(Unizif)** @ 1-2 ml/ 45 kg b.wt. IM/IV
- Meloxicam **(Melonex)** @ 30 ml/ 300 kg b.wt. IM/IV/SC

Antiseptics

- Abscess should be managed by proper drainage and flushing with antiseptic solutions to promote healing.

Prevention

- Vaccination
- Quarantine new arrivals for at least 2-3 weeks

Glanders

Key Points

- Glanders is a highly contagious zoonotic disease affecting equines caused by *Burkholderia mallei*.
- *B. mallei* is an obligate mammalian pathogen and was first isolated by Loeffler and Schutz in 1882.
- Historically, *B. mallei* has been used as a bioterrorism agent.

General Clinical Examination

- Acute Form: High fever, cough, nasal discharge, ulcers on the nasal mucosa and nodules on skin of lower limbs or abdomen. Death may occur within a few days due to toxaemia.
- Chronic Form: Inappetence, cough, dyspnea, nasal discharge, weight loss, enlargement of submandibular lymph nodes.

Treatment

- No treatment is undertaken.
- Infected animals are euthanised to prevent the spread of the disease as per Prevention and Control of Infectious and Contagious Diseases in Animals Act, 2009.

Leptospirosis

Key Points

- One of the most common zoonotic bacterial diseases affecting multiple species including cattle, sheep, and goats of animals caused by Leptospira interrogans.
- Clinical infections in cattle are mostly associated with serovar Hardjo or Pomona.
- Occurs most commonly during warm and wet climates, and is endemic in tropical areas.

General Clinical Examination

- High fever, Anorexia
- Rapid onset of agalactia (milk drop syndrome)
- In chronic leptospirosis - abortion, premature birth, stillbirth, birth of weak offspring and infertility may occur.

Treatment

Antibiotic therapy

- Penicillin G @ 10,000-20,000 IU/kg BW BID IM for 3-5 days followed by
- Dihydrostreptomycin @ 12 mg/ kg BW IM for 3-5 days in large animals.

NSAIDs

- Flunixin meglumine **(Unizif)** @ 1-2 ml/ 45 kg b.wt. IM/IV
- Meloxicam **(Melonex)** @ 30 ml/ 300 kg b.wt. IM/IV/SC
- Tolfenamic acid **(MAXXTOL)** @ 4 mg/kg b.wt. IM/IV

Prevention

- Vaccination: Whole-cell inactivated vaccines are available
- Movement control and quarantine of infected animals

Listeriosis

Key Points

- Food-borne illness, is caused by member of the genus Listeria.
- *L. monocytogenes* is the primary pathogen associated with human and animal listeriosis.
- Disease course in sheep and goats is rapid, and death may occur between 24 and 48 hours after onset of clinical signs.

General Clinical Examination

- Rhombencephalitis - also referred to as circling disease
- Unilateral facial nerve paralysis
- Dropping of the eyelid and ear
- Septicaemic or visceral listeriosis is found in young ruminants
- Abortion usually occurs in the last trimester without prior clinical signs

History

- Feeding of mouldy silage

Treatment

Antibiotic therapy

- Penicillin G @ 10,000-20,000 IU/kg BW IM for 1-2 weeks is the drug of choice for listeriosis.
- Ceftiofur **(Xyrofur)** @ 1.1-2.2 mg/ kg BW bid IM for 3-5 days.

Loop diuretics

- Mannitol @ 1-2 mg /kg BW IV in encephalitis

Nervine tonic (Tribivet M)

LA @ 5-10 ml, SA @ 3-5 ml, IM/IV

NSAIDs

- Flunixin meglumine **(Unizif)** @ 1-2 ml/ 45 kg b.wt. IM/IV
- Meloxicam **(Melonex)** @ 30 ml/ 300 kg b.wt. IM/IV/SC
- Tolfenamic acid **(MAXXTOL)** @ 4 mg/kg b.wt. IM/IV

Prevention

- Feed only good quality silage
- Discarding any spoiled or mouldy silage

Viral Diseases

Foot and Mouth Disease

Key Points

- Caused by Aphtho virus leads to severe economic losses.
- Disease of cloven footed animals.
- It exists in seven serotypes (O, A, C, Asia-1, SAT-1, SAT-2, SAT-3) antigenically and, of these only three serotypes (O, A, Asia-1) are prevalent in India.

General Clinical Examination

- Temperature: 103-106°F
- Salivation
- Vesicles and bullae on tongue, buccal mucosa, dental pad and inter digital space
- Lameness
- Drop in milk yield

History

- Outbreaks in surrounding areas
- Transportation of animal across the endemic areas
- Introduction of new animal to herd
- Vaccination status

Differential Diagnosis

Blue tongue (Sheep)- Mucopurulant nasal discharge
Foot rot- No oral lesions
Bovine viral diarrhea (Mucosal disease)- Erosive lesions on nostrils and mouth
Vesicular stomatitis- Mucosal vesicles and ulcers in mouth
Contagious ecthyma (Orf)- Lesions at muci cutaneous junctions of lip
PPR - Necrotic stomatitis, no foot lesions
Vesicular exanthema - Blisters in oral mucosa

Prevention

- Isolate the infected animals
- Vaccination for other animals
- Good farm management practices
- Provide soft feed and rest

Treatment

Wash the affected body parts with $KMNO_4$
Antibiotics

- Penicillins @ 4.4 mg/kg b.wt. IM/ IV
- Ceftriaxone **(Intacef)** @ 5 mg/kg b.wt. IM or IV

NSAIDs

- Flunixin meglumine **(Unizif)** @ 1-2 ml/45 kg b.wt. IM/IV
- Meloxicam **(Melonex)** @ 30 ml/300 kg b.wt. IM/IV/SC
- Tolfenamic acid **(MAXXTOL)** @ 4 mg/kg b.wt. IM/IV

Blue Tongue

Key Points

- Non contagious viral disease primarily of domestic (cattle, sheep, goat and wild ruminants caused by Reovirus.
- Sheeps are most severely affected and cattle act as a reservoir host.
- High mortality rate is young lambs.

General Clinical Examination

- Temperature- 105-106°F
- Eye and nasal discharge
- cyanosis of tongue
- Swelling of mouth, head, neck
- Dyspnea
- Crusting of mucopurulent nasal discharge in muzzle and nostrils

History

- Age
- Recent wounds
- Vaccination status

Differential Diagnosis

- Foot rot-no oral lesions
- FMD lesions seen in inter digital space
- PPR- Necrotic stomatitis and profuse diarrhea

Treatment

Antibiotic therapy

- Ceftriaxone **(Intacef)** @ 5 mg/kg b.wt. IM or IV
- Penicillin @ 4.4-11 mg/kg b.wt. IM

NSAIDs

- Flunixin meglumine **(Unizif)** @ 1-2 ml/ 45 kg b.wt. IM/IV
- Meloxicam **(Melonex)** @ 30 ml/ 300 kg b.wt. IM/IV/SC
- Tolfenamic acid **(MAXXTOL)** @ 4 mg/kg b.wt. IM/IV

Prevention

- Foot bath and mouth wash with KMnO
- Vaccinate other animals of the herd
- Provide soft gruel diet and rest
- Spray insecticides in and around the farm

Peste des petits ruminants

Key Points

- Acute or sub acute viral disease of goats and sheep caused by Morbilivirus and characterized by fever, necrotic stomatitis, gastroenteritis, pneumonia, and sometimes death.
- Isolation of affected herd and inform the concerned authorities.

General Clinical Examination

- Temperature - 104-106°F
- Bronchopneumonia
- Putrid breath

History

- Vaccination status
- Abortions in herd
- Cough, dyspnea

Differential Diagnosis

- GI Infections - Parasitic ova in fecal examination
- Contagious ecthyma - Lesions at muco-cutaneous junction of lip
- Heart water disease - Hemoglobinuria
- Coccidiosis - Bloody diarrhea
- Mineral poisoning - History of accidental ingestion

Treatment

Fluid therapy

- DNS or RL

Antibiotic Therapy:

- Pencillins @ 4.4-11 mg/kg b. wt. IV/IM

NSAIDs

- Flunixin meglumine **(Unizif)** @ 1-2 ml/45 kg b.wt. IM/IV
- Meloxicam **(Melonex)** @ 30 ml/300 kg b.wt. IM/IV/SC
- Tolfenamic acid **(MAXXTOL)** @ 4 mg/kg b.wt. IM/IV

Prevention

- Isolate the infected animal
- Provide soft gruel diet
- Restrict movement to reduce respiratory stress

Lumpy Skin Disease (LSD)

Key Points

- Caused by the lumpy skin disease virus (LSDV), a member of genus Capripoxvirus within family Poxviridae.
- Transmitted through insect vectors such as mosquitoes, ticks and flies.
- The disease primarily affects cattle and water buffaloes.

General Clinical Examination

- High fever
- Sharp drop in milk yield
- Nodules on the skin, mucous membranes and internal organs

History

- Anorexia
- Reduced milk yield

Treatment

Symptomatic Treatment can be given.

Antibiotic therapy

- Enrofloxacin @ 2.5-5 mg/kg BW, IM/SC, OD for 5 days.

NSAIDs

- Flunixin meglumine **(Unizif)** @ 1-2 ml/45 kg b.wt. IM/IV
- Meloxicam **(Melonex)** @ 30 ml/300 kg b.wt. IM/IV/SC

Wound management

- Antiseptics can be used
- Wound healer spray **(Exoheal)**

Prevention

- Live attenuated Goatpox vaccine is recommended
- Fly repellents to control the vectors

Hemoprotozoan Diseases

Babesiosis

Key Points

- Tick-borne illness caused by *Babesia* spp. most notably *B. bovis* and *B. bigemina*.
- Ixodid tick act as a vector.
- Characterized by high fever and hemoglubinuria (coffee colored urine).
- Cross breed cattle are more susceptible.

General Clinical Examination

- Temperature- 104-106°F
- Urine- Coffee colored (Haemoglobinurial)
- Hard feces (pipe stem feces)

History

- Tick infestation

Treatment

Anti hemoprotozoal

- Diminazene Aceturate **(Nilbery)** @ 3-5 mg/kg b.wt. or 1 ml/ 10-20 kg b.wt. deep IM (Single dose is effective).
- Imidocarb dipropionate **(Imizet)** @ 2.2-4.0 mg/kg b.wt. IM/SC (Every 72 hours for 2-4 times).

NSAIDs

- Flunixin meglumine **(Unizif)** @ 1-2 ml/ 45 kg b.wt. IM/IV
  Meloxicam **(Melonex)** @ 30 ml/ 300 kg b.wt. IM/IV/SC
- Tolfenamic acid **(MAXXTOL)** @ 4 mg/kg b.wt. IM/IV

Fluid therapy - Isotonic Fluids

Blood transfusions may be necessary in severe anaemia.

Prevention

- Hematinics: 3-4 weeks
- Rumenotorics: 3-4 weeks
- Ectoparasiticides pour on for the affected animals and other animals in the surrounding

Theileriosis

Key Points

- Theilerlosis is a group of tick-borne hemoprotozoal diseases caused by *Theileria annulata* and *Theileria parava* (transimitted by tick hyaloma).
- Characterized by generalized lymph node swelling and anemia.
- Cross bred cattle highly susceptible than indigenous breeds.
- Indigenous cattle less susceptible.

General Clinical Examination

- Fever - 107°F
- General lymph node swelling - Especially in re scapular and pre crural lympy nodes
- Anemia
- Death occur within 18-24 days of infection

History

- Tick infestation
- Vaccination status
- Breed

Treatment

Anti hemoprotozoal

- Buparvaquone **(Zubion)** - 2.5 mg/kg b.wt., IM (If required, can be repeated after 48 hours).

NSAIDs

- Flunixin meglumine **(Unizif)**: 1-2 ml/ 45 kg b.wt. IM/IV
- Meloxicam **(Melonex)**: 30 ml/ 300 kg b.wt. IM/IV/SC

Inj. B complex (Tribivet)

- LA @ 5-10 ml and SA @ 1-2 ml

Supportive therapy (3-5 days)

- Isotonic fluids

Prevention

- Hematinics-3-4 weeks
- Rumenotorics-3-4 weeks
- Ectoparasiticides pour-on for affected animals and other animals

Trypanosomiasis

Key Points

- Hemoprotozoal disease of cattle, sheep, goat, horse and camel caused by *Trypanosoma evansi* (Transmitted by flies).
- Characterized by circling movement, in coordination, convulsions, intermittent fever and anemia.
- Indigenous cattle less susceptible.

General Clinical Examination

- Intermittent fever
- Anemia
- Chancres (Local painless inflammation at the site of bite)
- Corneal opacity

History

- Fly infestation
- Intermittent fever
- Weight loss

Treatment

Anti hemoprotozoal

- Diminazene aceturate **(Nilbery)** @ 3-5 mg/kg b.wt. IM
- Quinapyramine sulfate @ 7-8 mg/kg b.wt.

NSAIDs

- Flunixin meglumine **(Unizif)**: 1-2 ml/ 45 kg b.wt. IM/IV
- Meloxicam **(Melonex)**: 30 ml/ 300 kg b.wt. IM/IV/SC

Supportive therapy (3-5 days)

- Isotonic fluids

Prevention

- Hematinics: 3-4 weeks
- Rumenotorics: 3-4 weeks
- Ectoparasiticides pour on affected animals and other animals
- Control of ticks

Anaplasmosis

Key Points

- Also called yellow bag or gall sickness, is an arthropod-borne rickettsial disease caused by an Anaplasma spp.
- Anaplasma marginale is the most common aetiological agent for bovine Anaplasmosis.
- Transmitted biologically by ixodid ticks belonging to the genera Rhipicephalus, Hyalomma, Dermacentor and Ixodes.

General Clinical Examination

- Sub-normal temperature is recorded along with severe anaemia
- Severe depression in milk yield
- Jaundice

History

- Tick infestation
- Vaccination status
- Breed

Treatment

Anti-hemoprotozoals

- Imidocarb **(Imizet)** @ 1.2-2.4 mg/kg BW by IM/SC route

Antibiotic therapy

- Oxytetracycline @ 6.0-10.0 mg/kg BW by IM/IV route should be given for 3-5 days.
- Blood transfusion is also recommended

Prevention

- Live or killed Anaplasma vaccines
- Hematinics for 3-4 weeks
- Ectoparasiticides pour on for control ticks

Other Viral Diseases of Sheep, Goat, Pig and Horse

Sheep and Goat Pox Pox virus Severe in lambs and kids	Fever, pustular scabby lesions mostly on non-woolly/ non-hairy parts of body like udder, inside of thighs, axilla, face, lips, ears, under the tail	Clinical signs (characteristic lesions). Confirmation by serological test (complement fixation, immuno diffusion) or animal inoculation	Symptomatic treatment with antibiotics for 3-7 days, dressing of cutaneous lesions
Contagious Ecthyma Parapox virus. Sheep and Goat	Thick, tenacious scabby lesions on lips, muzzle and nostrils	Clinical signs. Confirmatory diagnosis can be done by PCR assay	Symptomatic treatment with antibiotics for 3-7 days, dressing of lesions with Boroglycerine
Swine Fever Pesti virus Pigs	Fever, anorexia, depression, constipation or diarrhoea, purplish discolouration of abdominal skin. Nervous signs: circling, tremors, incoordination, convulsion, paralysis	Clinical signs, post mortem lesions (button ulcer of intestine and turkey egg kidneys). Confirmation by serological test (e.g. haemagg-lutination test) and animal inoculation test	Symptomatic treatment with antibiotics, antipyretics and fluid therapy
Swine Influenza Influenza virus all ages of pigs	Fever, anorexia, reluctance to move, nasal discharge, dyspnoea and coughing	Clinical signs. Confirmation can be done by RT-PCR and viral isolation	Symptomatic treatment with antibiotics, antipyretics and analgesics

Equine Influenza Equine influenza A virus Young horses	High fever, anorexia, nasal discharge, dyspnoea and coughing	Clinical signs. Confirmation by virus isolation from nasal swabs, thorough PCR testing and using ELISA	Symptomatic treatment with antibiotics, antipyretics and analgesics
Equine Infectious Anaemia Lenti virus (Insect borne disease) Horses	Recurrent fever, anaemia, petechial haemorrhage, jaundice, oedema of dependent parts, dyspnoea, tachycardia, weakness, abortion. Death may occur due to anoxic anaemia or cardiac failure	Clinical signs, post mortem lesions and haematology. Confirmation by Coggins agar gel immunodiff-usion (AGID) test or ELISA	Symptomatic treatment with antibiotics, antipyretics, blood transfusion followed by hematinic

Viral Diseases of Dogs

Name of Disease: Etiology and Species Affected	Clinical Signs and Lesions	Diagnosis	Treatment and Control
Canine Distemper Paramyxovirus Young pups (3-12 months) are more susceptible	Biphasic fever, anorexia, vomition, diarrhoea, nasal discharge, coughing, pustules on ventral aspect of abdomen, Nervous signs-chorea	History and clinical signs. Confirmation by serological test (e.g. fluorescent antibody technique) and isolation of virus	Symptomatic treatment with broad-spectrum antibiotics viz. Cefpodoxime **(Cefpet)** @5-10 mg/kg b.wt. once daily orally, Ceftriaxone **(Intacef Tazo Pet)** @15-25 mg/kg IM/IV or Marbofloxacin **(Marbomet tab)** @2-5 mg/kg once daily orally for 3-5 days. Anti-emetics, anti-convulsants, fluid therapy, multivitamins and dressing of skin lesions
Parvo virus infection/ Gastroenteritis Pups are more susceptible	Anorexia, fever, vomition, bloody foul-smelling diarrhoea, dehydration and death	History and clinical signs. Faecal testing by ELISA or PCR can confirm the diagnosis	Symptomatic treatment with antibiotics, anti-emetics, intensive fluid therapy, styptics parenterally

Rabies Rhabdo virus	**Furious rabies** hyperactivity, restlessness, severe aggression, excessive salivation, convulsion, coma and death within 1-2 weeks. **Dumb rabies** Quite form, paralysis of limb and respiratory muscle, hydrophobia, squinting eyes, difficulty swallowing, coma and death within 1-2 weeks	Clinical Signs, history of vaccination and biting of rabid animal, fear of water, fluorescent antibody technique (FAT), Negri bodies in post-mortem examinations	There is no specific treatment, isolation of infected animal, scheduled vaccine can prevent infection.
Infectious Canin Hepatitis (ICH) Canine adenovirus Severe in young pups	Fever, anorexia, vomition, diarrhoea, jaundice, corneal opacity/edema (blue eye)	Clinical signs. Confirmation by serological test (e.g. gel diffusion test) and virus isolation	Symptomatic treatment with antibiotics, anti-emetics, dextrose IV. Liver tonics **(Livotas pet)** @1-10 ml orally twice daily and eye drops

Common Endoparasitic Diseases of Livestock

Name of Disease: Etiology and Species Affected	Clinical Signs and Lesions	Diagnosis	Treatment and Control
Hepatic Fascioliasis *Fasciola gigantica, Fasciola hepatica* Cattle, Buffalo, Sheep, Goat	Chouronic diarrhoea, bottle jaw, loss of appetite, weight loss, anaemia, weakness, death within 2-3 months	Clinical signs, faecal examination and post mortem examination (presence of fluke in liver and bile duct)	Oxyclozanide **(Neozide bolus)** @ 1 Bolus/100 kg b. wt. orally or Triclaben - dazole **(Olgard)** @1 ml/5kg b. wt. orally. Supportive treatment with liver extract and Vit B complex **(Tribivet)**
Amphistomiasis *Paramphisto-mum spp* Cattle, Buffalo, Sheep, Goat	Persistent foetid diarrhoea, bottle jaw, anorexia, weight loss, dehydration, weakness	Clinical signs and post mortem finding (parasites at duodenum)	Oxyclozanide **(Neozide bolus)** @1 Bolus/100 kg b. wt. orally. Supportive treatment with fluid therapy
Nasal granuloma *Schistosoma nasalis* Cattle, buffalo, sheep, goat	Snoring respiration, sneezing, granulomatous growth in nostril	Clinical signs, eggs in nasal washings	Anthiomaline @15 ml IM in cattle (four inj. every alternate day)
Ascariasis *Toxocara vitulorum* (Calves), *Toxocara canis* (Dogs), *Ascaris suum* (Pigs), *Parascaris equorum* (Horse)	Poor growth, rough coat, pot-belly, colic, constipation, diarrhoea, coughing, sometimes intestinal obstruction	Clinical signs and faecal examination	Piperazine @110 mg/kg b. wt. or Fenbendazole **(Fentas)** @ 1 bolus/200-300 kg b. wt. orally.

Verminous pneumonia (Lung worm disease) *Dictyolaulus* spp. Ruminants	Hacking cough, dyspnoea, nasal discharge, diarrhoea, anorexia, stunted growth and death	Clinical signs, presence of larvae in faeces	Fenbendazole **(Fentas)** @ 1 bolus/200-300 kg b. wt. orally or Ivermectin 1% **(Neomec)** @1 ml/50 kg b. wt. SC
Thelaziasis (Eye worm disease) *Thelazia rhodesii* Ruminants	Lacrimation, corneal opacity and photophobia	Clinical signs, presence of worm in conjunctival sac	Ivermectin 1% **(Neomec)** @1 ml/50 kg b. wt. SC
Ancylostomiasis (Hook worm) *Ancylostoma* spp. Dogs	Pale mucosa, stunted growth, bloody diarrhoea, weakness, itching of skin	Clinical signs and faecal examination	Fenbendazole **(Fentas)** @ 1 bolus/200-300 kg b. wt. orally. Pyrantel pamoate **(Eazypet)** @5-10 mg per kg b. wt. orally
Dirofilariasis (Heartworm disease) *Dirofilaria immitis* *Dogs*	Dyspnoea, chouronic cough, poor exercise tolerance, anaemia, epistaxis and haematuria	Clinical signs and recovery of microfilaria in direct blood smear	Ivermectin 1% **(Neomec)** @1 ml/50 kg b. wt. SC
Tapeworm in dogs *Diphyllobothorium latum, Dipylidium canimum*	Stunted growth, diarrhoea, vomition, potbelly, rubbing of anus on ground and biting of anal region	Clinical signs and presence of tapeworm segments in stool	Fenbendazole **(Fentas)** @ 1 bolus/200-300 kg b. wt. orally and Praziquantel **(Eazypet)** @ 5-10 mg/kg b. wt. orally.

Systemic Diseases of Livestock

Disease : Etiology	Clinical Signs	Diagnosis	Treatment
Ascites Fibrosis of liver, renal insufficiency, hypoproteinaemia	Distended abdomen, anaemia, dyspnoea, emaciation	Clinical signs	Diuretics, corticosteroids e.g. Isoflupredone (**Inerol** @ 0.02 mg/kg b.wt. IM), salt free and protein rich diet
Cystitis Bacterial infection, trauma, calculi	Frequent painful urination, reduced appetite. Urine: cloudy/ red	Clinical signs, bladder wall thickened and painful on palpation	Antibiotics, antispasmodics, urinary antiseptics
Epistaxis Trauma, hot summer, Vitamin K, C and Calcium deficiency, tumor, nasal granuloma	Bleeding from nose, sneezing, shaking of head	Clinical signs	Ice packs over head or nose, Inj. Vitamin K, Inj Tranexamic acid @5-25 mg/kg b.wt. Inj. Anthiomaline for nasal granuloma
Toxaemia Bacterial toxins, metabolic toxins	Hyperthermia followed by hypothermia, tachycardia, congested mucosa, anorexia, anuria, cold skin, constipation/ diarrhoea	Clinical signs	Antibiotics, intensive fluid therapy, corticosteroids e.g. Isoflupredone (**Inerol** @0.02 mg/kg b.wt. IM), liver tonics (**Livotas** @30-40 ml orally daily). Vit B complex

Shock Haemorrhage, dehydration, severe trauma, toxaemia, anaphylaxis	Hypothermia, pale and dry mucosa, severe weakness, recumbency, swallow respiration, oliguria/ anuria	History and clinical signs	Restoration of blood volume, corticosteroids, antibiotics, antihistaminics, adrenaline (in anaphylaxis)
Skin Diseases			
Dermatitis Bacteria, viruses, fungi, mites, allergens, Vit A deficiency, Zinc deficiency	Bacterial- pyoderma Fungal- ring worm Mites- mange Allergic- urticaria/ eczema Vit A deficiency- hyperkeratosis Zinc deficiency- parakeratosis	Clinical signs, examination of skin scrapping and cultural examination	Remove primary cause, Antihistaminics, corticosteroids, antibiotics, antiparasitic, Vit A and Zinc supplementation
Ringworm Fungi- *Trychophyton* sp., *Microsporum* sp.	Discrete circular whitish asbestos like lesion on head, face, neck, shoulder and back. Itching, alopecia, dandruff	Clinical signs, cultural examination	Apply Tincture Iodine/ Salicylic acid ointment for one month after clipping hairs and cleaning the area. Antifungals orally

Infectious Diseases of Poultry

Name of Disease: Etiology and Age Affected	Clinical Signs and Lesions	Morbidity/ Mortality	Treatment and Control
Bacterial Diseases			
Fowl cholera /Avian Pasturellosis *Pasturella multocida* All age of birds	**Per-acute:** sudden death **Acute:** anorexia, nasal discharge, sneezing, dyspnea, coughing, diarrhoea, cyanosis of comb and wattles **Chouronic: swollen comb and wattles,** lameness **Lesion:** Patechae on heart	Morbidity: High Mortality: up to 90%	Antibiotics eg. Levofloxacin @10 mg / kg b.wt. orally (**Pulmoliv-BH**) Sulphame-zathine @30 ml/4 lit. water for 5-7 days. **Control:** Biosecurity & vaccination
Infectious Coryza *Avibacterium paragalli-narum* All age groups	Profuse nasal discharge, sneezing, dyspnea, coughing, lacrimation, **swelling of face & infraorbital sinus,** eyes filled with cheesy substance, reduction in feed intake and drop in egg production	Morbidity: High Mortality: Low	Antibiotics eg. Levofloxacin @ 10 mg / kg b.wt orally (**Pulmoliv-BH**) Sulphame-zathine @30 ml/4 lit. water for 5-7 days. **Control:** Biosecurity and vaccination, avoiding overcrowding and wet litter; proper ventilation.

Fowl Typhoid *Salmonella gallinaru* All ages	anorexia, ruffled feathers, drooping of wings, sleepiness, greenish diarrhea, Liver enlarged and bronze coloured	Mortality: 10 - 50%	Antibiotics eg. Levofloxacin @10 mg / kg b.wt. orally (**Pulmoliv-BH**). **Furasol** (furaltadone) @0.5-1 g/lit. water for 7 days. **Control:** Biosecurity
Pullorum Disease/ Bacillary White Diarrhoe *Salmonella pullorum* Mostly baby chicks	Dead in shell chicks, anorexia, weakness, huddle near heat source, labored breathing, whitish diarrhea, soiling of vent and sudden death	Morbidity: 10-80%, Mortality: up to 90%	Antibiotics eg. Levofloxacin @10 mg / kg b.wt. orally (**Pulmoliv-BH**) **Control:** Biosecurity
Air Sacculitis/ Colibacillosis *Escherichia coli* Mostly adults	Diarrhea, soiling of vent, anorexia, depression, dyspnea, sneezing Lesion: Air sacs thick & cloudy, milky fluid in pericardium	Morbidity: up to 70% Mortality: 5-10 %	Antibiotics eg. Levofloxacin @10 mg / kg b.wt. orally (**Pulmoliv-BH**)

Viral Diseases			
Newcastle Disease/ Ranikhet Disease Paramy-xovirus All ages	Dullness, depression, lethargy, ruffled feathers, gasping (difficult breathing) and respiratory rales. Sneezing, coughing, nasal discharge and torticollis (twisted neck). Clear mucus discharge from mouth, greenish watery diarrhea, paralysis of legs/ wings, drop in egg production and sudden death. Lesions: Haemorrhages in proventriculus	Morbidity : up to 100% Mortality : 50-90%	No specific treatment **Broad spectrum antibiotics** to prevent secondary bacterial infection. **Prevention and Control** Control of visitors Isolation of affected birds. Depopulation of site Proper sterilization of equipments. Disinfection of shed Burial/ burning of dead birds **Vaccination: LaSota vaccine** at 1st week (with drinking water) **R_2B Mukteshwar** vaccine in 8th and 18th week.
Avian Influenza/ Bird flu Orthomy-xoviruses	Coughing, Sneezing, Nasal discharge, Congestion and swelling of nasal passages, Encephalitis, Hemorrhagic lesions on comb and wattles	Morbidity : up to 100% Mortality: 10-70%	-

Infectious laryngotracheitis (ILT) Gallid herpesvirus 1 (GaHV-1) Mostly adult birds (5-9months)	Coughing, Open mouth breathing, mucopurulent nasal discharge, Swelling of the head and neck, particularly around the eyes, noticeable drop in egg production (5-15%)	Morbidity: 80-90% Mortality: 5-15%	ILT vaccine in endemic areas
Fowl pox Avipoxvirus Any age but severe in Young chicks	Nodular lesions or pox on unfeathered skin, such as comb and wattles. Closed eyes due to swelling, difficulty breathing	Morbidity: 10-95% Mortality: upto 50%	**Broad spectrum** antibiotics as Terramycin poultry formula @5 g/4.5 lit. of water. Local application of antiseptic ointment.
Marek's Disease (MD) Herpes virus Young chickens between 3-5 months of age	Poor growth, paralysis of legs, wings. Blindness in eye form. Skin tumour in skin form. Sudden death in acute form.	Morbidity: 30-100% Mortality: 5-15%	Vaccination of day- old chicks at hatchery
Infectious Bursal Disease (IBD)/ Gumboro disease Birna virus Young chicken (3-6 weeks)	Spiking mortality i.e. it begins at 3 days, spikes at 5-7 days and then starts declining. Depression, self-vent picking, prostration and trembling before death. Sulphur coloured diarrhoea.	Morbidity: 100% Mortality: up to 80%	**IBD Vaccination** Providing immunomodulators in feed and following strict bio security measures.

Infectious Bronchitis (IB) Corona virus All ages but mostly under 10–12 weeks	Young birds–rales, gasping, nasal discharge, lacrimation Adult birds– Abnormal, small rough thin shelled and misshapened eggs. Drop in egg production (10–50%). Lesion: Cheesy plugs in bronchi	Morbidity: 100% Mortality: Adult–negligible Young–25–40%	**IB Masschusetts strain vaccine**
Fungal Disease			
Aspergillosis/Brooder pneumonia *Aspergillus fumigatus* upto 10 weeks	Reduced appetite, increased thirst, dyspnea, gasping, death in 24–48 hours	Mortality: 10–50%	CuSo4 (1:2000) dilution for 7 days Control: Avoid dampness of litter
Aflatoxicosis Aflatoxin All ages (more in chicks)	Retarded growth, anorexia, ruffled feathers, anemia, ascites, ataxia and death	Mortality: 50–90%	Use feed additives as $CuSO_4$ @150 g/ton of feed. Control: Avoid use of contaminated feed

OIE Recommended Quarantine Period of Some Important Diseases

Disease	Days
Rabies	4-6 months
Contagious bovine pleuropneumonia (CBPP)/ contagious caprine pleuropneumonia (CCPP)	6 months
Tuberculosis	3 months
Infectious bovine rhinotracheitis (IBR)	30 days
Haemorrhagic septicaemia (HS)	21 days
Brucellosis	30 days
Swine fever	40 days
Glander	28 days
Dourine	28 days
Equine influenza	28 days
Blue tongue	40 days
Fowl cholera	14 days
Fowl typhoid	28 days

Important Diagnostics Tests

Diseases/Conditions	Test
Left displacement of the abomasum (LDA)	Liptak test
Traumatic reticuloperitonitis (TRP)	Pinching with wither, Pole magnet test
Simple indigestion	Sedimentation activity test (SAT)
Ascitis	Tactile percussion
Ketosis	Rothoura's test
Magnesium in urine	Xylidili test
Calcium in urine	Sulkowitch test
Glucose in urine	Benedicts test
Proteinuria	Biuret test
Bile pigent	Gelins test
Bile salt in urine	Hay's test
Hematuria	Benzedene test
HCN poisoning	Picrate test
Nitrate poisoning	Diphenylamine test

Anthrax	Ascolis test
Leptospirosis	Microscopic agglutination test (MAT)
Equine infectious anemia	Coggin's test
Streptococcus pyogens	Dick test
Staphylococcus agalactae	Hotis test
Trypanosoma	Stilbamidine test
Toxoplasma	Sabin and Feldman dye test
Echinococcus	Casonis intracutaneous test
Trichomoniasis	Tricin test
Tuberculosis	Stormant test
Brucellosis	Rose Bengal plate test (RBPT)
Glanders	Struss test
Campylobacter, Vibrio	Kanagawa reaction

Deworming Schedule for Livestock

Type of Worm	Deworming Schedule for Cattle and Buffalo
Roundworms	• Once a month up to 6 months of age • Once in two months from 6–12 months of age • Thrice a year in animals above one year of age
Liver flukes	• Twice a year in endemic areas (before and after monsoon)
Tapeworms	• Twice a year i.e. in January and June in calves in problem herds

Vaccination Schedule for Cattle and Buffalo

Name of Disease	Age at First Dose	Booster Dose	Subsequent Dose
Foot and Mouth Disease (FMD)	4 months and above	1 month after first dose	Six monthly
Haemorrhagic Septicaemia (HS)	6 months and above	–	Annually in endemic areas
Black Quarter (BQ)	6 months and above	–	Annually in endemic areas
Brucellosis	8 months of age (only female calves)	–	Once in a lifetime
Theileriosis	3 months of age and above	–	Once in a lifetime. Only required for crossbred and exotic cattle
Anthrax	4 months and above	–	Annually in endemic areas
Rabies (Post bite therapy only)	Immediately after suspected bite (zero day)	3rd day	7, 14, 28 and 90 (optional) days

Vaccination Schedule for Goat and Sheep

Name of Disease	Vaccination Schedule	
	Primary Vaccination	**Regular Vaccination**
Anthrax	3 months and above	Annually (in endemic area only)
Haemorrhagic Septicaemia	3 months and above	Annually before monsoon
Enterotoxaemia	3 months and above if dam is vaccinated. At 1st week if dam is unvaccinated. Booster: 15 days after primary	Annually before monsoon
Black Quarter	3 months and above	Annually before monsoon
Peste des Petits Ruminants (PPR)	3 months and above	Once in three years
Foot and Mouth Disease	3 months and above	Twice in a year (September and March)
Goat Pox (for Goat)	3 months and above	Annually (December month)
Sheep Pox (for Sheep)	3 months and above	Annually (December month)
Contagious Caprine Pleuro-Pneumonia (CCPP)	3 months and above	Annually (January month)

Vaccination Schedule for Dogs

Vaccines	Initial Puppy Vaccination	Initial Adult Vaccination	Revaccination
Canine Parvovirus-2 (CPV-2) Canine Distemper virus (CDV) Canine Adenovirus-2 (CAV-2)	Administer at 6–8 weeks of age, then every 2–4 weeks until 16 weeks of age or older. To minimize the risk of maternal antibody interferences with vaccination, the final dose of initial series should be administered between 14 and 16 weeks of age. Approximately 3 doses @ 2nd, 3rd and 4th month	Two doses 2–4 weeks apart are generally recommended	Booster at either 6 months or 1 year of age, then not more often than every 3 years
Parainfluenza Virus (CPiV)	Administer at 6–8 weeks of age, then every 2–4 weeks until 16 weeks of age or older	Two doses 2–4 weeks apart are generally recommended	Booster at either 6 months or 1 year of age, then annually
***Leptospira interrogans* (with serogroups canicola and icterohaemorrhagiae; killed bacterin)**	Initial dose at 8 weeks of age or older. A second dose is given 2–4 weeks later	Two doses 2–4 weeks apart	Annually
Canine Coronavirus (CCV)	Two doses 2–4 weeks apart with initial dose at >6 weeks of age	Two doses 2–4 weeks apart	Annually

Rabies (killed)	Administer one dose at 12 weeks of age. If vaccination is performed earlier than 12 weeks of age, puppy should be revaccinated at 12 weeks of age. In high risk areas a second dose may be given 2–4 weeks after the first	Administer a single dose	Booster at 1 year of age. Canine rabies vaccines with either a 1- or 3-year DOI are available
***Bordetella bronchiseptica* (live avirulent bacteria, intranasal)**	Administer a single dose as early as 3 weeks of age	A single dose	Annually or more often in very high-risk animals not protected by annual booster
Bordetella bronchiseptica	Administer one dose at 6–8 weeks and one dose at 10–12 weeks of age	Two doses 2–4 weeks apart	Annually or more often in very high-risk animals not protected by annual booster
Borrelia burgdorferi	Recommendation is for initial dose at 12 weeks of age or older. A second dose is given 2–4 weeks later. Borrelia vaccines may be given as early as 9 weeks of age if there is a high risk of exposure	Two doses 2–4 weeks apart	Annually. Revaccinate just prior to start of tick season as determined regionally

Vaccination Schedule for Cat

Vaccine	Initial Kitten Vaccination	Initial Adult Vaccination	Revaccination
Rabies	A single dose as early as 12 weeks of age, with revaccination 1 year later	A single dose with revaccination 1 year later	Required annually or every 3 years, depending on vaccine used
Feline Distemper (Panleukopenia)	As early as 6 weeks, then every 3-4 weeks until 16 weeks of age	2 doses, 3-4 weeks apart	1 dose is given a year after the last dose of initial series, then every 3 years
Feline Herpes Virus	As early as 6-8 weeks of age, then every 2-4 weeks until 16 weeks of age or older	Two doses 2-4 weeks apart are generally recommended	1 dose is given a year after the last dose of initial series, then every 3 years
Calici Virus	As early as 6 weeks, then every 3-4 weeks until 16 weeks of age Initial dose	2 doses, 3-4 weeks apart	1 dose is given a year after the last dose of the initial series, then every 3 years
Feline Leukemia Virus (FeLV)	as early as 8 weeks of age; a second dose must be administered 3-4 weeks later	Two doses, 3-4 weeks apart	A single dose 1 year following the last dose of the initial series, then not more often than every 2-3 years in cats determined to have sustained risk of exposure
***Bordetella bronchiseptica* (Intranasal)**	A single dose intranasally as early as 4 weeks of age	A single dose intranasally	Annual booster is indicated for cats with sustained risk

Vaccination Schedule for Poultry

For Layers

Age	Name of Vaccine	Route
5th-7th day	Lasota	IN/IO
14th-16th day	I.B.D.	IO/DW
20th-26th day	I.B.D. (booster)	DW
30th day	Lasota (booster)	DW
7th week	Fowl Pox	IM
9th week	Deworming	-
10th week	R2B	IM
15th week	Debeaking	DW
17th week	Lasota	-

For Broilers

Age	Name of Vaccine	Route
3rd-5th day	Lasota	IO/IN
7th-9th day	I.B.D.	IO/DW
16th-18th day	I.B.D. (booster)	DW
24th-26th day	Lasota (booster)	DW

Note: I/N – Intra Nasal; I/O: Intra Ocular; D/W: Drinking Water; I/M: Intra Muscular

Vaccination schedule may vary in different areas depending on diseases prevalence.

Section – IX
Veterinary Gynaecology and Obstetrics

Important Terminologies

Gynaecology: Branch of science, dealing with diseases and conditions of female reproductive system during non-pregnant period.

Obstetrics: Branch of science that deals with pregnancy, birth and postpartum period.

Andrology: It covers physiological and pathological aspects of male reproduction (word "Andrology" is derived from androgens).

Theriogenology: Specialized branch of Veterinary medicine concerned with animal reproduction.

Eutocia: When delivery of fetus is normal and spontaneous.

Dystocia: It means "Difficult birth".

Nulliparous: Animal has never previously parturated.

Primiparous: Producing young animal for first time or having produced only one young animal.

Multiparous: Animal has previously parturated more than once.

Monotocus: Producing a single offspring at a birth.

Polytocous: Giving birth to multiple offspring at the same time.

Puerperal Period (Involution period): Time after birth when the female animals body including uterus recovers and returns to the pre-pregnant state.

Infertility: Temporary failure of reproductive efficiency due to any abnormality e.g. endometritis, cystic ovarian disease (COD) etc.

Sterility: Absolute loss of reproductive ability in male or female e.g. bilateral hypoplasia (congenital), fallopian tube blockade, ovario-bursal adhesions.

Fertility: Ability to conceive, to carry viable fetus. With normal calving interval, calving rate, fertility are measured.

Puberty: Age and time at which generative organs become functional and reproduction may occur.

Foal heat: Mare comes into heat 10-13 days after parturition. Mating at this time may have very less chances of conception.

Freemartin: In case of freemartin, ovum contains both ovarian and testicular tissue. Freemartin is a classical example of intersex, in cattle when co-twin produced, male develop normal while female does not.

Salpingitis: Inflammation of fallopian tube.

Metritis: Inflammation of uterus, when entire thickness of uterus is involved (uterine mucosa + myometrium).

Endometritis: Uterine mucosa is involved; most common cause in open period (calving-to-conception interval).

Perimetritis: When serosa is also involved.

Parametritis: Adjacent tissue + uterus is involved in inflammatory process.

Hydroallantois: Sudden increase in allantoic fluid in allantoic cavity (placenta is affected).

Hydramnios: Too much amniotic fluid around the fetus (fetus is affected).

Superfecundation: Females ovulating two or more ova during one estrous and breeding with two or more males during same estrous and ova being fertilized by spermatozoa from each male.

Superfetation: If a pregnant female comes in estrous and is bred again and a second conception occurs in uterus already containing at least one live fetus.

Superovulation: It is hormonal treatment intended to increase the ovulation rate and number of available oocytes in the donor animal without disrupting the physiological and endocrinological process associated with oocyte maturation, ovulation, fertilization and embryonic and fetal development.

Anatomical Structures of Reproductive tract

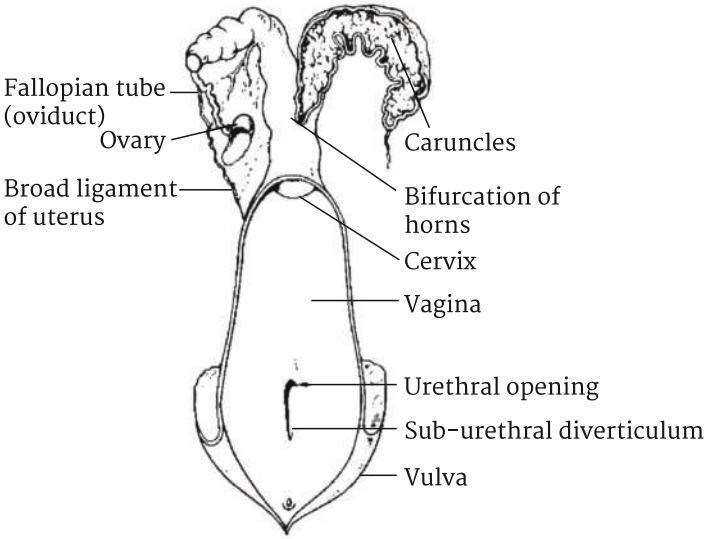
Includes vulva, vestibule, vagina, cervix, uterus, oviducts and ovaries. Except vulva, all parts are located internally beneath rectum, which allows rectal palpations of the tract to be done easily. Female reproductive tract involves further parts:

Vulva

- External part of reproductive tract.

Vestibule

- Part of reproductive tract shared with urinary system, approximately 4 inches long.
- Openings from urinary bladder and a blind sac located below opening of urethra called sub-urethral diverticulum are located on its floor. By knowing their location, Veterinarians/Artificial Insemination (AI) technicians can prevent insertion of inseminating rod into these openings, which could result in injury or insemination failure.



Reproductive Tract of Cow

Vagina

- Located between opening to bladder and cervix, approximately 8 inches long.
- Site of semen deposition during natural service.
- Serves as unrestrictive passageway for calf at time of birth.
- Acts as line of defence against invasion by bacteria. Epithelium of vagina secretes fluids, which combine with cervical fluids to inhibit growth of undesirable bacteria.

Cervix

- Lies between vagina and uterus, 4–5 inches long and 1–2 inches in diameter. It restricts access to uterus. Area around its opening actually protrudes back into vagina, which deflects inseminating rods away from cervical opening if care is not taken during insemination.
- Compared to vagina, walls of cervix are thick and dense. Three or four ridges or rings within cervix, called annular folds, can be distinguished by rectal palpation. Folds must be manipulated rectally while inseminating rod is passed through to uterus.
- Anterior cervix may serve as a site for semen deposition during Al. Whether by deposition following Al or by migration from vagina after natural service, cervix acts as a reservoir for semen and provides favourable environment for sperm survival.

- Secretions of cervix are usually thick, but these fluids thin at the time of Estrous to facilitate transfer of sperm to uterus. Some of the mucus may be seen as discharge from vulva during Estrous.
- Cervix or its fluids act as a physical barrier and protect uterus from any foreign material or bacteria during pregnancy. A thick plug forms in canal of cervix and blocks access to pregnant uterus. Accidental rupture of this plug by insertion of inseminating rod can result in abortion.

Uterus

- Consists of a 'body' and two 'horns'. It is attached to broad ligament and suspended within pelvic cavity and posterior portion of body cavity. Body of uterus is adjacent to cervix. In non-pregnant state, it extends less than 2 inches before it divides into two separate horns.
- Body of uterus is the major site of semen deposition during Al. If tip of inseminating rod is inserted too far into uterus, semen is deposited in only one of the horns. If the egg was released from ovary on other side, there is little chance that sperm and egg would unite.
- Walls are composed of several layers of muscle (endometrium, myometrium and serosa) which aid in transport of sperm to oviduct following insemination and in expulsion of calf at birth. Certain glands within walls secrete a fluid, uterine milk, which provides nutrients to developing embryo before and after its attachment to uterine wall.
- Uterus also develops maternal side of placenta to nourish and protect developing fetus. Its surface contains many specialized areas called caruncles on which cotyledons of fetal placenta interlock to provide a passageway for exchange of nutrients and waste between fetus and cow. After calving, if caruncles and cotyledons fail to unlock, placenta cannot be expelled and retained placenta results.

Oviduct

- Lie between each ovary and tip of adjacent uterine horn, approximately 10 inches long, 1/4 inch in diameter.
- Ovarian end of oviduct is funnel shaped (called infundibulum), catches the egg as it is released from ovary at ovulation and moves it to enlarged upper end of oviduct called ampulla. Fertilization occurs here within 12 hours of ovulation. After fertilization, fertilized ovum is transported to uterus within 3-4 days.
- Oviductal isthmus functions as a sperm reservoir where sperm adhere transiently to the epithelium and are released at the time of ovulation.

Ovaries

- Each ovary is approximately 1.5 inches long and 3/4 inch in diameter in dairy cow.
- Ovaries are suspended from broad ligament near end of oviduct and lie near tips of curved uterine horns.
- Function of ovaries is to produce egg or ovum and hormones involved in regulating estrous cycle and pregnancy. Only one ovum is usually released during each estrous cycle. Graffian follicle is the fluid-filled structure in ovary within which an ovum develops prior to ovulation. Size of graffian follicle going to ovulate is 1 cm.
- In bovine, ovulation can occur at any point on ovary except hilus and part of ovary, which is attached to broad ligament. In cattle, 60% ovulations occur from right ovary. In camel, ovulation can occur alternatively right and left ovary and in mare, ovulation can only occur at "ovulation fossa".

Broad Ligament

- To which, uterus, oviducts and ovaries are attached and suspended in cow's pelvic area.
- This suspension allows these organs to move freely in pelvic canal and into body cavity, providing space to accommodate growing fetus. It consists of following parts:
  - Mesosalpinx: It is attached or support the fallopian tube
  - Mesometrium: Supports uterus (especially horns and body)
  - Mesovarian: Supports ovaries
  - Inter-cornual: It is present between the horns

Fertile Life (Sperm and Oocyte)

Species	Sperm	Oocyte
Cattle	24-48 hours	12-24 hours
Sheep	24-48 hours	16-24 hours
Mare	72-120 hours	6-8 hours

Reproduction Cycle of Livestock and Companion Animals

Particulars	Cow	Buffalo	Doe	Ewe	Sow	Mare	Bitch	Queen
Age at weaning (weeks)	12-16	12-16	6-10	8-16	6-8	12-16	4-6	4-6
Age of puberty (months)	24-36	36-42	6-12	6-12	5-8	18-24	6-12	6-15
Estrous type	Polyestrous	Polyestrous	Polyestrous	Seasonal	Polyestrous	Polyestrous	Monoestrous, all year, but mostly late winter and summer	Provoked ovulation, seasonally polyestro-us, spring & early fall
Estrous length	21 days	21 days	20 days	17 days	21 days	21 days	6-7 months	15-21 days
Estrous duration	12-24 hours	12-24 hours	24-36 hours	24-36 hours	2-3 days	4-8 days	4-14 days standing heat	9-10 days in absence of male, 4-6 days if mated
Ovulation time	10-15 hours after end of estrous	10-14 hours after end of estrous	Towards end of estrous	Towards end of estrous	36 hours after onset of estrous	24-48 hours before end of estrous	between 48-60 and 72 h from the onset of estrous	induced ovulator, not occur unless mating

Particulars	Cow	Buffalo	Doe	Ewe	Sow	Mare	Bitch	Queen
Period of maximum fertility	Last 8 hours of estrous	Last 8 hours of estrous	2nd half of estrous	2nd half of estrous	12-36 hours after onset of estrous (2 services at an interval of 12-14 hours)	24 hours before end of estrous	On alternate days from day 2 to end of heat	Daily from day 2 of heat
Period of involution of uterus	25-30 days	25-35 days	15-20 days	15-20 days	15-20 days	8-10 days	3 months	5-6 days
Breeding season	Throughout year	Sept - Feb	Jun-Aug, Jan - Feb	Jun-Aug, Jan - Feb	Throughout year	Feb-Apr	Rainy and winter season	Apr-Sept
Time to breed after parturition	60-90 days	60-75 days	80-90 days	Usually the following autumn	1st estrous 3-9 days after weaning piglet	About 25-35 days of 2nd estrous	3-5 months	4-6 weeks

Estrous Cycle

Estrous cycle is rhythmic sexual behavioural pattern after puberty that is exhibited by female beginning at one estrous (heat) and ending at subsequent estrous.

Classification

Based on occurrence of estrous cycle

- **Mono-estrous:** Only one estrous cycle per year e.g. wild animals
- **Poly-estrous:** Periodic estrous cycles throughout the year e.g. cow and sow
- **Seasonally poly-estrous:** Periodic estrous cycles only during a particular season e.g. sheep and mare

Based on ovarian activity

- **Regular estrous cycle:** Characterised by ovulation and formation of corpus luteum (CL) e.g. cow, sheep, mare, bitch and sow
- **Spontaneous ovulators:** Ovulations are spontaneous but the CL formed will not be functional until mating has occurred e.g. rat or mouse

- **Induced ovulators:** Ovulation and CL formation depends on whether mating has occurred or not e.g. cat, rabbit, mink
  (Note: In most species, ovulation takes place during estrous but in cows, ovulation occurs 10 – 15 hours after the end of estrous).

Phases of Estrous Cycle

In bovine, estrous cycle can be divided into two phases depending upon dominant structure present on ovary.

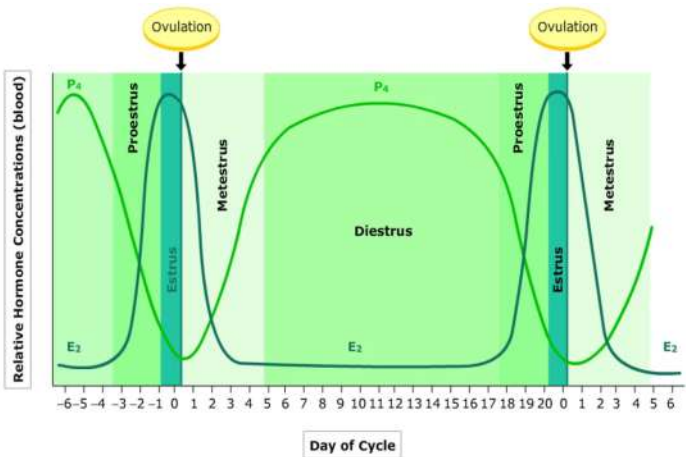
- **Follicular Phase:** Is the period from regression of CL to ovulation. The primary ovarian structure is Graafian follicle and primary reproductive hormone is estrogen.
- **Luteal Phase:** It is much longer than follicular phase and extends from ovulation to luteal regression. Predominant ovarian structure is CL and primary reproductive hormone is progesterone.

Stages of Estrous Cycle in Bovine:

Estrous cycle can be divided into four stages *viz.* proestrous, estrous, metestrous and diestrous. Each of these stages is a subdivision of follicular and luteal phases of the cycle.

Proestrous:

Characterized by significant rise in estradiol (E2) i.e. primary form of estrogen during reproductive years, which is produced by developing follicles. Proestrous begins with luteal regression and ends with onset of Estrous. Duration is 2–5 days and is characterised by a major endocrine transition, from a period of progesterone dominance to a period of estrogen dominance brought about by FSH and LH.



Estrous:

- When estradiol reaches a certain level, female exhibits estrous and then ovulates. Estrous is the period of sexual receptivity and mating. Estradiol is main reproductive hormone responsible for estrous behaviour and physiological changes in reproductive tract. Duration is 12-24 hours.

Metestrous:

- Following the ovulation, cells of follicle are transformed into luteal cells that form CL during metestrous. So, metestrous is the period from ovulation and formation of CL, which is an ill-defined phase. The cellular transformation of follicle to CL is called luteinization. Duration is 3-5 days.

Diestrous:

- Longest phase, characterized by a fully functional CL and high levels of progesterone (P_4). Duration is 10-12 days. During this period, females do not exhibit sexual receptivity.

Symptoms of Estrous in Cow

- Standing to be mounted by other cows or attempt to mount other cows
- Stringy mucous hanging from vulva and mucus smeared on buttocks
- Increased restlessness, bellowing and reduced feed intake
- Drop in milk yield
- Chin resting on cow's rump by other cows
- Tail raising
- Frequent urination
- Vulva appears edematous and hyperemic

Symptoms of Estrous in Buffalo

- Signs of estrous are not pronounced as in cattle.
- Heterosexual behaviour, particularly standing to be mounted by a bull is the most reliable sign.
- Signs such as vulval swelling, clear mucoid vulval discharge, spontaneous milk let down, bellowing, restlessness, frequent urination and raised tail vary in occurrence and intensity from animal to animal and in relation to standing estrous.

Estrous Cycle in Mare

- Normal estrous cycle in mare is 21-22 days.
- Estrous, the period when mare displays behavioural signs of sexual receptivity to stallion, lasts for 5-7 days.
- During diestrous, the luteal phase that lasts for 14-15 days, mare displays sexual rejection to stallion.

Symptoms

- Restless and irritation.
- Frequently adopts micturition posture and voids urine with repeated exposure of clitoris by prolonged rhythmic contractions (known as winking of clitoris).
- Raises tail to one side and leans her hindquarters.
- Vulva becomes large and swollen, wet, glossy and covered with transparent mucus.
- Variable amount of mucoid discharge.
- If mare is in Estrous, stallion will usually exhibit "Flehmen" .

Estrous Cycle in Sow

- Average length of the cycle is 21 days and may vary from 18-23 days.
- Estrogenic phase of the cycle is 6-7 days and luteal phase is 14 days with CL regression beginning on day 16.
- Duration of estrus is 1-4 days, with an average of 2-3 days.
- Silent heat occur in about 2% of porcine cycles.

Symptoms

- Estrous symptoms are definite and marked which include:
- Reduced appetite.
- Restless and nervous.
- Often pace back and forth by fence.
- Salivation.
- Champing of jaws.
- If suckling, sow may ignore her piglets, try to escape or if free will seek out boar and stand for service.
- Vulval lips swollen, congested and show mucous discharge.
- Mounting other animals.
- Grunting and standing motionless for long periods in a position for service is the most noticeable feature.

Estrous Cycle in Doe and Ewe

- Normal estrous cycle length in Ewe is 17 days and in doe is 21 days.
- Photoperiodism is a characteristic of reproductive cycle or sexual receptivity in sheep and goats. A reduction in daylight to about 10 or 11 hours, whether it occurs naturally or induced artificially by penning the ewes in a darkened area during part of the day, will induce onset of estrous cycle in anestrous ewes.
- Estrous lasts for 24–36 hours.
- Duration of estrous is influenced by both species, breed, age, season and the presence of male influences.

Symptoms in Doe

- Estrous symptoms are more conspicuous in does, which include
- Restless and frequent bleating (weak, wavering crying).
- Tail wagging from side to side and up and down (most reliable sign).
- Reduced appetite and decreased milk production.
- Vulva edematous and congested.
- Clear mucous discharge from vagina.
- Occasionally exhibit homosexual behaviour.

Symptoms in Ewe

- Estrous symptoms are relatively inconspicuous and is not evident in absence of ram.
- Ewes seek ram.
- Vulva edematous and congested.
- Clear mucous discharge from vagina.
- Waggles her tail and moves it laterally.

Estrous Cycle in Bitch

Bitch experience ovarian cycles twice yearly. Breeding seasons depend on both genetic and management factors. Different breeds enter their first heat between 6 and 10 months of age. Some bitches may not begin to cycle until 18 to 24 months of age. The inter-estrous interval on an average is 7 months and ranges from 3 and half months to 13 months.

Symptoms in Bitch

In Proestrous

- Bitch is playful, appears sexually attractive to male but refuses mounting attempts by moving away, baring of teeth and snapping.
- Bitch may keep her tail tight against perineum and cover vulva. This behaviour changes as proestrous progresses.
- Becomes more receptive, seeks males, playing and teasing but still refuses male by crouching or lying down.
- In late proestrous, bitch may sit or stand passively when mounted.
- Bloody discharge fades and becomes transparent to straw coloured and the vulva which is swollen and hard during proestrous, becomes small and soft as estrous approaches.

In Estrous

- Bitch may crouch and elevate perineum toward male.
- Bitch attracts males over long distances due to presence of potent pheromones.
- Vulva is soft and flaccid and vaginal discharge is often straw coloured or pink.

Length of Estrous Cycle in Domestic Animals

Species	Estrous	Metestrous (Days)	Diestrous (Days)	Proestrous (Days)
Cow	12-24 hours	3-5 days	13 days	3 days
Mare	4-8 days	3-5 days	6-10 days	3 days
Sow	2-3 days	3-4 days	9-13 days	3 days
Ewe	24-36 hours	3-5 days	7-10 days	2 days
Bitch	4-14 days	-	75-90 days	9 days

Factors Affecting Estrous Cycle

Nutrition

- Inanition or starvation caused by lack of energy or nutritional deficiency impairs or prevents secretions of gonadotropic hormones from pituitary gland thereby preventing occurrence of cycles.

Seasonal Influences and Light

- Seasonal breeding is regulated by light through the medium of eyes or hypothalamus and pituitary gland. Total daily amount of light is important in control of onset of estrous cycle. It is called as sexual photoperiodicity.
- In sheep and goat, decreased day light (during October, November) influences onset of estrous.
- In mares, increased total daily hours of light (during mid-February – March) will hasten onset of estrous cycle.

Breeding Season

- Majority of buffaloes show heat in: October, November.
- Majority of cattle show heat in: April, May.
- Bitch have two breeding seasons in year: October, November and March, April.

Temperature

- Excessive heat during summer months causes decreased thyroid activity, which directly reduces reproductive efficiency.
- In cattle under hot conditions, length of estrous cycle is increased to 25 days as compared to 20-22 days in cool weather.

Age

- In cattle and swine, young female usually has a slightly shorter length of estrous cycle than adult animals.

Systemic Diseases

- Severe chronic wasting diseases cause debility and emaciation resulting in cessation of estrous cycle.

Pathology of Uterus and Cervix

- In cattle, conditions like pyometra, foetal maceration, mummification causes persistence of corpus luteum and cessation of estrous cycle.

Endocrine Disturbances

- Endocrine disturbances leading to cystic ovaries or pituitary, ovarian and adrenal tumors affect the length of estrous cycle.

Miscellaneous Causes

- Pregnancy causes physiological cessation of estrous cycle.
- Presence of males hastens onset of estrous.

Sub Estrous/ Silent Heat/ Quiet Ovulations

Ovulations occur without behavioural manifestation of estrous. The first and second ovulation postpartum are often not precede by behavioural signs of estrous and thus are truly 'Silent heats'. In heifers, the estrous associated with first ovulation is usually silent.

Causes

- A sub threshold of hormone production or an imbalance between hormones.
- Nutritional deficiencies such as: ß carotene, Phosphorous, Copper, Cobalt etc.

Diagnosis

- Diagnosis is based on clinical history and rectal palpation of genital system.

Treatment

- If a mature CL is present, $PGF_2\alpha$ or an analogue followed by Timed Artificial Insemination (TAI) can be carried out. If a CL is at refractory stage, double injection prostaglandin (PG) regimen at 11 days interval could be used.
- Alternatively PRID or other progesterone implants could be used followed by fixed time insemination.

Abnormalities of Estrous

Species	Abnormality	Causes	Physiologic Mechanism
Cattle and Buffalo	Anestrous	Pyometra, mummification	Maintenance of CL
		Lactation	Suckling stimulus inhibits gonadotropin release
		Cystic ovaries	Deficiency of LH and/or GnRH
		Ovarian hypoplasia and Freemartinism	Failure to produce ovarian estrogens
		Nutritional and Vitamin deficiencies	Gonadotropin production by anterior pituitary

Cattle and Buffalo	Subestrous, Silent estrous	High lactation; nutritional deficiencies such as ß carotene, Phosphorous, Copper, Cobalt etc.	Hormonal imbalance (gonadotropin production by anterior pituitary)
	Nymphomania	Cystic ovaries	Endocrine imbalance
Doe and Ewe	Anestrous	Season, lactation	Effect of photoperiod on gonadotropin secretion
Sow	Anestrous	Lactation	As for cattle
Mare	Anestrous	Season, diet, ovarian hypoplasia	As for doe and ewe
	Prolonged estrous	Early in breeding season	Failure of follicle beyond 2 cm to develop that is due to inadequate endocrine stimulus
	Split estrous, silent estrous, lack of estrous	Pseudopregnancy	Early pregnancy failure with persistence of CL
		Prolonged diestrous after foaling	Persistence of CL

Methods of Estrous Detection

- Visual observation.
- Putting of yellow mark on back of animal. Colour is rubbed off when animal is jumped by other animal.
- Use of teaser bull: penis deviated.
- Chin ball: can be used on bulls, when it jumps it colours the hook of female.
- Use of close circuit cameras.
- Detection of hormones: Progesterone (P_4) concentration decreased in milk during heat. It should be < 5 ng for heat.

  (Note: P_4 concentration is also used for early pregnancy diagnosis)

Synchronization of Estrous

Causing animals to be in heat at same time. It is done by two methods;

- **Termination of functional corpus luteum:**

  By using drugs like Cloprostenol (**Pragma,** 1-2 ml IM route)

- **P_4 (progesterone) containing devices:**

  These are used which block release of gonadotropins (GnRH, FSH and LH) for 10-14 days. When progesterone is pontaneously removed, gonadotropins are released in more amount and cause ovarian rebounce. Devices such as progesterone-releasing intravaginal device (PRID) or Controlled internal drug release (CIDR). Animal comes to heat 2-3 days after removal.

Hormones of Reproduction

Hormone	Source	Functions
Gonadotropin releasing hormone (GnRH)	Hypothalamus	Regulates secretion of FSH and LH from Anterior pituitary
Follicle stimulating hormone (FSH)	Anterior pituitary	In female: Stimulates follicular growth,secretion of oestrogen In male: Stimulates testicle to secrete testosterone
Luteinizing hormone (LH)	Anterior pituitary	In female: Stimulates ovulation, formation of corpus luteum, secretion of progesterone In male: Stimulates testicle to secrete testosterone
Prolactin	Anterior pituitary	Promotes uterine contractions, secretion of progesterone
Oxytocin	Posterior pituitary	Promotes uterine contractions, stimulates milk let down, transport of sperm in female genitalia
Oestrogen	Ovary, Placenta, Adrenal cortex	Growth of reproductive tract, development of secondary sexual characters, promotes female sex behaviour, increases uterine contractions, promotes growth of mammary duct
Progesterone	Ovary (CL) Placenta, Adrenal cortex	Maintenance of pregnancy, inhibit uterine contractions, helps in implantation of zygote, promotes glandular development in endometrium, stimulates mammary alveolar growth
Relaxin	Ovary, Uterus, Placenta	Relaxation of pelvic ligament, dilatation of cervix
Prostaglandins ($PGF_2\alpha$)	Uterus (Endometrium)	Causes luteolysis, stimulates uterine contractions, induces abortion & labour
Testosterone	Testicle	In male: Development & maintenance of reproductive tract, sperm formation and sex drive

Gestation Period in Domestic and Wild Animals

Animals	Days
Cattle	279-285
Buffalo	281-334
Goat	148-156
Sheep	144-151
Horse	300-345
Pig	112-120
Dog	56-68
Cat	59-68
Camel	365-400
Rabbit	30-35
Deer	197-220
Elephant	600-660
Giraffe	420-450
Hippopotamus	225-250
Leopard	92-95
Lion	108
Tiger	105-113
Monkey	150-180

Pregnancy Diagnosis (PD)

Need

- Improving reproductive performance.
- Helps in undertaking treatment of infertile animals.
- Earlier the pregnancy diagnosis performed, more profitable is the return for dairy cows and buffaloes.
- Helps in proper care and feeding of pregnant animals.
- Monitor development of pregnancy.
- Monitor early embryonic death.
- Improve record keeping data.
- Inform decisions on individual cows.
- Essentially required for sale, registration and insurance of animals.

Methods

- Observing symptoms of pregnancy.
- Per-rectal examination of female genitalia.
- Laboratory tests.

A. Observing Symptoms of Pregnancy

- Cessation of oestrous cycle after artificial insemination (AI) or natural service.
- Sluggish, docile behaviour and glossy hair/ body coat.
- Gradual drop in milk production.
- Gradual increase in size of abdomen and body weight.
- Flanks become hollow and spine appears more prominent.
- Increase in size of udder, which begins at about 5 month of gestation in heifers, while in older cows it is usually observed just 2-4 weeks before parturition.
- Foetal movements are seen in right flank after 6th month of pregnancy.

B. Per-rectal Examination of Female Genitalia

It is the most easiest, practical and accurate method of pregnancy diagnosis. This method is performed as follows:

- Restrain the animal properly either by using trevis or rope.
- Put disposable long arm polythene hand glove and lubricate with liquid paraffin or lubitas.
- Insert lubricated hand slowly into rectum and remove dung.
- First locate cervix and then examine uterine horns and ovaries to feel specific changes that occurs at different stages of pregnancy as mentioned further:

Month wise Observations

First month

- Uterine horns are intrapelvic and both horns are symmetrical.
- Feel of uterine horns is normal.
- One of the ovary exhibits corpus luteum (CL).
- Cervix remains closed.

Second month

- Uterus is intra-pelvic and palpable from all sides.
- Uterus is tonic/ tense.
- Pregnant horn is 2-4 times enlarged (3-6 cm at 6 weeks and 6-9 cm at 8 weeks).
- Non-pregnant horn is normal.
- Slippery feel of foetal membranes when horn is palpated between fingers.
- Uterine wall is thinner than normal.
- Cervix is closed and at normal position.
- Ovaries are at normal position and one of the ovary exhibits pregnancy CL.

Third month

- Uterus hangs on brim of pelvis and is palpable from three sides.
- Uterus is tonic/ tense.
- Pregnant horn is further enlarged (size 9-12 cm).
- Non-pregnant horn enlarges to about double its normal size.
- Uterine wall becomes very thin.
- Cervix is stretched/pulled forward.
- Ovaries are pulled forward.

Fourth month

- Uterus is entirely abdominal and non-palpable from all sides.
- Uterus is felt like full-inflated ball (size 12 -18 cm).

Fifth month

- Uterus is entirely abdominal.
- Foetus and fluctuations are felt.
- Cotyledons are bigger in size (3.5 cm).
- Fremitus (++) can easily be felt.
- Cervix is stretched towards abdomen.

Sixth to seventh month

- Uterus is entirely abdominal.
- Foetus sinks more deep in abdominal cavity and it may not be easily palpable.
- Cotyledons are further enlarged (4.5 cm).
- Fremitus (+++) is strong.
- Ovaries are out of reach.

Eighth to ninth month

- Foetus comes nearer to pelvic cavity.
- Foetal parts (*viz.* head and legs) can be clearly felt.
- Fremitus (++++) is very strong.
- Size of cotyledons increases to about tennis ball size (7–8 cm).
- Foetal bumps are felt when foetus is pressed in abdominal cavity.
- Strong foetal movements are palpable.

Gestational Days and Palpable Findings of Foetal and Maternal Structures

Gestational Days	Palpable Findings
30–65 days	Palpation of amniotic vesicle
35–90 days	Asymmetry of uterine horns and fluctuation of uterine contents
35–90 days	Palpation of fetal membrane slip
65–150 days	Palpation of fetal bump
70 days to term	Palpation of cotyledons
90 days to term	Fremitus in middle uterine artery
180 days to term	Foetus and its movement

Foetal Membrane Slip Test

Time to Perform	Result
32 days	Small thread in 1 horn
45 days	Small strings in 1 horn
60 days	Strings in both horns
70 days	Large strings in both horns

C. Laboratory Tests for Pregnancy Diagnosis

1. Progesterone estimation

- It is 80 - 90% accurate; can be done as early as 18 - 23rd day.
- Done in both milk and serum/plasma by radio-immune assay (RIA).
- Levels higher than 4 ng/ml of milk and 1 ng/ml of plasma are indicative of pregnancy.

2. Barium chloride test: Accuracy of the test is described to be 70-95% from 15 to 210 days of pregnancy.

Method

- Take 5 ml of urine in test tube.
- Add 5 ml of 1% Barium chloride solution and mix well.

Interpretation

- No turbidity/ no precipitation indicates pregnancy.

3. Milk alcohol coagulation test

Method

- Take milk and mix with equal quantities of alcohol and allow to stand for 1-3 hours.
- If coagulation occurs, it indicates that the cow is pregnant.

4. Sodium hydroxide test

Method

- Take 0.25 ml of cervical mucus.
- Add 5 ml of 10% solution of NaOH.
- Heat it until boiling.

Interpretation

- Development of brownish colour: Pregnancy (80-90%).
- Pale yellow colour: Non-pregnant.

5. **Ultrasonography (USG):** It is quick, reliable and safe method for small animals.

Principle: Piezoelectric crystal when stimulated electrically emit ultrasound.

Probe placement for trans-abdominal ultrasonography

- Ultrasound frequencies used for pregnancy diagnosis: 2-12 MHz
- Types of transducers: Sector, linear, curvilinear
- Sites and types of transducers:
  - Trans-abdominal: Sector convex, curvilinear
  - Trans-vaginal: Sector
  - Trans-rectal: Linear
- Most appropriate time for pregnancy diagnosis using ultrasonography with high accuracy in cattle, mare, camel and buffaloes is 28-30 days by using a trans-rectal linear probe of 5.0-7.5 MHz frequencies.
- Bitch requires a trans-abdominal probe of frequency 3.5-5.0 MHz to visualize pregnancy with accuracy from 25-30 days.

Ultrasonographic Features of Early Pregnancy in Domestic Animals

Sonographic Structure Appearance (days post mating)	Cow	Buffalo	Mare	Doe/ Ewe	Sow	Bitch	Camel	Queen
Foetal fluid	18-20	18-22	10-16	20-25	18-20	18-20	17-18	10-16
Foetal heart beat	24	30	24-25	21-23	-	24	28-30	16-18
Foetus	28-30	20-26	20-22	25-30	25-30	-	23-25	16-20
Cotyledons/ allantoins	35-40	30-35	20-22	40-45	-	-	-	25
Foetal bones/ foetal buds	57-60	70-75	-	70	-	42-50	40	30-33
Foetal sex determination	57-60	60-70	60-70	60-90	-	-	-	38-43
Foetal movement	42-50	47-51	40-45	-	60	-	-	30-34

6. Radiographic examination: It is also useful in small animals.

- In sheep and goat, foetuses are visible by day 70 of gestation.
- In bitches, foetal skeletons are visible with high accuracy only by 6th week of pregnancy.
- Fetal skulls are visible by day 45 and entire foetal skeleton is visible by end of 7th week of gestation.
- Signs of foetal death as seen by radiography include the spalding sign (overlapping of cranial bones), gas shadows in foetal heart and stomach and tightly flexed spine (seen in foetuses died for long time).
- Foetal skeletons begin to calcify only after 6th week in sows and hence radiography should be performed only after this time for pregnancy diagnosis in sows.

7. Foetal electrocardiography:

- It is useful for diagnosis of twin, triple and quadruple pregnancies in cattle, sheep and horses.

8. Ascheim-Zondek (A-Z) test:

- It is a biological test used for detection of gonadotropic hormones.
- Only animal species that secrete sufficient quantities of gonadotrophins that can be used as a marker molecule for pregnancy diagnosis is equine.
- Equine chorionic gonadotropin (eCG) continues to be secreted from day 40 to 120 days of pregnancy.

9. Microscopic examination of vaginal mucus:

Presence of more number of large, nucleated, spherical cells in vaginal mucus smear are indicative of pregnancy.

10. Cubonis test:

It is a chemical test used for pregnancy diagnosis in mare. This test involves detection of oestrogenic hormone in urine of pregnant mares and can be performed after 150 days of conception.

Principle: Urine is hydrolysed with HCl, and benzene is added for extraction of oestrogen from hydrolysed urine.

Method

- Take 15 ml urine in a test tube and add to it 3 ml concentrated HCL.
- Heat the mixture in a water bath at boiling point for 10 minutes.
- Cool the mixture under a water tap.
- Pour the mixture into a separating funnel and add 18 ml benzol to it and shake well.

- Collect the benzol layer in another test tube and add to it 10 ml concentrated H_2So_4.
- Heat the mixture at 80-90°C for 5-10 minutes and cool

Interpretation:

- Green fluorescence: pregnant
- No colour: Non-pregnant

Pregnancy Diagnosis by Different Techniques

Species	Diagnostic Techniques	Days from Service/ AI
Cattle and Buffalo	Early pregnancy factor (EPF)	First week
	Failure to return Estrous	21-24 days
	Ultrasonography	20 days
	Progesterone	22-24 days
	Rectal palpation	35-40 days
	Estrone sulphate	72 days
Doe and Ewe	Early Pregnancy Factor (EPF)	Within 24 hours
	Failure to return Estrous	16-21 days
	Progesterone	Goat- 20 days Sheep- 17 days
	Estrone sulphate	45-50 days
Mare	Failure to return Estrous	16-21 days
	Progesterone	16-22 days
	Rectal palpation	17-25 days
	Equine chorionic gonadotrophin (eCG)	40-120 days
Bitch	Estrone sulphate	40-100 days
	Radiography	Last 20 days of gestation
	Ultrasonography	30 days
	Laparoscopy	15 days

Differential Diagnosis of Pregnancy on Per-rectal Examination

Pyometra

- Pyometra is characterised by presence of pus in uterus.
- Uterus is mostly located in pelvic cavity.
- Uterine enlargement may be unilateral or bilateral.
- Uterus is atonic, thick-walled and doughy.
- Fremitus, cotyledons and foetal bumps are absent.
- Corpus luteum is present on ovary.

Mucometra

- Characterised by accumulation of mucus in uterus.
- Uterus is usually intra-pelvic.
- Both horns are equally distended.
- Uterus is tonic and thick-walled.
- Fremitus, cotyledon and foetal bumps are absent.
- Luteal cysts are present on ovary.

Hydrometra

- Hydrometra is characterised by accumulation of watery fluid in uterus.
- Uterus is mostly located in pelvic cavity.
- Both uterine horns are enlarged.
- Uterus is thin walled and tonic.
- Fremitus, cotyledons and foetal bumps are absent.

Mummification

- It is characterised by death of foetus followed by absorption of fluids.
- History indicates long duration of pregnancy.
- Uterine horns are asymmetrical.
- Uterus is thick-walled.
- Uterine contents are hard, thick and ball like.
- Fremitus, cotyledons, foetal bumps and fluids are absent.

Maceration

- Characterised by death of foetus followed by liquefaction of soft tissues of body.
- Only bony parts of foetus are felt.
- Uterine wall is thickened and doughy.
- Fremitus, cotyledons, fluctuations and fluids are absent.

Parturition

Process of giving birth, specifically the delivery of a fully developed fetus and its membranes from the uterus.

Stages of Parturition

Stages	Action	Time Required/Species
First stage	Dilatation of cervix	3-8 hours (cattle/buffalo)
		2-6 hours (sheep/goat)
		1/2-4 hour (mare)
Second stage	Expulsion of foetus	1/2-1 hour (cattle/buffalo)
		1/2-2 hour (sheep/goat)
		10-30 min (mare)
Third stage	Expulsion of placenta	2-8 hours (cattle/ buffalo)
		2-3 hours (sheep/goat)
		1/2-3 hours (mares)

Signs of Approaching Parturition

- Relaxation of sacroschiatic ligament
- Size of vulva increased 2-4 times
- Enlargement of udder
- Opaque, yellow turbid discharge from teats
- Stringy mucous discharge from cervix (vulva)
- Anorexia and Restlessness
- Frequent sitting and standing
- Arching back
- Kicking at belly
- Sweating in flank region and below elbow before 4-6 hours

Role of Hormones in Parturition

Estrogen

- Stimulate release of $PGF_2\alpha$ from uterus
- Primes the uterus for effect of oxytocin
- Primes the cervix for effect of relaxin

$PGF_2\alpha$

- Corpus luteum (CL) lysis
- Strong uterine contraction

Relaxin

- Relaxation of cervix

Oxytocin

- Strong uterine contraction for foetal expulsion

Classification of Placenta

Based On	Types	Animals
Loss of maternal/ tissue in placental shedding	Deciduate	Cat, rabbit, mouse, women, primates and insectivores
	Non-deciduate	Cow, mare, ewe, dog and pig
Foetal membrane involved	Choriovitelline	Some marsupials
	Chorioallantoic	Cow, sheep, goat, horse, women and dog
Shape of placenta	Diffuse	Pigs, horses, camels, lemurs, whales, dolphins, kangaroos and possums
	Cotyledonary	Ruminants
	Zonary	Dog and cat
Structural layers between maternal and foetal blood	Epitheliochorial	Pig and horse
	Syndesmochorial	Ruminants
	Endotheliochorial	Dog and cat

Obstetrical Instruments and their Use

Cervix dilator: For dilation of cervix in partially dilated cases at the time of parturition.

Uterine dilator: For dilatation of uterine lumen in dystocia.

Whelping forceps: For delivering pups during dystocia.

Vaginal speculum: For examination of vaginal mucus membrane and external os of cervix for presence of any abnormal discharge, pus, trauma, laceration, adhesion, growth and other congenital defects etc. in birth canal and also for insemination or medication in small animals.

Eye hook: It may be sharp or blunt. Sharp eye hook is used in dead fetuses while blunt eye hook is used in live foetuses. Eye hook is attached to a snare and is applied at inner canthus of eye of foetus.

Cammerer's detorsion fork: Used to rotate fetus along its longitudinal axis in cases of uterine torsion.

Fetotomy wire: Is the wire used to saw foetus, hence, also named as wire saw. Aproximately 10 feet of wire is used at one time for amputation of foetal part.

Calving rope: Used for applying traction on foetal parts at the time of calving.

Farrowing forceps (ordinary type): Used for delivering fetus at parturition in sow.

Snare introducer: Used for introducing snare around different part of fetus at the time of handling dystocia.

Krey-Schottler hook: Used to apply traction when no foetal extremity is available. Always apply it on bony portion of foetal body after fixing it with a snare.

HK calf puller: Used to pull calf during dystocia.

Thygesen's fetotome: It is in two separable pieces with two barrels for the wire saw. The two parts can be separated, cleaned and boiled easily in sterilizer.

Guarded embyotome: These are used to make incisions on fetus within uterus to drain fluid or gas for reduction in size and easy delivery in ascitic, anasarca or emphysematous foetuses.

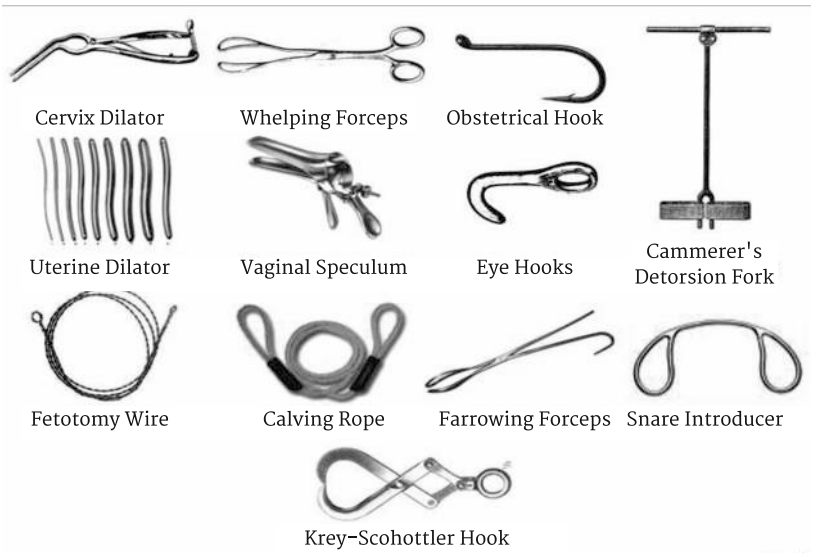
Gunther's finger knife: Used for intra-uterine embryotomy operation.

Willium's long obstetrical hook: Used for embryotomy operation. For getting hold on foetal part where hand can not reach and surface are slippery. It can be applied on head, palatine arch, spine and pelvis.

Pratt vulsellum forceps: Used for withdrawing cervix posteriorly for surgical operation and for medication by applying at os through vaginal passage.

Kuhn's crutch repeller: It is used to repel fetus in uterus to create space for easy manipulation of foetus.

Uterine scissor: Used for intrauterine surgical interventions like removal of tumours, fibrous bands, adhesions etc.



Major Reproductive Health Problems of Dairy Cattle

Disorder/ Condition	Etiology	Clinical Signs	Treatment	Prophylaxis
Dystocia: Prolonged parturition in which delivery is difficult or impossible without assistance	Maternal dystocia: Narrow birth canal, incomplete cervical dilation, uterine torsion, uterine inertia etc. Foetal dystocia: Large size of fetus, twins, abnormal position, posture or presentation of foetus	Restlessness, continuous straining, labour pain, foetal parts in vagina	Manual correction of position, posture or presentation. Withdrawal of foetus by forced traction. Inj. Epidosin for incomplete cervical dilation Inj. Oxytocin for uterine inertia. Rolling of dam for reliving torsion. Caesarean section for last choice	Breed at proper age. Provide adequate nutrition and exercise to pregnant animals Avoid long distance transportation during advance pregnancy. Avoid rolling, struggling and falling of animals
Retention of foetal membranes or ROP: Failure of expulsion of fetal membranes/ plancenta even after 12 hours of parturition	Abortion, dystocia, deficiency of hormones like oxytocin/ estrogen, Nutritional deficiency, Infections like brucellosis/vibriosis/ trichomoniasis	Undetached foetal membranes /placenta, straining, foul smelling, fever, loss of appetite	Manual removal of membranes/ placenta. **Ropitas bolus IU,** **Lenovo IU/ Cflox-TZ IU,** Inj. Ceftiofur **(Xyrofur)** @ of 1.1-2.2 mg/kg b. wt. IM for 3-5 days.	Avoid unnecessary traction at delivery. Adequate nutrition. Breed at proper age. Control of infectious diseases.

Disorder/ Condition	Etiology	Clinical Signs	Treatment	Prophylaxis
Uterine/vaginal prolapse: It is partial or complete turning inside-out of the organ, in which the inside comes to outside through lips of vulva and hangs down.	Inherited tendency, low level of progesterone, dystocia, breeding injury, ROP, straining due to diarrhoea or constipation	Protrusion of uterus, cervix or vagina beyond vulva, continuous straining, rise in body temperature. Death in severe cases	Washing of prolapsed mass with antiseptic solutions, reduction of the mass by cold fomentation, reposition of prolapsed part. Intrauterine administration of antimicrobials like Levofloxacin + Ornidazole **(Lenovo-IU)** @ 30-60 ml. Apply rope-truss. Keep animal in slanting position with hind limbs at higher level. Parenteral antibiotics in postpartum prolapse	Eliminate causes of irritation. Avoid injury or unnecessary traction at delivery. Do not apply weight to hanging placenta.

Disorder/ Condition	Etiology	Clinical Signs	Treatment	Prophylaxis
Anestrous: Absence of estrous (heat) behavior in a female, either because she is not cycling or because estrous is not detected.	Physiological stages, which does not relate to infertility: before puberty, during pregnancy, lactation & early postpartum period. Uterine pathology such as pyometra, early embryonic death, foetal resorption, maceration and mummification. Persistent CL, hormonal imbalance & nutritional deficiency	Absence of estrous, Infantile ovaries, No follicle or CL on ovary, Persistent CL, Pathological conditions of uterus	For Infantile ovaries: Ovarian massage, use of herbal drugs. For Persistent CL: Inj. Cloprostenol **(Pragma)** @ 500 mcg IM in cattle/ buffalo. Antibiotics for uterine infections. Mineral supplement	Uterine tonics after parturition. Regular mineral mixture supplement.
Repeat breeding: Animal fails to conceive from three or more regularly spaced services in absence of detectable abnormalities.	Genetic/ anatomical defects in genital track, sperm abnormalities, hormonal dysfunction. Progesterone deficiency leads to embryonic death. Nutritional deficiency. Managemental: Stress, wrong time AI, improper thawing of semen	Animal fails to conceive within 3-4 consecutive services. Regular estrous on 21 day. Prolonged estrous period. Clear/ cloudy Estrous discharge	Intrauterine therapy with **Lenovo IU or C-Flox Tz IU** in cases of unclear uterine/ vaginal discharge. Parenteral administration of antibiotics in uterine infections. Ovsynch protocol for timely AI	Observation for Estrous symptoms. Regular nutritional supplements.

Disorder/ Condition	Etiology	Clinical Signs	Treatment	Prophylaxis
Metritis: Inflammation of uterus. **Grade 1 metritis:** It is characterized an enlarge uterus and an infection with purulent discharge. **Grade 2 metritis:** Characterized by fever (>39.5°C), decreased milk yield and fetid red-brown uterine discharge. **Grade 3 metritis:** Also known as puerperal or toxic metritis and is associated with dystocia, retained placenta, twin births, and abortion	Bacteria: Brucella. Staphylococci, Streptococci Protozoa, *Trichomonas foetus.* Dystocia, ROP, abortion, delayed involution of uterus, uterine inertia, lack of exercise, injury during insemination.	Rise in body temperature, loss of appetite, suspended rumination, drop on milk yield, purulent discharge from uterus, straining. On rectal palpation, uterus feels doughy, thick walled and enlarged.	Flush the uterus with NS and Lugol's iodine to remove discharge. Give antibiotics like Ceftiofur (**Xyrofur** @ 1-2.2 mg/kg b. wt. IM for 3-5 days), Ceftriaxone+ Taxobactum (**Intacef Tazo** @ 5-10 mg/kg b. wt. for 3-5 days IM or IV) etc. Intrauterine therapy with **Lenovo IU/ C-Flox Tz IU** @ 30-60ml	Early treatment for ROP. Control of diseases like Brucellosis, Vibriosis, Trichomoniasis etc. responsible for abortion. Isolation of affected animals.

Disorder/ Condition	Etiology	Clinical Signs	Treatment	Prophylaxis
Endometritis Inflammation of endometrium	Bacterial infections	Mild purulent discharge. Repeat breeding, cloudy discharge in Estrous. Per rectal (P/R) examination reveals thick and inflamed uterus.	Parenteral and intrauterine antibiotic therapy	Avoid bacterial infections. Hygienic measures should be taken
Pyometra: Accumulation of purulent or mucopurulent material within uterine lumen, causing distension of uterus in the presence of a closed cervix and a functional CL	Bacterial infections, ROP, abortion.	Open pyometra shows purulent vaginal discharge. In closed pyometra, no vaginal discharge. Fever, anorexia. P/R reveals doughy consistency of uterus	Remove purulent materials from uterus, flush with NS and Lugol's iodine. Intrauterine therapy with **Lenovo IU** or **C-Flox Tz IU.** Inj. D-Cloprostenol **(Pragma-D)** @ 150 mcg IM in cattle/buffalo and 75 mcg IM in sheep/pig. Broad spectrum antibiotic therapy	Avoid bacterial infections. Avoid ROP by proper nutrition. Avoid abortion by proper nutrition and progesterone injection.

Cystic Ovarian Disease (COD)

There are three types of cysts on ovary;

Follicular cyst

- Follicles develop on ovary and after attaining a size of maturity (2 cm) persist on ovary for a period of 1 week or more in the absence of functional CL.
- There is complete deficiency of CL in this case.

Luteal cyst

- It is unilateral single cyst on ovary; leathery appearance due to lutinization. It is due to problem in release of LH.

Causes

- Hormonal imbalance (insufficiency in release of preovulatory LH surge).
- Stress factors
- Toxins and infections
- Secondary to uterine infection
- Exotic breeds are more prone to COD
- Nutritional stress
- Increased milk production

Treatment:

- PMSG or hCG (5,000 to 10,000 IU) or use GnRH preparations or its synthetic analog like Buserelin **(Gynarich)** @ 10-20 mcg IM/IV/SC.
- $PGF_2\alpha$ or its analog Cloprostenol **(PRAGMA)** @ 500 mcg IM or D-Cloprostenol **(PRAGMA-D)** @ 150 mcg IM.

Early Embryonic Death

- Mostly occur between 8-19 days after fertilization.

Factors

- Nutrition: Negative energy balance; excess crude protein in diet; toxins and deficiencies of calcium, phosphorus, iodine, selenium, copper, vitamin E etc.
- Cytogenic abnormalities i.e. chromosomal abnormalities.
- Immunological factors: Embryo is considered as foreign body. Abortion occur due to not developing immunosuppression.
- Unfavorable uterine environment
- Hormonal imbalance (inadequate progesterone levels)
- Improper timing of artificial insemination
- Heat stress
- Infectious diseases

Prevention for early embryonic death:

- Administrating GnRH and hCG post insemination.
- Supplementing exogenous progesterone.
- **PMSG administration:** Increases progesterone secretion and luteal function without excessive follicular development.

Uterine Torsion

Rotation of uterus on its long axis with twisting of anterior vagina. It is the complication of 1st stage of labor or early 2nd stage of labor.

Causes

- Instability of bovine uterus, which results from greater curvature of the organ being dorsal and the uterus being disposed anteriorly to its suspension of broad ligament.
- Incordination of fetal movement in which fetus try to adjust itself to its normal posture in response to myometrial contraction.
- Uterine instability (180 degree).
- Frequent sitting and standing behavior of buffalo
- Jumping of buffalo/cow

Types

1. **Right-sided torsion**

   Right ligament moves downward

2. **Left-side torsion**

   Left ligament moves downward

Treatment

Several methods can be used to correct a uterine torsion such as

- Manual detorsion or rotation of fetus and uterus per vagina
- Rolling the cow
- Use of a detorsion rod
- Caesarean section

Reproduction in Birds

Birds	Incubation Period (days)	Age at Sexual Maturity (months)	Egg Weight (g)	No. of Eggs in First Laying Year	Fertility (%)	Hatchability of Fertile Eggs (%)
Layer	21	5-6	58	300	97	90
Broiler	21	6	65	180	92	90
Turkey	28	7-8	85	90	83	84
Duck	27-28	6-7	60-65	300	95	75-80
Goose	30-33	9-12	135-215	30-70	70	70
Quail	15-16	1.5-2	10	300	90	75-85

Abortion Causing Agents in Farm Animals

Organism	Name of Organism	Time of Abortion
Cattle and Buffalo		
Bacteria	*Brucella abortus*	Third trimester
	Leptospira pomona	Third trimester
	Listeria monocytogens	Third trimester
	Compylobacter veneralis	4-7 months of pregnancy
Virus	Infectious Bovine Rhinotracheitis	At any time
	Epizootic Bovine abortion	6-8 months of pregnancy
	Bovine Viral Diarrhea	At any time
Mycotic	*Aspergillus* spp.	4-7 months of pregnancy
Sheep and Goat		
Bacteria	*Compylobacter intestinalis*	Late abortion
	Leptospira interrogans	Late abortion
	Listeria monocytogens	Late abortion
	Sheep-*Brucella ovis*	Late abortion
	Goat-*Brucella melitensis*	Late abortion
Virus	Enzootic abortion in Sheep	Early embryonic mortality and Late abortion
	Nairobi disease virus in Sheep	Late abortion
	Blue tongue virus	Late abortion

Organism	Name of Organism	Time of Abortion
Horse		
Bacteria	*Streptococcus zooepidermicus*	At any stage of pregnancy
	Salmonella abortusequi	4–11 months of pregnancy
	Leptospira pomona	7–11 months of pregnancy
	Klebsiella pneumonia	Early embryonic mortality
Virus	Equine herpes virus	8–11 months of pregnancy
	Equine viral arteritis	5–10 months of pregnancy
Mycotic	*Aspergillus* spp.	4–11 months of pregnancy

Section – X
Veterinary Surgery and Radiology

Important Terminologies

Sterilization: Complete removal of all forms of microorganisms (bacteria, viruses and spores), both vegetative and spore forms, from a surface or an object.

Disinfection: Destruction of most pathogenic micro-organisms on inanimate (non-living) objects.

Asepsis: Balance of pathogenic microbes in living tissue.

Antisepsis: Destruction of most pathogenic micro-organisms on living organism.

Anaesthesia: State of controlled, temporary loss of sensation or awareness that is induced for medical or veterinary purposes. It may include some or all of analgesia, paralysis, amnesia and unconsciousness.

Sedation: Induction of a calm, relaxed, or drowsy state, typically achieved through the administration of sedative medications.

Tranquilizers: Drugs, which cause sedation without drowsiness.

Hypnotics: Drugs that induce sleep or drowsiness, typically by depressing the central nervous system (CNS).

Analgesics: Drugs used to relieve pain without causing loss of consciousness.

Suture: A fine cord like structure used for closing wound.

Ligation: Tying of ligature (fine cord) to blood vessel or stump of tumour.

Restraint: Controlling unwanted movements of animal.

Casting: Making animal fall down in lateral recumbency and tying legs.

Inflammation: A purposeful reaction of living tissues to irritant/ injury.

Wound: Break in continuity of tissue in any part of body.

Ulcer: An open wound showing no tendency to heal.

Abscess: An abnormal cavity in tissue containing pus.

Cyst: A sac or any closed cavity containing liquid or semiliquid material.

Tumour/ Neoplasm: A mass of new tissue having no physiological use, which persists and grows independently of its surrounding structure.

Necrosis: Local death of tissue within living individual.

Gangrene: Necrosis of tissue with putrefaction by saprophytic bacteria.

Hernia: Protrusion of an organ or tissue through accidental or natural opening.

Herniorrhaphy: Suturing of hernial ring.

Hernioplasty: Repair of hernia by using a graft.

Sinus: A blind purulent tract showing no tendency to heal.

Fistula: An abnormal opening or passage between a cavity or duct and surface of body or between two cavities or two ducts.

Yoke gall: Localised acute inflammation of skin and subcutis on neck of cattle due to constant friction caused by yoke.

Fracture: Break in continuity of bone.

Dislocation: Displacement of bone from its normal position in relation to joint.

Arthritis: Inflammation of joint.

Abduction: Movement of limb in an outward direction from plane of body.

Adduction: Movement of limb towards midline of body.

Hematoma: Subcutaneous accumulation of blood.

Hemorrhage: Loss of blood from vascular system.

Epistaxis: Bleeding from nostril.

Tourniquet: An appliance used for temporary stoppage of circulation in burn injury caused by dry heat (fire, hot solid, electric current).

Scald: Injury caused by moist heat (steam).

Frost bite: Injury caused by excessive cold.

Paralysis: Loss of function of muscle.

Paraplegia: Paralysis of hind quarters.

Paresis (Palsy): Partial loss of function of muscle.

Hemiplegia: Condition in which one side of body is paralysed.

Pterygium: A fibrovascular wedge shaped growth over limbus (limbus forms the border between transparent cornea and opaque sclera, contains the pathways of aqueous humour outflow).

Dermoid: Congenital cyst like growth containing skin and hair.

Strabismus (squint): Deviation of one or both globes of eyes from normal.

Intussusception: Invagination of a part of intestine into an adjacent portion.

Volvulus: Twisting of a loop of intestine on its long axis.

Strangulation: Trapping of loop of intestine in hernia.

Cystorrhaphy: Suturing of ruptured urinary bladder.

Corneal opacity: Lack of transparency of cornea.

Cataract: Opacity of lens and or its capsule.

Glaucoma: Increased intraocular pressure.

Exopthalmus: Buldging of eyeball.

Hyphaemia: Accumulation of blood in anterior chamber of eye.

Hypopion: Accumulation of pus in anterior chamber of eye.

Entropion: Inward turning or inversion or in rolling of eyelid.

Ectropion: Outward turning or eversion or out rolling of eyelid.

Ptosis: Closure/ drooping of upper eyelid.

Blepharospasm: State of partial or complete closure of eyelid.

Blepharitis: Inflammation of eyelid.

Conjunctivitis: Inflammation of conjunctiva.

Keratitis: Inflammation of cornea.

Trichiasis: Misdirected or abnormal deviation of eyelashes.

Distichiasis: Presence of double row of eyelashes.

Pannus: Subepithelial vascularization of cornea.

Membranoplasty: Anchoring of membrane nictitans (third eyelid) to later canthus with mattress suture.

Tarsorrhaphy: Closure of eyelid with sutures.

Suture Materials

A suture is a thread used for uniting wound edges. Nylon, silk, cotton, catgut, stainless steel suture, etc., are some of the common suture materials used. The term "suture" is used for denoting a pattern of suturing also, e.g., interrupted suture, continuous suture, Lembert's suture etc.

Properties of an Ideal Suture

- Possess tensile strength corresponding to the wound where it is applied.
- Easy to handle with good knot security.
- Should be flexible and elastic to put tight knot.
- Stimulate minimal tissue reaction.
- Non-electrolytic, non-capillary, non-allergenic and non-carcinogenic.
- Does not predispose to oedematous inflammation.
- Bio-inert and passes through tissues without any friction.
- Inexpensive, easily available and easy to sterilize without alteration.

Types of Suture Materials

Absorbable Sutures	Non-Absorbable Sutures
• Catgut • Kangaroo tendon • Fascia lata • Cargile membrane • Collagen • Polyglactin 910 (Vicryl) • Polyglycolic acid (Daxon) • Polydiaxanone	• Silk • Silk worm gut • Cotton • Linen • Nylon • Horse hair • Umbilical tape • Vetafil • Stainless steel, Aluminium, Silver, Tantallum, etc. wires • Wound clips, Pin sutures • Prolene • Polypropylene

Catgut is most commonly used absorbable suture which is made up of elastic submucosa of sheep intestines. According to the degree of chromicising the following types are available.

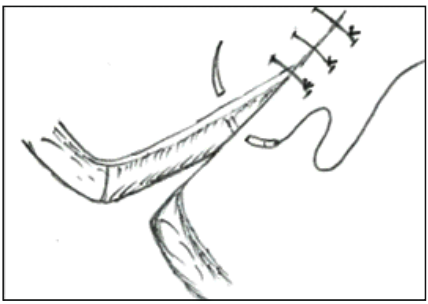
Types of Catgut

Type	Degree of chromicising	Approximate no. of days taken for absorption
Type-A	Plain	10 days
Type-B	Mild chronic	15 days
Type-C	Medium chronic	20 days
Type-D	Extra chronic	40 days

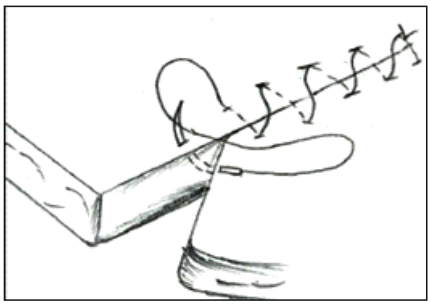
Suture Patterns

Name of Pattern	Wound Edge	Consideration	Possible Indications
Simple interrupted	Apposition	Interrupted	Skin, subcutaneous tissue, fascia, nerve, blood vessels
Intradermal/ subcuticular	Apposition	Interrupted/ continuous	Subcutaneous tissue
Cruciate/cross mattress	Apposition	Interrupted	Skin, stump of tail, digits
Horizontal mattress	Apposition/ eversion	Interrupted	Skin, subcutaneous tissue
Vertical mattress	Apposition/ eversion	Interrupted	Skin, subcutaneous tissue, fascia
Far-near-near-far	Apposition	Interrupted	Skin, subcutaneous tissue, fascia
Far-far-near-near	Apposition	Interrupted	Skin, subcutaneous tissue, fascia
Overlapping	Overlapping	Sustain maximum tension	Ventral or abdominal hernias
Simple continuous	Apposition	Continuous	Subcutaneous tissue, fascia, muscles, blood vessels
Lock stitch/ ford	Apposition	Continuous	Diaphragm, interlocking muscle layers
Lembert	Inversion	Interrupted/ continuous	Hollow organs like stomach, uterus, urinary bladder
Halstead	Inversion	Interrupted	Hollow organs like stomach, uterus, urinary bladder
Cushing	Inversion	Interrupted/ continuous	Hollow organs like stomach, uterus, urinary bladder

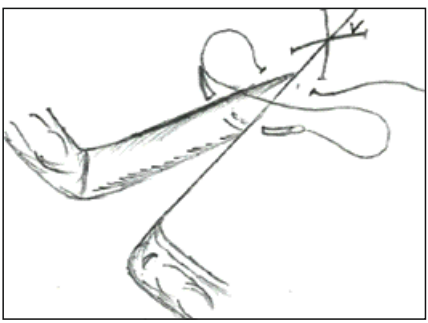
Name of Pattern	Wound Edge	Consideration	Possible Indications
Connell	Inversion	Interrupted/ continuous	Hollow organs like stomach, uterus, urinary bladder
Locking loop/ Modified Kessler	Apposition	Interrupted tendon	Tendon repair
Intraneural	Apposition	Interrupted	Nerves



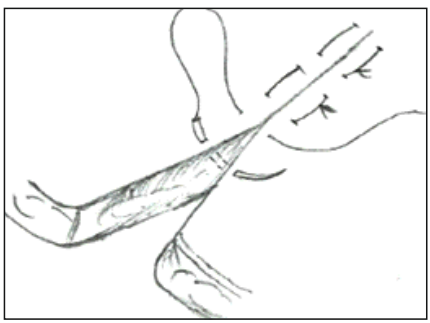
Simple interrupted suture



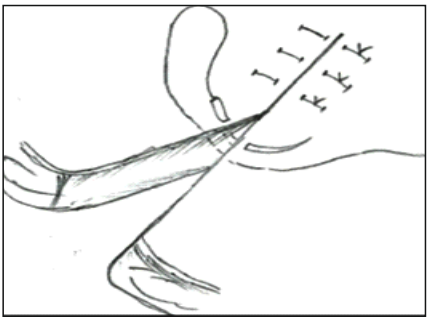
Simple continuous suture



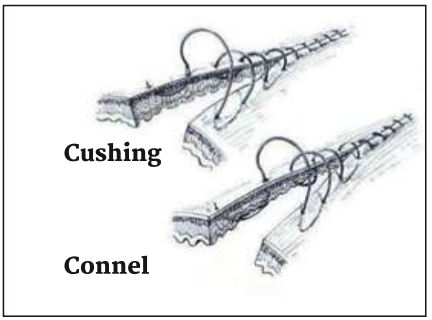
Cruciate suture



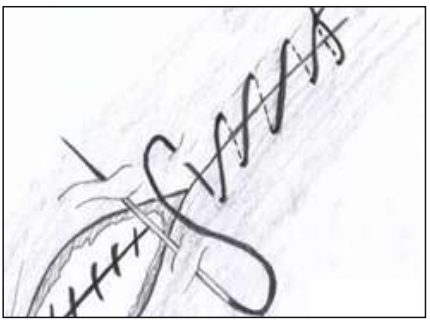
Horizontal mattress suture



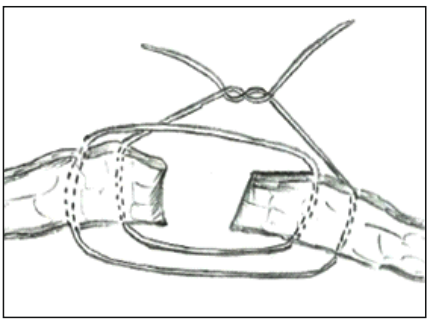
Vertical mattress suture



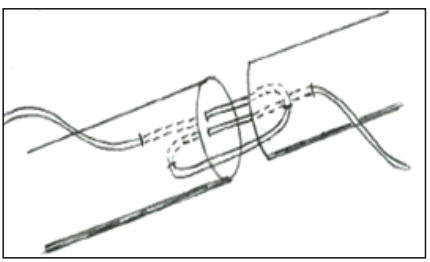
Cushing and Connel suture



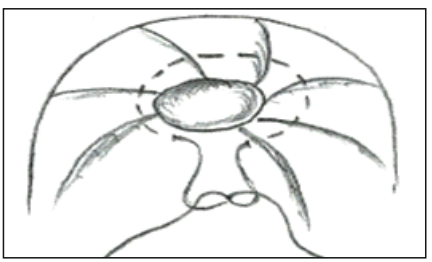
Lembert suture



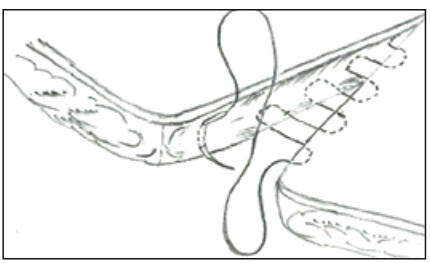
Far-Far-Near-Near suture



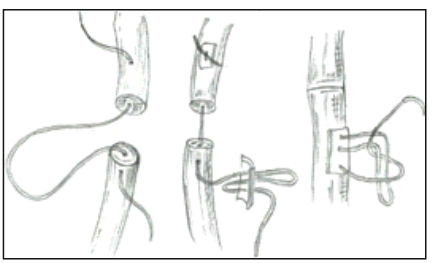
Far-Near-Near-Far suture



Purse string suture

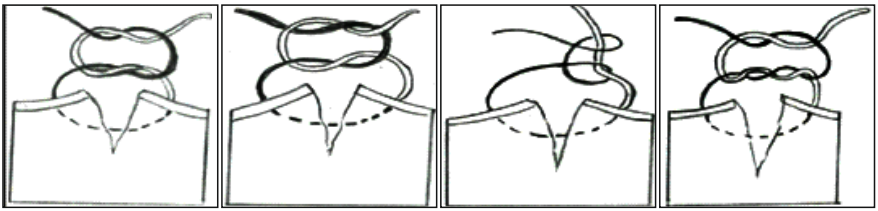


Subcutaneous suture



Intraneural suture

Knots in Suture



Square knot **Granny knot** **Half Hitch knot** **Surgeon's knot**

Wound: Any injury that disrupts the normal continuity of tissues, including skin, mucous membranes and even underlying tissues. These disruptions can be caused by external factors such as blunt force, sharp objects, burns or even internal issues like pressure necrosis. There are several types of wounds

Types of Wounds

Type	Etiology	General Management
Incised	Caused by sharp object	• Fresh or aseptic wound is cleaned and mopped to keep it dry, blood clots removed, drain placed and skin sutures applied using monofilament suture with a fine swaged needle. • Contaminated and septic wound is irrigated with normal saline solution and 1 percent tamed Povidone iodine, antiseptic solution is poured, topical debridement should be done. • Infected wound is treated as an open wound. Wound is lavaged with 0.5 % Sodium hypochlorite in small animals and 0.5 % Potassium permanganate solution in large animals. • Antiseptic dressing has to be undertaken daily. On cessation of exudation from wound, it may be dressed on alternate days. • Antibiotics and anti-inflammatory drugs should be administered wherever necessary.
Lacerated wounds	Tearing of tissue with peculiar jagged, irregular border	
Penetrating wounds	Caused by long pointed objects, may lead to communication with body cavities and deep seated infections	
Gunshot wounds	Caused by firearms, intensity depends on velocity of bullets, may lead to incised, lacerated or contused wound	
Poisoned wounds	Caused by poisons or toxins	
Bite wounds	Caused by bites of dogs, wild animals, snakes or birds	
Virulent wounds	Caused by virus or bacteria, lead to formation of pustules or vesicles	
Ulcerative wounds	Caused by surface evacuated due to slough of necrotic debris e.g., ischemic necrosis	

Type	Etiology	General Management
Erosive wounds	Necrotic areas confined only to epidermis	• Injections of multivitamins and antioxidants are given for speedy wound healing.
Punctured wounds	Caused by blunt or sharp objects, they are deep and invite anaerobes	
Abrasions	Denuded areas of skin and mucous membrane	
Contusions or bruises	No discontinuity in skin but damage to muscles, tendon, bones and nerves	

Type of Tumors

Type	Affected Organ
Benign tumour	Slow in growth, not adherent to overlying skin, usually do not ulcerate, not invade or infiltrate into surrounding tissue.
Malignant tumor	Grows rapidly and gives rise to secondary tumors in their vicinity and in other parts of body, skin is usually adherent to tumour and may ulcerate.
Connective Tissue Tumors	
Fibroma	Consists of white connective tissue fibres, usually well capsulated and easy to remove
Chondroma	Composed of cartilaginous tissue
Osteoma	Composed of bony tissue
Odontoma	Composed of tooth tissue
Epulis	Arise from bone and periosteum at alveolar border
Myoma	Composed of muscular tissue, e.g., rhabdodomyoma-affecting tongue
Myxoma	Structure resembles connective tissue and vitreous humour of eye
Neuroma	Made up of nerve cells & fibres
Glioma	Composed of neurogenic tissue
Angioma	Made up of lymphatic or blood vessels
Sarcoma	Malignant tumour involving any kind of connective tissue like bone, cartilage, fibrous tissue etc.
Lipoma	Composed of fat cells

Type	Affected Organ
Epithelial Tumors	
Papilloma	Tumor originating from epithelium of skin or mucous membranes appearing in the form of a wart-like growth from the surface.
Adenoma	Epithelial tumor with a gland like structure originating from glandular epithelium, e.g., adenoma of salivary gland.
Carcinoma	Malignant epithelial tumor, e.g., carcinoma of eye, mammary gland etc.
Endothelial Tumors	
Mesothelioma	Develops from mesothelial tissue
Perithelioma	Develops from tunica adventitia of blood vessels
Psammoma	Fibrous tumor of brain tissue
Cholesteatoma	Tumor of crystalline structure; e.g., cholesteatoma of brain
Lymphoid Tissue Tumors	
Lymphoma	Tumor made up of lymphoid tissue
Lymphosarcoma	Malignant neoplasm arising in lymphatic tissue
Teratoma	Tumor containing disorderly arranged tissues and organs, resulting from faulty embryonic differentiation and organisation
Dermoid cyst	A tumor composed of cutaneous tissues
Dentigerous cyst	A tumor containing tooth

General Management of Tumor

- **Ligation:** A tight ligature is applied at base of tumor.
- **By using ecraseur:** Useful specially for removing small pedunculated tumours situated in pharynx, vagina etc.
- **Chemical caustics:** Chemicals like Caustic potash, Arsenical paste, Nitric acid, Acetic acid etc. may be used for removal of small tumours. Salicylic acid ointment is very effective for warts.
- **Surgical excision:** Tumour is carefully dissected out from surrounding tissues under local or regional anaesthesia without damaging to surrounding tissues.
- **Treatment for warts:** Larger warts may be enucleated surgically. Use of "wart vaccine" is found useful in certain cases in bovines.
- **Cryotherapy:** Freezing of tissues causes necrosis and sloughing of tumor tissues. With the help of cryoprobe, liquid or gaseous nitrous oxide (−70°C) or liquid nitrogen (−180°C) is circulated to destroy tumours of skin, mouth and pharynx.
- **By using red-hot iron:** Tumor is clamped below its base and red-hot iron is applied distal to clamp so as to remove tumour.
- **Treatment for malignant tumors:** Treatment is useless in case of malignant tumours because of their tendency to recur.

Fracture

Break in the continuity of hard tissues as bone, cartilage, etc. It can be a complete break, a crack or a chip in the bone. Fractures can occur due to various causes, including trauma, falls or accidents.

Etiology

1. **Predisposing (Indirect) Causes**

- Fractures are common in certain bones because of their superficial position, shape, osseous structure or their function as levers during muscular movements.
- Smooth roads and slippery floors of stables and sheds.
- Diseased condition of bones like osteomalacia, osteoporosis, osteitis, necrosis of bone, caries of bone etc.
- Old age of animal.

2. **Exciting (Direct) Causes**

- External violence e.g., blows, kicks, accident, etc.
- Internal violence, excessive or incoordinate muscular action, e.g. fractures occurring in horses during galloping or jumping or due to struggling when cast for operations.

Classification

Fractures are classified in many ways as follows:

A. Fractures are broadly classified into three types, *viz.* simple, compound and complicated fractures.

1. **Simple fracture (Closed fracture):** A fracture which does not communicate with outside, i.e., there is no wound on skin leading to fracture site.
2. **Compound fracture (Open fracture):** Fracture, which is communicating with an open wound on skin. It may be primary or secondary compound fracture.

- **Primary compound fracture:** Fracture, in which wound is caused at the time of fracture either from external trauma or by protrusion of bone fragment through skin.
- **Secondary compound fracture:** When a simple fracture has later been rendered compound, it is called a secondary compound fracture.

3. **Complicated fracture:** A closed fracture in which there is considerable injury to important neighbouring vessels or nerves or is accompanied by opening of a joint or visceral cavity, e.g. complicated fracture of rib.

B. Fracture may be Incomplete or Complete

1. Incomplete fracture

It is a fracture, which does not extend through complete thickness of bone, e.g., greenstick fracture, splintered fracture, fissured fracture, sub periosteal fracture, deferred fracture, etc.

- **Greenstick fracture:** Fracture in which bone is partly broken like a bent green stick. It occurs in young animals.
- **Partial or splintered fracture:** When splinters of bone are separated from main bone as a result of direct violence as may be caused by firearms.
- **Fissured fracture:** There is a fissure (crack) extending through bone without causing any displacement of fragments. Fissures in bone may be longitudinal, transverse or oblique. Fissured fractures are seen in tibia, radius, metacarpus and os suffraginis.
- **Sub periosteal (Intraperiosteal) fracture:** fracture of cortical bone without rupture of periosteum.
- **Deferred fracture:** Is an incomplete fracture in which separation of fragments occur only after a varying period after the due to subsequent violence, strain or concussion, e.g., some cases of "broken back" in horse.

2. Complete fracture

Fracture in which bone is broken completely through its thickness. Following are examples of complete fractures:

- **Single fracture:** bone is broken in one place only.
- **Double fracture:** when there are two fractures in same bone.
- **Multiple fracture (Comminuted fracture):** bone is broken into more than two pieces.

3. Avulsion fracture

The tearing of bony prominences (like tuberosity) by forcible pull of its tendinous or muscular attachments. This kind of fracture either complete or incomplete.

C. Based on Portion of Bone Involved:

- **Diaphysary fracture:** Fracture involving diaphysis (shaft) of a long bone.
- **Epiphysary fracture (Epiphysary separation):** Fracture at junction of epiphysis and shaft of bone. It is common in young animals in whom calcification of epiphysis is incomplete, e.g., epiphysary fracture of proximal end of tibia in calves; epiphysary fracture of distal end of femur in dogs.
- **Supracondylar fracture:** Fracture above condyle, e.g., supracondylar fracture of humerus.
- **Condyloid fracture (Condylar fracture):** Fracture in which small fragments including condyle is separated from bone, e.g. condyloid fractures of humerus, femur, etc.
- **Transcondylar fracture:** Fracture of humerus or femur in which line of fracture is at level of condyles.
- **Intercondylar fracture:** Fracture between condyles of humerus. An intercondylar fracture and a transcondylar fracture may coexist, making a T-shaped fracture.
- **Pertrochanteric fracture:** Fracture of femur passing through greater trochanter.
- **Transcervical fracture:** Fracture through neck of femur.
- **Periarticular fracture:** When a bone is fractured close to its articulating extremity without extending into joint.
- **Articular fracture (Joint fracture):** Fracture involving articular surface of a bone.
- **Extracapsular fracture:** Fracture near a joint but not entering within joint capsule.
- **Intercapsular fracture:** Fracture within joint capsule.

D. Depending on Direction of Fracture:

- **Transverse fracture:** Fracture at right angles to axis of bone.
- **Longitudinal fracture:** Fracture extending in a longitudinal direction, e.g., "split pastern" in horse, wherein there is a longitudinal fracture of os suffraginis.
- **Oblique fracture:** Break in bone extending in oblique direction.
- **Spiral fracture:** Fracture, which is in spiral direction.

E. Depending on Relationship Between Fragments in Fracture:

- **Torsion fracture:** Fracture in which one of the fragments has been twisted and separated.
- **Impacted fracture:** Fracture in which one fragment is firmly driven into another or one bone is driven into the fracture site of another, e.g., head of femur being driven into a fractured acetabulum.
- **Dentate fracture:** Fracture in which ends of fragments are toothed and interlocked.
- **Riding fracture (Over-riding fracture):** A fracture in which fragments lie side by side, causing shortening of limb.
- **Distracted fracture:** Fracture in which fragments are separated by muscular pull, e.g., fracture of olecranon.

F. Fracture could be:

- **Compression fracture:** Fracture produced by compression, causing apparent reduction in size of bone due to pressure, e.g., some fractures occurring in cancellous bones like vertebrae.
- **Depressed fracture:** Fracture of skull in which a fragment is depressed below the surface.
- **Colle's fracture:** Fracture of distal end of radius. Abduction of paw is noticed in Colle's fracture.
- **Pathological fracture (Spontaneous fracture, secondary fracture)**: Fracture occurring due to weakening of bone by disease and not due to trauma.
- **Congenital (Intrauterine) fracture:** Fracture of bone of a foetus in uterus.

Anaesthesia

Anaesthesia is a medically-induced loss of consciousness with concurrent loss of protective reflexes due to anaesthetic agents. Various medications may be prescribed to induce unconsciousness, amnesia, analgesia, skeletal muscle relaxation and loss of autonomic system reflexes. During this state, patient is unarousable to verbal, tactile and painful stimuli.

Stages of anaesthesia: Depth of anaesthesia may be classified into four stages:

1. Stage I (Stage of voluntary movement or excitement)
2. Stage II (Stage of involuntary movement or excitement)
3. Stage III (Stage of Surgical anaesthesia)
   i. Plane 1 & Plane 2: Light surgical anaesthesia
   ii. Plane 3 & Plane 4: Deep surgical anaesthesia
4. Stage IV (Stage of medullary paralysis)

Stage I (Stage of Analgesia)

- Starts from beginning of anaesthetic inhalation and lasts up to loss of consciousness.
- Animal struggles to avoid inhaling strange and unpleasant anaesthetic vapours.
- There is release of adrenaline due to fear and excitement.
- Pupil is dilated.
- Sensory cortex is depressed.
- Respiration is rapid and deep, with rise in blood pressure (BP) and pulse rate.
- All sensory reflexes are present.

Stage II (Stage of Delirium)

- Starts from loss of consciousness.
- Animal lose its ability to stand, assumes lateral recumbency.
- Gradually loses consciousness and reacts to external stimuli with reflex struggling or movements of limbs (with pedal or galloping movements).
- Reflex vomition occurs in dogs unless feed is withheld.
- Nystagmus (slow rhythmic oscillation of eye ball) in horses.
- Depression extends to motor cortex.
- Respiration is very irregular, with rise in BP and pulse rate.
- All sensory reflexes are present.
- Stages I and II are collectively comprise induction of anaesthesia.

Stage III (Stage of Surgical Anaesthesia)

- It extends from onset of regular respiration to cessation of spontaneous breathing.
- Depression is extended from cortex and mid brain to spinal cord.
- This stage is divided into 4 planes:
- Planes 1 and 2: Light surgical anaesthesia
- Planes 3 and 4: Deep surgical anaesthesia

Plane 1

- Depression is extended to mid brain and spinal cord partly, with slow and regular respiration
- Normal BP and normal pulse rate.
- Presence of all neuromuscular (NM) reflexes.

Plane 2

- Depression covers all spinal cord, with slow and regular respiration, normal BP and pulse rate.
- Absence of eyelid, skin, swallowing (pharyngeal) and photomotor reflexes.
- Corneal and cough reflexes are present.
- Presence of cough reflex prevents entry of tissue debris into respiratory tract during pharyngeal surgery.
- When muscle relaxants are used as pre-anaesthetics, the level of anaesthesia is assessed by noting photomotor reflex.
- Most of the surgical operations are done in this plane.

Plane 3

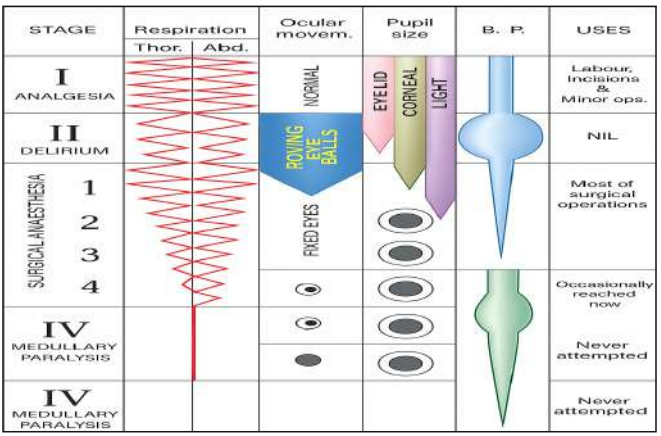
- Depression covers whole of spinal cord, with thoracic or abdominal respiration and fall in BP.
- Absence of all reflexes.
- Pupil starts dilating.

Plane 4

- Depression extends to part of medulla.
- Shallow abdominal respiration (intercostal paralysis), fall in BP and rapid and weak pulse, dilated pupil and absence of all NM reflexes.

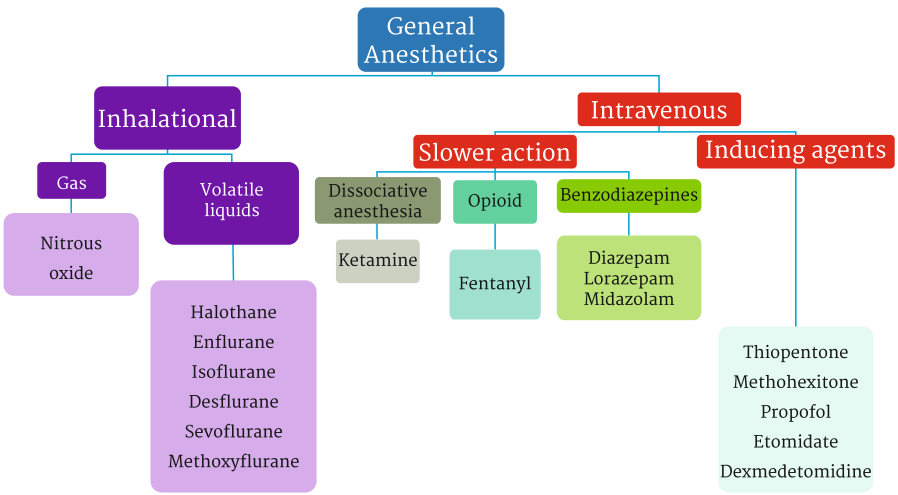
Stage IV (Stage of Medullary Paralysis)

- This stage starts from cessation of breathing and extends till cardio-vascular failure and death.
- Vital medullary centers are paralyzed, cessation of respiration, severe fall in BP, weak pulse and absence of all neuromuscular (NM) reflexes.
- Animals dies unless urgent revival measures are not readily available (artificial respiration, administration of analeptics and CV stimulants) to counter excess CNS depression.



Stages of Anaesthesia

Classification of General Anaesthetics



Surgical Conditions and their Management

Condition/Etiology	Symptoms/ Diagnosis	Treatment
Hernia Congenital weakness of muscles, trauma	• Soft reducible swelling • Evidence of ring in external hernia.	• Herniorraphy • Hernioplasty, if hernia ring is large
Fracture Trauma/Injury	• Pain, crepitus, abnormal mobility, deformity, swelling • Radiography for diagnosis	• Reduction and fixation or immobilization
Tumour Continuous irritation	• Solid, hard and painless mass, bleeding tendency • Paracentesis reveal frank blood • Biopsy for confirmation	• Anti-cancerous drug • Auto vaccine • Surgical excision
Upward luxation of patella	• Jerky flexion or dragging of affected limb • Marked lameness initially	• Patellar desmotomy
Yolk gall Rough yoke, unpaired bullock, hard working, overloading	• Acute, painful inflammatory swelling over neck • May contain exudate followed by pus (abscess) and fibrous tissue formation (induration)	• Complete rest Anti-inflammatory drugs & antibiotics • Hot fomentation & massage with Iodine ointment • Drainage of pus and radical excision for abscess and induration respectively

Condition/ Etiology	Symptoms/ Diagnosis	Treatment
Horn cancer Chronic irritation, paints, solar radiations, viruses, genetic, etc.	• Rubbing of horn on hard ground or with limb • Deviation of horn, asymmetry, increased diameter at base of horn • Separation of horn from base and cauliflower like growth is seen • Bleeding tendency • Radiography for diagnosis	• Amputation of horn • Auto vaccine and immune potentiating drugs like Inj. Levamisole @ 7.5 mg/kg SC
Traumatic reticulo-peritonitis (TRP) Ingestion of pointed metallic objects	• History of pica • Recurrent tympany, fever, stiff gait, abducted elbow, arched back • Radiography for diagnosis	• Rumenotomy
Diaphragmatic hernia (DH) Foreign body, congenital weakness of diaphragm.	• History of recent calving or advance pregnancy, chronic frothy bloat, scant pasty feces, splashing reticular sound. • Radiography for diagnosis	• Rumenotomy • Herniorraphy: Transabdominal or transthoracic approach • Hernioplasty
Atresia ani Congenital	• Absence of opening of anus, straining for defecation, distension of abdomen	• Surgical creation of anal opening at the normal site

Condition/ Etiology	Symptoms/ Diagnosis	Treatment
Aural haematoma in dogs Arises as a self-inflicted injury from scratching and head shaking.	• Accumulation of blood, either fresh or clotted, within pinna (earflap). • Pinna will appear very thick and spongy • Diagnosis by palpation or physical examination	• Under general anaesthesia, it should be drained completely, then cavity should be flushed with Povidone iodine. Closure of the cavity is accomplished by placing multiple through and through sutures using a non-absorbable suture material (nylon) in a horizontal mattress fashion (staple sutures) starting from periphery to incision line.
Venereal granuloma Virus can be transmitted through coitus	• Swelling of vagina and prepuce • Bleeding from genital passage • Cauliflower like growth in vulva/ vagina of bitch and prepuce/penis of dog	• Surgical excision • Anti-cancerous drug e.g. Vincristine @ 0.025 mg/kg IV weekly • Auto vaccine • Radiotherapy

Common Operative Techniques

1. Disbudding

Indication: Disbudding involves destroying horn-producing cells (corium) of horn bud. Horn buds are removed without opening frontal sinus. Several methods for disbudding cattle exist, but each method has its advantages and disadvantages.

Methods

i. **Hot-iron:** Commonly performed and is reliable, but is considered to be quite painful. Electrical and butane hot-iron disbudding devices are available. Excessive heat applied during hot-iron disbudding can damage underlying bone.

Method of disbudding

Procedure should take only a few seconds, skill is required and requires firm restraint of animal. Don't be too forceful, especially with goat kids. Because of their smaller size and thinner skull, they are more prone to injury from excess force or deep burns.

ii. **Cautery:** Using a scoop where nociceptors are destroyed by heat and pain perception is consequently reduced.

iii. **By Caustic materials** (e.g., Sodium hydroxide, Calcium hydroxide): Applied to horn bud can damage surrounding skin and/or eyes if runoff occurs; as long as the active chemical is in contact with tissue, damage continues.

iv. **By Calcium chloride inj.:** Injection is placed under horn bud results in necrosis of horn bud, but its administration without prior sedation and/or local anaesthesia is not recommended due to the level of discomfort induced by the procedure.

v. **Cryosurgical techniques:** Less reliable than hot-iron disbudding, require additional procedural time and induce behavioural indicators of pain and distress.

vi. **Physical:** Horn buds are removed using knives, shears or dehorning spoons, cups or tubes. To remove corium and prevent horn regrowth, a complete ring of hair surrounding horn bud should also be removed.

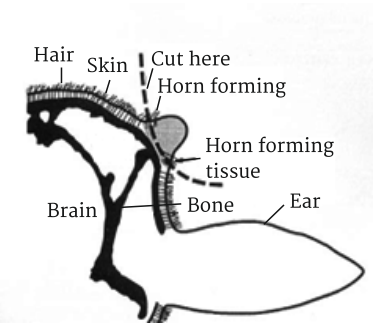
2. Dehorning

It is removal of horns after they have formed horn bud.

Indications: Horn cancer, horn fracture, for easy control and management

Methods

Physical methods of dehorning (gouge dehorning) include use of embryotomy wire, guillotine shears or dehorning knives, saws, spoons, cups or tubes.



Site of dehorning

Barnes-type scoop dehorner is commonly used for physical dehorning. Presence of corneal diverticulum's of frontal sinus causes surgical dehorning of adult cattle to be more invasive.

Site: Base of horn below coronary band (junction of skin and horn)

Nerve block: Cornual nerve block

Procedure

- Animal is restrained in standing position.
- Site is prepared aseptically and circular incision is given on junction of skin and base of horn.
- Incision is extended towards poll region on one side and exactly in opposite direction towards frontal ridge on other side.
- Skin and underlying tissues are separated to form a flap.
- Horn is cut with saw from the base.
- Bleeding is checked with artery forcep or ligature.
- Edges of flap are trimmed to bring in apposition and sutured with nylon by giving interrupted sutures.

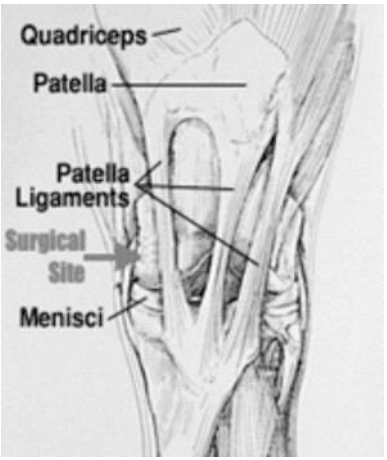
Post-operative care: Wound is cleaned with spirit or Tincture iodine and dressed with antiseptic ointment. Parenteral administration of broad-spectrum antibiotic for 5-7 days. Sutures are removed after 8-10 days or after wound healing.

Points to remember: Disbudding of calves and kids means removing very early developing horn base to prevent horn growth. It's a procedure carried out routinely for management reasons. It is good practice to disbud all calves unless they are of a naturally polled type. Horned cattle should be penned separately for transport. Disbudding should be carried out while buds are still very small, well before they become too large for a disbudding iron to fit over. For most calves, best age for disbudding is from 3 to 6 weeks of age. Goat horns often appear earlier than calf horns and they grow faster, so check kids daily from birth.

3. Medial Patella Desmotomy

Indication: Upward luxation of patella is one of the main functional disorders of stifle joint in cattle and horses. In young horses, this condition occurs mainly secondary to beginning of training and is mainly related to their straight hind limb conformation. It can be characterized by temporary or permanent dislocation of patella from its regular position during locomotion. This problem is also commonly seen in young and debilitated animals with a steep angle between femur and tibia.

Site: About 1.5-2" above anterior tuberosity of tibia close to insertion medial ligament in a depression between middle and medial ligament.



Site for medial patella desmotomy

Procedure

- It is performed in standing, sedated and locally-anesthetized animal.
- Medial patellar ligament is identified along front and inside aspect of stifle. The ligament is easily palpable in standing animal.
- Tissue adjacent to and beneath medial patellar ligament is aseptically prepared and locally anesthetized.
- Incision is made (using No. 12 scalpel blade) along medial aspect of medial patellar ligament. The incision is adjacent and parallel to the ligament.
- Medial patellar ligament is isolated using a pair of hemostats and partially exteriorized from the incision. Once capture of all ligament fibers is confirmed, the ligament is transected (in a horizontal plane).
- Incision is closed with 3-4 interrupted sutures or left open to drain.

Post-operative care: Minimal care of the incision is necessary following the procedure. Perioperative anti-inflammatory and antimicrobial therapy is recommended. Suture removal is typically performed at 2 weeks postoperatively.

4. Rumenotomy

Indication: Traumatic reticulitis, acute severe frothy bloat, non-penetrating foreign body syndrome, traumatic pericarditis, diaphragmatic hernia, vagus indigestion, oesophageal obstruction near cardia, acute urea and other toxicosis, persistent ruminal impaction.

Sites: Left paralumbar fossa:

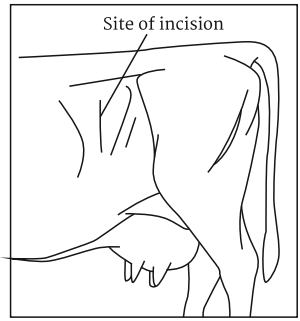
a) Vertical incision in mid flank

b) Parallel and near to the last rib in large sized animals.

Nerve Block: Paravertebral nerve block or Infiltration anaesthesia (Linear infiltration Inverted 'L' or 'T' block).

Procedure

- Rumenotomy is performed through a left para lumbar incision in standing animal.
- Abdominal muscles and parietal peritoneum are traversed by a direct incision corresponding to skin incision.
- Following systematic exploration of peritoneal cavity, it is necessary to anchor rumen to the incision to avoid contamination of abdominal musculature and peritoneum.



Site of incision for rumenotomy

- For fixing rumen following methods can be followed:
  - Continuous inversion suture pattern
  - Stay sutures
  - McIntock's rubber rumenotomy cuff
  - Weingarth's frame method
- Short incision is made on rumen and extended enough to permit easy access by hand into rumen and reticulum.
- Rumen contents are evacuated without contaminating peritoneal cavity by proper packing.
- Reticulum can also be examined by stretching hand through large rumenoreticular orifice and oesophageal groove. Sharp penetrating foreign bodies should be removed gently and small metallic materials may be retrieved by using a magnet inserted into reticulum.
- Incision site on rumen is sutured by row of continuous inversion sutures either Connel's or Cushing by using No. 2 or No.3 chromic catgut.
- A second layer of sutures may be placed with Lembert continuous suture and muscle layers are closed with mattress followed by continuous sutures.
- Skin incision is closed by vertical mattress or simple opposition sutures using nylon.

Post-operative care

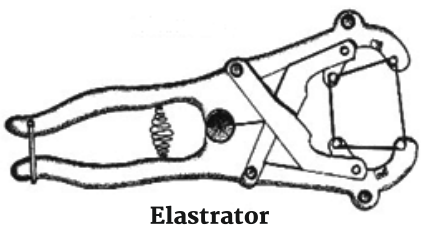
- Daily cleaning of sutured wound with spirit and dressing with antiseptic ointment.
- Parenteral administration of broad-spectrum antibiotic for 5-7 days.
- It is better to maintain animal on fluid therapy for a day or two following operation and then offer light diet preferably dry grass/ hay for next few days. Amount of feed to be given to animal should be gradually increased.
- Cud transplant is advised to improve rumen microflora.
- Anti-adhesive agents are administered by intra-peritoneal route if adhesions are observed.
- Removal of sutures after 8-10 days.

5. Castration

Indication: It is very common for young male sheep, goats and calves to be castrated, because castrated animals are usually easier to manage from age of puberty. A steer is a castrated male calf raised for beef.

Methods:

Castration may be accomplished by physical, chemical or hormonal techniques. Physical methods are most common. Young calves may be castrated with rubber rings, Burdizzo or by surgery. Surgical castration may be more appropriate for calves that are not handled until weaning.

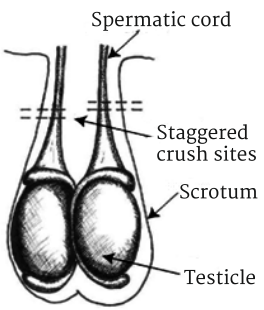


Elastrator

A. Elastic Band Castration

Elastic band castration cuts off blood supply to testicles. Equipment for banding calves is called an **elastrator.** An elastrator is the tool used to apply an elastic band to neck of scrotum. Elastic band obstructs blood flow to testicles and scrotum. In time, scrotum and testicles fall from the body.

Elastrator band is most reliable for calves less than three weeks of age. Faulty application of elastic bands results in retention of a testicle and calves with a bull-like appearance (stags). To successfully use elastic bands, operator must understand the anatomy and restrain calf properly.



Crush sites

Procedure

- Pull both testicles into scrotum. A muscle attached to each testicle will be pulled against.
- Place rubber band on the elastrator. Hold the elastrator with prongs facing up. Close the handles to open the band.
- With the calf standing and both testicles in the scrotum, stretch the ring open and slip the open band up over the scrotum.
- Release band just above the top of testicles (~0.5 cm), not at base of scrotum.
- Check to be sure both testicles are still in tip of scrotum and that the ring is placed properly. If not, cut ring with scissors and start again.

B. Burdizzo Clamps

- The burdizzo method crushes blood vessels, interrupts blood supply to testicle and thus useful castration technique. Good restraint is essential because the burdizzo must be in place about 10 seconds to crush the artery.

Burdizzo castrator

Procedure

- Choose and use proper sized burdizzo according to size of animal. With undersized equipment, there will be too much tissue between jaws and there will not be enough force to crush arteries.
- Find spermatic cord on one side of scrotum. Reach between hind legs and grasp scrotum above testicles. Pinch the cord to outside edge of scrotum between thumb and forefinger. If right handed, use left hand to hold the cord and right hand to operate burdizzo.
- Position the burdizzo correctly for crushing. One jaw of burdizzo has projections at each end to keep spermatic cord from slipping out of burdizzo. Place the jaw with projections on front side of scrotum. Point the projections toward operator.
- Close the burdizzo, wait for 10 seconds and check to be sure the spermatic cord has been held between jaws of burdizzo.
- Release burdizzo, move it to a new site 1 cm below the first site, and repeat steps four and five times. Choose a site below the first crush to minimize acute pain from a second crush.
- Repeat the procedure on opposite side. Stagger the pinched areas on left and right side of scrotum. The crush lines must not overlap the centre-line of scrotum
- Check calves four to six weeks later to be sure the testicles have shrivelled. Testicles swell initially and then degenerate and shrink in size.

Surgical Technique

Surgical castration is the most certain method of castration because testicles are removed completely. It can be performed at any age of calf. Good restraint is essential to minimize risk to calves and operators.

Anaesthesia: Local infiltration

Procedure

- Wash and clean your hands and surgical equipment using an antiseptic solution. Position yourself at the side or rear of calf and reach forward between hind legs.
- Make sure the scrotum is clean by using a mild surface disinfectant (such as Povidone iodine) to prepare the incision sites.
- Make an incision to open the skin of scrotum using method A or B after local infiltration anaesthesia.

Incision Method A

- Make incisions on outside of lower half of each side of scrotum.
- With your hands, force one testicle to bottom outside of the scrotum. Once the testicle is in proper site, hold it there and use a scalpel to make a generous incision over the testicle. The incision may extend into testicle itself.

Incision Method B

- Use one incision to remove the bottom third of scrotum. To do this, first push testicles up toward the body so that lower third of scrotum become empty.
- Grasp the tip of scrotum between your thumb and forefinger. Use a sharp scalpel to cut across the scrotum just above your thumb and finger. This cut will completely remove the tip of scrotum and testicles will fall down or can be pulled down by reaching up into the open scrotum.
- The cords are severed after ligation and the testicles are removed. The skin incision may be kept open or sutured with simple interrupted sutures.

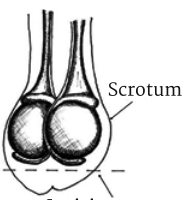
Post-operative care: Dressing with antiseptic ointment or powder till complete healing. Parenteral administration of broad spectrum antibiotics for 5-7 days.

Castration (Orchiectomy) in Dog

Indications: Prevention of breeding, malignant disease or any irreparable injury of testicles, prostatic enlargement, perineal hernia and to make dog docile.

Site: Prescrotal region or anterior to scrotum

Anaesthesia: Local infiltration in combination with sedation or general anaesthesia.



Site of incision

Procedure

- Dog is restrained in dorsal recumbency.
- One testes is pushed forward to bring it under skin over the ventral aspect of sheath.
- About 1" incision is placed over the skin above this testes and testes squeezed out by mild pressure.
- Cord is severed after ligation and the testes is removed.
- Other testes is removed in same manner through the same incision.
- Skin incision is sutured with subcuticular or simple interrupted sutures.

6. Caesarean Section

Indications: Various types of dystocia, deformities of maternal pelvis, fetal monsters, induration of cervix, foetal malposition, hydrops amnios and allantois, uterine torsion and emphysematus foetuses. Caesarean section is clearly indicated when the uterus is ruptured in order to avoid further trauma to uterus, major uterine vessels and small intestines.

Site: Different approaches are indicated in various dystocia situations. Left paralumbar or flank approach is the standard.

- Lower left abdomen oblique to milk vein (Modified Young's Approach).
- Vertical incision on lower left flank (for sow and cat).
- Lateral and parallel to milk vein (ruminant).
- Ventral abdomen midline 1" behind the umbilicus (Dog).

Anaesthesia:

- Local infiltration for ruminants.
- General anaesthesia for dog and cat.

Surgical technique

- Flank approach, incision is usually made more ventral in flank.
- Ventral paramedian approach, incision is midway between midline and subcutaneous abdominal vein and extends from umbilicus caudal to mammary gland. Following entrance into peritoneal cavity, surgeon manipulates a portion of uterine horn containing foetus and attempts to exteriorize an area for hysterotomy. Uterine incision is usually made over a limb, but in certain malpositions, area over head may be incised.
- Such exteriorization would not be possible with a swollen, emphysematous foetus. In these cases, the need for a ventral approach in which uterus can be apposed more closely to incision is obvious. Incision needs to be long enough to allow removal of foetus without further tearing or extending uterine incision. An attempt should also be made to avoid incising caruncles. Foetus is then removed to retain the uterus so that foetal fluids do not fall back into the peritoneal cavity.

Flank approach

- Clip, scrub and disinfect entire paralumbar fossa (last rib to hip); use of sterile drapes is optional (often difficult to use practically in standing patient).
- Make a 30-35 cm vertical incision in middle or caudal third of left paralumbar fossa.
- Dissect at one point to penetrate the peritoneum (obvious influx of air into the abdominal cavity) before extending the incision ventrally and dorsally; take care not to incise rumen wall.
- Insert hand into abdomen, pushing rumen forward and make a rapid assessment of foetal position and condition of uterine wall.
- Bring a greater curvature of gravid horn towards abdominal incision by gently but firmly lifting the foetus within uterus; this is easier if pregnancy is in left horn, grasp uterine wall over protruding part of foetus (e.g. limb, hock in anterior presentation) and exteriorise greater curvature of gravid horn; if dorsum of foetus is towards the incision, uterus should be rotated within the abdomen.
- Grasp a foetal leg just below hock through uterine wall and maintain firmly in a flank incision; grasp fore limb below carpus if foetus is in a posterior presentation. Incise uterine wall along greater curvature adjacent to limb and towards tip of horn with scissors or a finger embryotomy (fetotomy) knife starting at hock and extending towards digits (or begin at carpus in fore limb, if in a posterior presentation).
- Avoid incising maternal caruncles.
- Manually dissect through foetal membranes to fully exteriorise foot; foetal fluids will begin to drain externally.
- Permit umbilical cord to rupture naturally during extraction and after delivery, hold uterine incision in flank wound; manually remove any loose protruding portions of placenta.
- Close uterus with continuous Cushing suture, followed by continuous Lambert or modified Cushing (Utrecht uterine suture with buried knots) using chromic catgut No. 1 or 0 (zero).
- Sutures should incorporate serosa and muscularis, but not perforate mucosa (risk of contamination); suture knots should be buried suture of the uterine wall (with all portions of suture, including starting and finishing knots buried): start at the caudal ventral commissure of the wound if a single layer closure is intended or cranially if two layers are to be inserted.

Post-operative Care: Parenteral administration of broad-spectrum antibiotics daily for 7-8 days. Regular dressing of wound and care is taken to prevent it's soiling. Administration of fluid therapy and multivitamins.

7. Enucleation of Eyeball

Enucleation in cattle refers to the surgical removal of the eyeball (globe), while exenteration involves removing the entire orbital contents, including the eyeball, muscles, nerves, and other tissues. Enucleation is primarily indicated for irreparable ocular trauma, septic panophthalmitis, or neoplasia like squamous cell carcinoma (SCC).

Indication: Extensive inflammation or trauma to adnexa of eye, orbit or globe, painful glaucomatous eyes, extensive ocular tumours or congenital defects that result in exposure damage.

Site: Between eyeball and orbital rim through skin of both eyelids about 0.5 cm apart from palpebral border.

Anaesthesia: Premedication with Diazepam and then supraorbital, retro bulbar and auriculopalpebral nerve blocks.

Methods: The two types of enucleation commonly used are subconjunctival or trans-palpebral ablation techniques. In large animal surgery, the trans-palpebral technique is recommended.

Evisceration

Evisceration is the removal of contents of the globe, leaving cornea, sclera, extra ocular muscles and adnexal structures in place. This is done before placing a silicon cosmetic prosthesis into corneoscleral shell.

Exenteration

Exenteration means the globe and as much of the ocular contents as possible are removed. For exenteration surgery, dissection is done outside the extra ocular eye muscles and conjunctiva, all of which are removed with the globe.

Procedure of Enucleation of Eyeball

- Animal is restrained in lateral recumbency.
- Upper and lower eyelids are sutured together with 3-4 interrupted sutures leaving the suture ends at least 4-5" long for grasping and applying traction during the operative procedure.
- A skin incision either elliptical or encircling the eyelids is made.
- This incision is extended and undermined between the orbital rim and ball by blunt dissection taking care that conjunctival sac is not punctured.
- Eyeball is made free from orbital rim attachments by careful dissection.
- Haemorrhage is controlled either by pressure with forceps or ligation.
- The stump containing optic nerve and associated vessels is clamped, ligated and cut.

- The cavity is temporarily packed with gauge either plain or impregnated with tincture iodine or Ferric perchloride to check bleeding.
- Then temporary pack and blood clots are removed and a bandage soaked in tincture iodine or any other antiseptic solution is kept.
- Skin edges are sutured with simple interrupted or horizontal mattres sutures by using nylon. A small gap at medial canthus is left for removal of gauge and drainage of discharge.

Post-operative care: After operation, pressure bandage should be tied and kept for at least 24 hours. Daily removal of gauge and dressing of orbital cavity with tincture iodine till the discharge ceases, followed by dressing with antiseptic ointment or powder till complete healing. Parenteral administration of broad-spectrum antibiotics for 5-7 days.

8. Tracheotomy

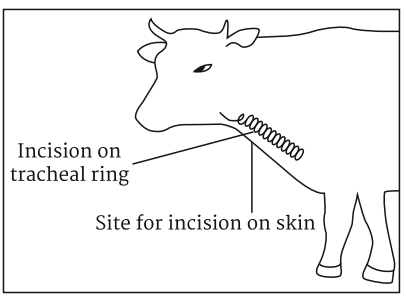
Indication: Upper respiratory tract obstructions (e.g. Hemorrhagic septicaemia).

Site: Ventral midline at junction between upper and middle one third of neck region. (4th to 6th tracheal ring is preferred).

Anaesthesia: Local infiltration anaesthesia.

Procedure

- Animal is restrained either in standing or in lateral recumbency.
- A 2-3" long incision is made on the skin and muscle.
- After retracting apart sterno-hyoideus muscle, a semi-circular incision is made between two adjacent tracheal rings, leaving half portion of ring intact.
- A tracheotomy tube is inserted in the tracheal lumen through this incision.



Site of incision for tracheotomy

- Any sterilised plastic, rubber or metal tube of half inches diameter may serve the purpose in an emergency.
- The available tube is then fixed to sides of skin by sutures.
- Surgical wound is closed in routine manner keeping the tube intact.

Post-operative care: Daily cleaning of tracheotomy tube for patency and antisepsis. Removal of tube after reduction of swelling and airway obstruction. One or two interrupted sutures are placed to close the gap in skin after removal of tube.

9. Cervical Oesophagotomy

Indications: Oesophageal obstruction (cervical choke), neoplasm in oesophagus, stricture or stenosis of oesophagus, oesophageal diverticulum.

Site: At the level of obstruction or neoplasm in oesophagus or junction of middle and distal 1/3rd part of cervical oesophagus in jugular furrow.

Anaesthesia: Local infiltration alone or in combination with sedation.

Procedure

- Animal is restrained in right lateral recumbency.
- After preparation of site, a 4-5" longitudinal incision is made through skin and subcutaneous tissue.
- Then muscle is incised and oesophagus is located and exteriorized.
- Oesophagus is incised either proximal or distal to the obstruction on healthy part. If oesophagus appears normal then incision is given on the site of obstruction itself. The length of incision should be large enough to remove the obstruction.
- After removal of obstruction, oesophageal incision is sutured with either Cushing and Leambert sutures or simple continuous sutures by using chromic catgut No. 1-0.
- Muscle is sutured with catgut No 1 by continuous lockstitch suture.
- Skin is sutured with nylon by simple interrupted sutures.

Post-operative care: Animal should be maintained on fluid for first 2-3 days, semisolid or liquid diet for next 2-3 days followed by green and dry fodder. Daily cleaning of sutured wound with spirit and dressing with antiseptic ointment. Parenteral administration of antibiotic for 5-7 days. Removal of sutures after 8-10 days.

10. Tail Amputation

Indication: Tail gangrene, irreparable injuries, malignant tumours.

Site: Above the site of injury/affection.

Anaesthesia: Caudal epidural nerve block.

Procedure

- Animal is restrained either in standing or in lateral recumbency.
- A tourniquet is applied at the base of tail to check bleeding.
- A "V" shaped incision is made on dorsal and ventral surface of tail distal to the coccygeal joint to be disarticulated.
- Both dorsal and ventral are seperated.
- Two lateral veins and mid-coccygeal artery on ventral side are ligated.
- Then tail is cut through intervertebral space.
- The tourniquet is loosened and bleeding is checked.
- Skin flaps are sutured by simple interrupted or horizontal mattress sutures.

Post-operative care: Daily dressing of wound with antiseptic ointment and parenteral administration of antibiotics.

11. Urethrotomy in Bovines

Indications: Urethral calculi.

Sites

- **Post-scrotal site:** About 3" behind scrotum directly on midline over urethra.
- **Ischial site:** About 2" below ischial arch downwards on midline.

Anaesthesia: Local infiltration

Procedure

Post-scrotal Urethrotomy

- Animal is secured in lateral recumbency.
- After preparation of site, about 4-5" long incision is made along the midline on skin and muscles.
- Sigmoid flexure is pulled out and is made straight.
- Urethra is palpated with finger to locate the calculi.
- The calculi is removed by taking incision over urethra.
- A polyethylene catheter is taken and its one end is passed towards bladder and other end towards tip of penis for clearing the passage of urethra.
- The catheter is kept in urethra for drainage of urine from bladder.

- Urethral incision is sutured with chromic catgut No. 3-0 by simple continuous sutures.
- Muscle layer is sutured with catgut by continuous lockstitch sutures.
- Skin is sutured with nylon by simple interrupted sutures.

Ischial Urethrotomy

- Animal is restrained in standing position.
- About 2-3" long incision is made along the midline on skin and muscle.
- Rest of the procedure is similar to post-scrotal urethrotomy.

Post-operative care: Daily cleaning of catheter and observation for free passage of urine through the catheter, removal of catheter after 5-6 days, parenteral administration of broad spectrum antibiotics for 5-7 days and remove sutures after 8-10 days or complete wound healing.

12. Urethrotomy in Dog

Site: At the site of obstruction (most common site of obstruction is at base of os-penis.)

Anaesthesia: Epidural or local infiltration or general anaesthesia.

Procedure

- A catheter is passed through urethral opening to locate site of obstruction.
- Glans penis is fully exposed and held in position and incision is made on midventral line of penis at the level of obstruction.
- Calculi are grasped and removed.
- The catheter is passed through the urethral opening to make sure that urethra is clear upto bladder.
- Either suture the urethra or leave it unsutured. The glans penis is then repositioned in sheath.

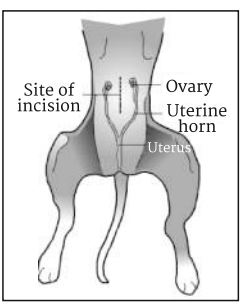
Post-operative care: Daily dressing of wound with antiseptic ointment. Parenteral administration of antibiotics for atleast 5-7 days. Sutures are removed after 8-10 days of operation or complete healing

13. Ovariohysterectomy or Spaying in Bitch

Indications: To avoid breeding/ for sterilization of bitch, chronic endometritis or pyometra and neoplasia of genital tract.

Site: Midline approach: Ventral midline abdominal incision about 2" posterior to umbilicus. Flank approach: Oblique incision in right mid flank.

Anaesthesia: General anaesthesia in healthy bitches and local infiltration anaesthesia in debilitated or toxaemic bitches.



Site of incision in spaying

Procedure

- Bitch is restrained in dorsal recumbency on operation table, which is slightly tilted towards front side.
- About 1-2" long incision is made on midline 2" posterior to umbilicus.
- Incision is extended deep up to peritoneum.
- Left uterine horn is grasped with thumb forcep and followed up to the ovary.
- Anterior ovarian ligament is cut and the anterior utero-ovarian vessels are ligated.
- Ovarian bursa is cut and ovary is disconnected from its anterior attachment.
- Right ovary is then removed in same manner.
- Then posterior uterine arteries are ligated and cut in level with the cervix.
- Broad ligament of uterus is torn to liberate the horn of uterus.
- Three artery forceps and ligatures are applied anterior to cervix and uterus is disconnected.
- Abdominal incision is closed in routine manner.

Post-operative care: Parenteral administration of broad-spectrum antibiotics daily for 7-8 days. Regular dressing of wound with antiseptic ointment. Sutures are removed after 8-10 days of operation or complete healing.

Nerve Blocks in Animals

Name of Nerve Block	Animals	Site	Indications
Maxillary Nerve Block	Dog, Cat	Upper site: 2-4 cm below external canthus of eye Lower site: Infraorbital foramen reached through the gum, above the level of third upper cheek tooth	To desensitize teeth, gum and alveoli of upper jaw.
Mental Nerve Block	Dog, Cat	Mental foramen on the lateral aspect of the horizontal ramus	To desensitization of lower lip, teeth, lower gum and alveoli of lower jaw.
Infraorbital Nerve block	Cattle, Buffalo, Horse, Dogs	Infraorbital foramen from where infraorbital nerve emerges rostral to facial tuberosity and dorsal to the first molar tooth	For repair of nasal lacerations. Surgeries of upper lips, nostrils, incisors and gums.
Supraorbital Nerve block	Cattle, Buffalo, Horse, Dogs	Supraorbital foramina behind supraorbital process	To develop analgesia of upper eyelid.
Corneal Nerve block	Cattle, Young calves	Point midway between the base of the horn and lateral canthus of eye or 2.5-3 cm below the base of horn	For amputation of horn in horn cancer, fracture of horn. disbudding of young calves.
Retrobulbar nerve block	Cattle, Horses	Depression where the supraorbital process meets the zygomatic arch	For enucleation of the eye, surgery with a squamous cell carcinoma of the cornea.
Pudic nerve block	Bull	Ischeo-rectal fossa of either site	To expose the penis.
Auriculo palpebral nerve block	Cattle	About midway between the lateral canthus of the eye and the base of the ear, just dorsal to the dorsal border of the zygomatic arch.	Motor paralysis of eye lids.

Radiology

Radiography: An imaging technique using X-rays, gamma rays or similar ionizing radiation and non-ionizing radiation to view the internal form of an object.

Radiograph: an image produced on a sensitive plate or film by X-rays, gamma rays or similar radiation and typically used in medical examination.

X-rays: are a form of electromagnetic radiation with high energy, very short wavelength having no charge or mass and travel at the speed of light through space as a combination of electric and magnetic field.

- As diagnostic aid for survey radiography and to detect previously unrecognized lesions.
- Diagnosis of fractures and bone abnormalities.
- Monitoring treatment progress.
- Assessment of soft tissue abnormalities.
- Pre-surgical evaluation.
- To screen the normal animals for morphological evaluation.

Ultrasonography (USG): A type of medical imaging that uses high-frequency sound (ultrasound) waves to produce images of internal organs and other tissues. It is widely used for diagnosing conditions, monitoring fetal development in pregnant animals.

- To imaging soft tissues like muscles, ligaments, tendons and organs such as the liver, kidneys and spleen.
- Plays a significant role in oncology by accurately detecting and characterizing tumours in various parts of the body.
- Provides detailed images of abdominal and pelvic organs.

Computed Tomography (CT) Scan: It is medical imaging procedure that uses X-rays and computer technology to create detailed cross-sectional images of the body. It provides clear, three-dimensional views of bones, organs and soft tissues, aiding in the diagnosis and treatment planning of various medical conditions.

- It construct a detailed 3 D image of part to be examine.
- To examine soft tissues, blood vessels, organs such as brain, abdomen and bones.
- Provide valuable data on the animal's vascular condition.
- To detection of very small changes tissue type.

Magnetic Resonance Imaging (MRI): It is a medical imaging technique that uses strong magnetic fields and radio waves. It produces high-resolution images that help diagnose a wide range of medical conditions, including neurological disorders, musculoskeletal injuries, tumours and vascular diseases.

- MRI can image in any plane.
- MRI can image abdominal organs (e.g., gastrointestinal tract, adrenal glands) and thoracic structures (e.g., heart, lungs) with excellent resolution.
- MRI images aid Veterinarians in pre-operative planning by providing detailed anatomical information.

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- More than 19,000 employees across the Globe.
- Presence in more than 90 countries worldwide- US, Europe, UK, Canada, Australia, New Zealand, Asia, South Africa, Latin America, Russia, MENA and CIS Countries.
- Strong presence in domestic specialty therapy segments and own marketing set-up in S.E. Asia, Latin America, Africa, Europe, Australia, New Zealand and Canada.
- Intas Animal Health is amongst the Top 3 Animal Health Companies in India.
- Tie-up with Global Animal Healthcare Companies for Indian and Overseas markets.
- Focusing on prime quality products, new technologies and customer convenience.
- Developed meaningful linkages between Veterinary professionals and Research communities *via* - Intas Polivet and Round table conferences.
- Knowledge sharing drive aimed to equip and update Veterinarians with the latest trends in clinical practice and diagnosis *via* Avipod, Confluence, Did You Know (DYK) series, Face2Vet, Petpod, Specare, V-Connect, V-Voice and WebVet.
- Educating the livestock farmers for improving animal productivity *via* Anmol Bandhan and World Milk Day.
- Honoured with IDMA Quality Excellence Awards (1998); Animal Pharm Global Excellence Award-CSR Category (2007); Quality Assurance Gold Award to Intas Biopharma (2010); Asia Pacific Company of the Year Award (2015, 2018), Company of the Year, EMEA Award (2016), Biosimilar Initiative Award (2018), EOY Award (2018), Express Pharma Excellence Award (2001, 2019) and Regulatory Initiative Award (2020).

INTAS
ANIMAL HEALTH

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ANISTAMIN

Composition :	Indications :	Dosage:	Presentation :
Each ml contains: Chlorpheniramine maleate 10 mg	Allergy, Anaphylactic Shock, Dermatitis, Itching, Rhinitis, Liminitis, Pruritus and Urticaria	Large animal: 5-10 ml, Small animal: 1-2 ml, Dog: 0.5-1ml. IM route	100 ml vial

BACTIVON

Composition :	Indications :	Dosage :	Presentation :
Each 50 mg pack contains **Vial A** Cefquinome Sulphate equivalent to Cefquinome…50 mg **Vial B** (Solvent 1.5 ml) Each ml containing Sodium bicarbonate 16 mg Water for Injections q.s. **Each 300 mg pack contains** **Vial A** Cefquinome Sulphate equivalent to Cefquinome...300 mg **Vial B** (Solvent 9 ml) Each ml containing Sodium bicarbonate 16 mg Water for Injections q.s. **Each 500mg pack contains** **Vial A** Cefquinome Sulphate equivalent to Cefquinome…500 mg **Vial B** (Solvent 15 ml) Each ml containing Sodium bicarbonate…16 mg Water for Injections q.s.	Respiratory diseases: Haemorrhagic Septicemia, Pneumonia, *Streptococcus equi* and *S. zooepidemicus* infections in equines Bacterial Septicemia Mastitis Digital dermatitis, infectious bulbar necrosis and acute interdigital necrobacillosis Calf Scours and Bacterial diarrhoea Gastro intestinal infections Mastitis Metritis- Agalactia Syndrome (MMA) in pigs Meningitis, Arthritis and Epidermitis	Cattle, Buffalo and Horses- 1 mg/kg. b.wt. Sheep, Goat and Pig- 2 mg/kg. b.wt. daily for 3-5 days IM or IV route	Available in 50 mg, 300 mg and 500 mg vials in a combi pack along with sterile solvent, disposable syringe and needle

BACTIVON Tazo

Composition :	Indications :	Dosage:	Presentation :
Vial A Each 562.5 mg vial contains: Cefquinome 500 mg Tazobactam 62.5 mg Vial B (Solvent 15 ml) Each ml contains: Sodium Bicarbonate : 16 mg Water for Injection: q. s.	Cattle and Buffalo: H.S., Pneumonia, Mastitis, Digital Dermatitis, Infectious Bulbar Necrosis, Acute Interdigital Necrobacillosis, Calf Scours, Bacterial Diarrhoea and Bacterial Septicemia Sheep and Goat: Bacterial Septicaemia, Pneumonia and Respiratory Infections, Gastrointestinal Infections Pigs: Mastitis, Metritis and Agalactia syndrome (MMA), Respiratory Diseases, Mastitis, Meningitis, Arthritis and Epidermitis Horses: Respiratory diseases caused by Streptococcus equi spp. and S. zooepidermicus, Bacterial Septicaemia and Foal Diarrhoea	Cattle, Buffalo and Horses: 1 mg/kg b. wt. Sheep, Goat and Pig: 2 mg/kg b. wt. Dog and Cat: 2 mg/kg b. wt. Daily for 3-5 days depending on the severity of infection by IM/IV route	562.5 mg vial in combi-packs with solvent, disposable sterile syringe and needle

Cflox POWER

Composition :	Indications :	Dosage :	Presentation :
Each ml contains: Ciprofloxacin 100 mg	Acute infections like HS, Pneumonia, CCPP, CBPP, Mastitis, Metritis, Pyometra and Repeat breeding problem	15 ml/ 300 kg b.wt. daily for 3-5 days. IM or IV route	50 ml vial

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Cflox-Tz Bolus

Composition :	Indications :	Dosage :	Presentation :
Each bolus contains: Ciprofloxacin 1500 mg Tinidazole 1800 mg	Diarrhoea associated with Salmonellosis, Johne's disease, Clostridial infection, Enteritis, Giardiasis, Severe infection with Proteus & Pseudomonas and viral infection (to prevent Secondary bacterial infection)	1 bolus/ 300 kg b.wt. for 3-5 days Orally	Strip of 2 boli Box of 25 strips

Cflox-Tz Tablets

Composition :	Indications :	Dosage :	Presentation :
Each tablet contains: Ciprofloxacin 250 mg Tinidazole 300 mg	Diarrhoea associated with Salmonellosis, Johne's disease, Clostridial infection, Enteritis, Giardiasis, Severe infection with Proteus & Pseudomonas and viral infection (To prevent Secondary bacterial infection)	Sheep, Goat & Calf : 1 tablet / 15-25 kg b.wt. for 3-5 days Orally	Strip of 10 tablets Box of 25 strips

CHRCOL Suspension

Composition :	Indications :	Dosage :	Presentation :
Each ml contains: Activated Charcoal: 300 mg	Beneficial in recovery from Poisoning due to Unknown poison/toxin, farm toxins, Chemicals, Contaminated Food due to Mycotoxins/Bacterial toxins. Toxin-induced Tympany Toxin-induced Diarrhea Gastrointestinal Decontaminant (periodical detoxification)	Cow, Buffalo, Camel and Horse: 0.5–1 ml/ kg. b.wt. or 500 ml Calf, Sheep, Goat and Pig: 1-2 ml/ kg. b.wt. Dog and Cat: 2-3 ml/ kg. b. wt. Orally	Available in 500 ml bottle

CHRCOL Bolus

Composition :	Indications :	Dosage :	Presentation :
Each bolus contains: Activated Charcoal 8 gm	Beneficial in recovery from Poisoning due to unknown poison/toxin, farm toxins, Chemicals, Contaminated Food due to Mycotoxins/Bacterial toxins Toxin-induced Tympany Toxin-induced Diarrhea Gastrointestinal Decontaminant (periodical detoxification)	Cow, Buffalo, Camel and Horse: One bolus for 25-50 kg. b. wt. (10 boli as a single dose) Calf, Sheep, Goat and Pig: One bolus for 15-25 kg. b.wt. Dog and Cat: One bolus for 10-15 kg. b. wt. Orally	Available in strip of 1 bolus and box of 10 strips

D'Mag SPRAY

Composition :	Indications :	Dosage :	Presentation :
Gamma Benzene Hexachloride 0.1% w/w Proflavine Hemisulphate 0.1% w/w Cetrimide 0.45% w/w Eucalyptus oil, Turpentine oil and Neem oil as base	Maggoted wound and other infected wound, fly repellant	Spray liberally twice daily	50 ml and 100 ml spray

DoraShot

Composition :	Indications :	Dosage :	Presentation :
Each ml contains: Doramectin 10 mg	Effective against both endoparasites like GI worms, Lungworms, Eye worms, Heartworms and ectoparasites like Ticks, Lice and Mites	Cattle, Buffalo, Sheep and Goat: 1 ml/ 50 kg b. wt. by IM or SC route Swine: 1 ml/33 kg b. wt. by IM route	10 ml, 20 ml and 50 ml vials

IMIZET

Composition :	Indications:	Dosage :	Presentation:
Each ml contains Imidocarb dipropionate 120 mg	For treatment and control of Babesiosis and treatment of Anaplasmosis	Cattle and Buffalo Babesiosis: Treatment: 1ml/ 100 kg b. wt. Prevention: 2.5 ml/ 100 kg b. wt Anaplasmosis: 2.5 ml/ 100 kg b. wt IM or SC route Horse Babesiosis: 2 ml/ 100 kg b. wt. IM route only If required to be repeated after 24 hrs.	5 ml and 10 ml vials.

INEROL

Composition :	Indications :	Dosage :	Presentation :
Each ml contains : Isoflupredone 2 mg	Bovine ketosis, laminitis, arthritis, tenosynovitis, bursitis, myositis, mastitis, shock and milk fever.	Cattle and Buffaloes: 5-10 ml according to size of the animal and severity of the conditions. Horse: 2.5-10 ml. Small animals: 1 ml/ 50 kg b.wt. by IM/ IA route only.	10 ml and 30 ml vials

INTACEF

Composition :	Indications :	Dosage :	Presentation :
Each 250mg vial contains: Ceftriaxone 250 mg Each 500mg vial contains: Ceftriaxone 500 mg Each 1 gm vial contains: Ceftriaxone 1 gm Each 2 gm vial contains: Ceftriaxone 2 gm Each 3 gm vial contains: Ceftriaxone 3 gm Each 4 gm vial contains: Ceftriaxone 4 gm	Mastitis, Haemorrhagic Septicemia, Broncho-pneumonia, Nephritis, Cystitis, Endometritis, Metritis, Pyometra, Actinobacillosis, Osteo-Arthritis and Peri-operative care	Cattle and Buffalo: 5-10 mg/kg b.wt. Calf, Sheep and Goat: 10-15 mg/kg b.wt. Dog and Cat: 15-25 mg/kg b.wt. daily for 3-5 days. IM or IV route	250 mg, 500 mg and 1 gm vials with WFI. 2 gm, 3 gm, and 4 gm vials in combipacks along with disposable sterile syringe, needle and WFI

INTACEF Tazo

Composition :	Indications :	Dosage :	Presentation :
Each 562.50mg vial contains: Ceftriaxone 500 mg Tazobactam 62.50 mg Each 2250 mg vial contains: Ceftriaxone 2000 mg Tazobactam 250 mg Each 3375 mg vial contains: Ceftriaxone 3000 mg Tazobactam 375 mg Each 4500 mg vial contains: Ceftriaxone 4000 mg Tazobactam 500 mg Each 5625mg vial contains: Ceftriaxone 5000 mg Tazobactam 625 mg	Pneumonia, Haemorrhagic, Septicaemia, Mastitis, Cystitis, Metritis, Infectious Osteoarthritis and Peri-operative care	Cattle and Buffalo: 5-10 mg/kg b.wt. Calf, Sheep and Goat: 10-15 mg/kg b.wt. Dog and Cat: 15-25 mg/kg b.wt. daily for 3-5 days. IM or IV route	562.50 mg, 2250 mg, 3375 mg, 4500 mg and 5625 mg in combi packs along with disposable syringe, needle, and WFI

INTALYTE

Composition	Indications :	Dosage :	Presentation :
Each 100 ml contains: Dextrose(anhydrous) 20gm Sodium Chloride 0.6 gm Potassium Chloride 0.04gm Calcium Chloride (dihydrate) 0.027 gm Sodium lactate 0.312 gm	Instant replenishment of fluid, electrolytes and energy in conditions associated with diarrhoea, heat stress and debility	Cattle, Buffalo and Horse: 500-2000 ml Sheep and Goat:100-200 ml, Calf: 100-500 ml Dog: 25-100 ml (Dose would differ as per degree of dehydration) IV route	500 ml and 1000 ml F.F.S bottles

INTAMOX

Composition :	Indications :	Dosage :	Presentation :
Each 2.5 gm vial contains: Amoxycillin: 1.25 gm Cloxacillin: 1.25 gm Each 3.5 gm vial contains: Amoxycillin: 1.75 gm Cloxacillin: 1.75 gm Each 4.5 gm vial contains: Amoxycillin: 2.25 gm Cloxacillin: 2.25 gm	Mastitis, H.S., Pneumonia, Leptospirosis, Pyometra and Metritis, Secondary Bacterial Infection	6-10 mg/kg b. wt. daily for 3-5 days IM/IV route	2.5 gm vial, 3.5 gm vial and 4.5 gm vial with Sterile WFI

INTAMOX-O

Composition	Indications	Dosage	Presentation
Each bolus contains: Amoxycillin : 1.5 gm	Pneumonia, Bronchopneumonia, Diarrhoea, Secondary bacterial infections, Wounds and Abscess	1 bolus / 200 kg b. wt. Daily for 3-5 days Orally	Strip of 4 boli

KisKin CREAM

Composition :	Indications :	Dosage :	Presentation :
Clobetasol propionate 0.03 w/w Oflaxacin 0.1 w/w Miconazole nitrate 2.0 w/w Zinc Sulphate 3.0 w/w	Surgical / fungal / complexed wounds, abrasions, cuts and burns. Eczematous dermatosis and other skin affections	Apply topically after proper cleaning of the affected area of wound for 3-4 times a day	50 gm tube

MAMMICEF

Composition :	Indications :	Dosage :	Presentation :
Each 10 ml syringe contains: Cefoperazone 250 mg	Clinical and Sub-clinical Mastitis	One syringe per affected quarter only once by intramammary route	10 ml prefilled syringe with sterile antiseptic wipe

Mammitas

Composition :	Indications :	Dosage :	Presentation :
Each pre-filled syringe contains: Cefuroxime sodium equivalent to Cefuroxime 250 mg In Sterile base q.s.	Clinical and Sub-clinical Mastitis	One syringe to be infused per affected quarter at every twelve hours interval for 3-4 consecutive times. In chronic mastitis, therapy may be extended up to eight syringes in total per quarter.	3.5 gm prefilled syringe

Mammitel-PNC

Composition :	Indications :	Dosage :	Presentation :
Each 5 gm pre-filled syringe contains: Cephalexin IP 100 mg Neomycin Sulphate IP 100 mg Prednisolone IP 10 mg	Clinical Mastitis	One syringe is to be infused per affected quarter every 12 hours intervals for 3-4 consecutive times	5 gm prefilled syringe with alcohol swab

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Marbomet Inj

Composition :	Indications :	Dosage :	Presentation :
Each ml contains: Marbofloxacin 100 mg	Respiratory Infections: Haemorrhagic Septicemia, Bovine Respiratory Disease, Pneumonia and Bronchopneumonia Acute and Chronic Mastitis Metritis Mastitis Agalactia Syndrome in pigs	Large Ruminants Daily dosing - 2 mg/kg b. wt. (1 ml/ 50kg) for 3 to 5 days by IM/SC or IV route Single dosing - 8 mg/kg b.wt. (2 ml/ 25 kg) by IM route Small Ruminants and pigs- 2 mg/kg b.wt. (1 ml/ 50kg) for 3 to 5 days by IM route	30 ml vial

Marbomet - LA

Composition :	Indications :	Dosage :	Presentation :
Each ml contains: Marbofloxacin 160 mg	Urinary tract infections, Respiratory tract infections, Mastitis, Bacterial diarrhoea, Metritis, Mastitis and Agalactia syndrome in pigs	Cattle and Buffaloes: 8-10 mg/kg b. wt. i.e. 10 ml/ 160-200 kg b. wt. IM/ IV route Sheep, Goat and Pig- 8 mg/ kg b. wt. i.e. 1 ml/ 20 kg IM route	30 ml vial along with sterile syringe and needle

MAXXTOL Bolus

Composition :	Indications :	Dosage :	Presentation :
Each bolus contains: Tolfenamic Acid 500 mg	All painful inflammatory conditions associated with Musculoskeletal Disorders, Respiratory Tract Infections, Mammary Gland Infections, Urogenital Tract Infections and Postoperative care Follow-up to Maxxtol Injection where ever prolonged treatment is required.	2 mg/ kg b. wt. to be repeated after 24 hrs. Large Animal: 2 bolus daily Small Animal: 1/4-1/2 bolus daily. Orally	Strip of 4 boli

MAXXTOL Inj.

Composition :	Indications :	Dosage :	Presentation :
Each ml contains: Tolfenamic Acid 40 mg	All painful inflammatory conditions associated with Musculoskeletal Disorders, Respiratory Tract Infections, Mammary Gland Infections, Urogenital Tract Infections and Postoperative care.	Cattle and Buffaloes: By IM or IV Route: 4 mg/kg b.wt. as a single dose or 2 mg/kg b.wt. to be repeated after 48 hrs. Sheep and Goat: By IM or IV Route: 2 mg/kg b.wt. as a single dose. Pig: By IM Route : 2 mg / kg b.wt. as a single dose. Horse: By IV Route : 2 mg / kg b.wt. as single dose.	30 ml and 100 ml vials

MAXXTOL-XP Inj.

Composition :	Indications :	Dosage :	Presentation :
Each ml contains: Tolfenamic Acid 80 mg	All painful inflammatory conditions associated with Musculoskeletal Disorders, Respiratory Tract Infections, Mammary Gland Infections, Urogenital Tract Infections and Postoperative care	Cattle and Buffaloes: By I/M or IV Route: 4 mg/kg b.wt. as a single dose or 2 mg/kg b.wt. to be repeated after 48 hrs. Pig: By IM Route : 2 mg/ kg b.wt. as a single dose. Horse: By IV Route : 2 mg/ kg b.wt. as a single dose.	20 ml and 100 ml vial

MAXXTOL Top Gel

Composition :	Indications :	Dosage :	Presentation :
Tolfenamic Acid 6.0% w/w Methyl salicylate 2.0 % w/w Menthol 5.0 % w/w Methyl paraben sodium 0.1% w/w Propyl paraben sodium 0.01% w/w in Gel base	Laminitis, Arthritis, Mastitis, Myositis, Bursitis, Sprains, Tenosynovitis and Tendinitis	To be applied topically 2-3 times in a day	30 gm tube

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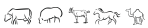
MAXXTOL QPR

Composition :	Indications :	Dosage :	Presentation :
Tolfenamic acid 6% w/w Methyl salicylate 10% w/w Menthol 5% w/w Cinnamon oil 0.4% w/w Linseed 0il 3% w/w	Soft Tissue conditions:-Closed wounds, including Sprains, Strains, Tendonitis, Bursitis, Myositis, Ligament tear, Pain management in Mastitis. Hard Tissue conditions: - Joint pain and Joint ill, Lameness and Laminitis, Osteoarthritis, Other chronic and acute musculoskeletal disorders	Clean affected part and spray Maxxtol QPR liberally until a complete cure is achieved	75 gm Spray

MELONEX Inj.

Composition :	Indications :	Dosage :	Presentation :
Each ml contains: Meloxicam 5 mg	All inflammatory conditions like Mastitis, Pneumonia, Broncho-pneumonia, Pleurisy, Metritis, Uterine Prolapse, Colic, Calf Diarrhoea, Arthritis, Osteoarthritis, Myositis, Synovitis, Laminitis, Otitis, and Perioperative care etc.	Cattle and Buffaloes: 30 ml/ 300 kg b.wt. in Mastitis, Pneumonia, Uterine Prolapse and Perioperative care. 15 ml/ 375 kg b.wt. for musculoskeletal disorders, Otitis, FMD and other inflammatory conditions Dog and Cat: 0.2 - 0.5 ml/ 10 kg b.wt. Horse: 30 ml/250 kg b.wt. Swine: 2 ml/25 kg b.wt. Sheep and Goat: 2 ml/33 kg b.wt. IM/ IV/ SC route	15 ml, 30 ml and 100 ml vials

MELONEX Bolus



Composition :	Indications :	Dosage :	Presentation :
Each bolus contains: Meloxicam 100 mg	Follow up therapy in all inflammatory conditions	Large animal: 2 boli/400 kg b.wt. daily Small animal: 1/4-1/2 bolus daily Orally	Strip of 6 boli Box of 30 strips

MELONEX-XP Inj.

Composition :	Indications :	Dosage :	Presentation :
Each ml contains: Meloxicam 20 mg Ethanol 150 mg	All inflammatory conditions like Mastitis, Pneumonia, Broncho-pneumonia, Pleurisy, Metritis, Uterine Prolapse, Colic, Calf Diarrhoea, Arthritis, Osteoarthritis, Myositis, Synovitis, Laminitis, Otitis, and Perioperative care etc.	Cattle and Buffaloes: In Respiratory tract infection, Mastitis, Pneumonia and Uterine Prolapse- 2.5 ml/ 100 kg b.wt. In Musculoskeletal Disorders and other inflammatory conditions 1ml/ 100 kg b.wt. Horses : 3 ml/ 100 kg b.wt. Pigs: 2 ml/ 100 kg b.wt. IV IM and SC route	30 ml and 100 ml vials

MELONEX PLUS Inj.

Composition :	Indications :	Dosage :	Presentation :
Each ml contains Meloxicam 5 mg Paracetamol 150 mg Lignocaine 1% w/v	All pyretic conditions like Pyrexia of Unknown Origin, Ephemeral Fever (3 day sickness), Bacterial Infections, Viral Infections and Piroplasmosis	Large animal: 30 ml/ 400 kg b.wt. Calf, Sheep and Goat: 1 ml/ 10 kg b.wt. Dog: 0.2-0.5 ml/ 10 kg b.wt. IM route only	30 ml and 100 ml vials

MELONEX PLUS Bolus

Composition :	Indications :	Dosage :	Presentation :
Each bolus contains: Meloxicam 100 mg Paracetamol 1500 mg	Follow up therapy in all pyretic conditions	1 Bolus / 200 kg b.wt. daily Orally	Strip of 6 boli Box of 30 strips

MELONEX Z Bolus

Composition :	Indications :	Dosage :	Presentation :
Each bolus contains: Meloxicam: 100 mg Serratiopeptidase: 75 mg	Follow up therapy in all chronic inflammatory conditions	Large animals: 2 boli/ 500 kg b.wt. daily Small animals: ¼ - ½ bolus daily orally	Strip of 4 boli : Box of 30 strips

MELONEX Z *plus* Bolus

Composition :	Indications :	Dosage :	Presentation :
Each bolus contains Meloxicam 100 mg Paracetamol 2000 mg Serratiopeptidase 75 mg	Bacterial and Viral Infections, Ephemeral Fever, Haemoprotozoan Infections, Pyrexia of Unknown Origin, Septicemia and Toxemia.	1 bolus/ 250 kg. b. wt. daily Orally	Strip of 6 boli, Box of 30 strips

Moxidecton

Composition :	Indications :	Dosage :	Presentation :
Each ml contains: Moxidectin 10 mg Benzyl alcohol 40 mg Water for injections q.s	An endectocide effective in control and treatment of both endoparasites of gastrointestinal roundworms, lungworms, hookworms, lice and ectoparasites like mites, grubs and ticks.	Cattle, Buffalo, Sheep, Goat and Camel: 200 µg/kg b. wt. *i.e.* 1 ml per 50 kg b.wt. *via* Subcutaneous route only Pig: 300 µg/kg b. wt. *i.e.* 1 ml per 33 kg b.wt *via* Intramuscular route only behind the shoulder or as directed by Veterinarian.	10 ml vial with sterile disposable syringe and needle.

NEOMEC Inj.

Composition :	Indications :	Dosage :	Presentation :
Each ml contains: Ivermectin 10 mg	An endectocide effective against both endoparasites like GI worms, Lung worms, Eye worms, Heart worms, and ectoparasites like Ticks, Lice, Demodectic, Sarcoptic, Psoroptic Otodectic and Notoedric mange.	Cattle, Buffalo, Sheep, Goat and Camel : 1 ml/ 50 kg b.wt. Dog, Horse, Swine and Rabbit : 0.3 mg/ kg b.wt. SC route	1 ml, 10 ml, 50 ml and 100 ml vials

NEOMEC LA

Composition :	Indications :	Dosage :	Presentation :
Each ml contains : Ivermectin 31.5 mg Methyl paraben 0.18% w/v Propyl paraben 0.02% w/v	Treatment and extended control of infestation caused by gastrointestinal and pulmonary nematodes, mites, lice and ticks	1 ml/ 50 kg b. wt. SC route	10 ml vial

NEOMEC SX

Composition :	Indications :	Dosage :	Presentation :
Each ml contains: Ivermectin 10 mg Clorsulon 100 mg	An endectocide effective against both endoparasites like GI worms, Lung worms, Eye worms, Liver flukes and Ectoparasites like Ticks, Lice and Mites.	Cattle, Buffalo and Sheep: 1 ml/ 50 kg b. wt. SC route	10 ml vial

Nilbery

Composition :	Indications :	Dosage :	Presentation :
Each ml contains: Diminazine Diaceturate 70 mg Phenazone 375 mg	For the treatment and control of Trypanosomiasis, Babesiosis, Mixed infection and Pyrexia of Unknown Origin (PUO)	3.5-7 mg/ kg b.wt. or 1 ml/ 10-20 kg b.wt. Deep IM route	30 ml and 90 ml vials

Nyzom

Composition :	Indications :	Dosage :	Presentation :
Each vial contains: Isometamidium Chloride Hydrochloride 250 mg	Trypanosomiasis	Cattle, Buffaloes, Sheep and Goat : Treatment: 0.25-0.5 mg/kg b. wt. Prevention: 0.5-1 mg/kg b. wt. Horse : 0.5 mg/kg b. wt. Dog: 1 mg/kg b. wt. Camel : 0.5-0.75 mg/kg b. wt. Deep IM route	250 mg vial along with sterile WFI

PLASMUP

Composition :	Indications :	Dosage :	Presentation :
Each 100 ml contains: Hydroxyethyl Starch (130/0.4) 6.0 g Sodium Chloride IP 0.9 g Water for Injections IP q. s.	Treatment and prophylaxis of hypovolemia, surgical blood loss, hemorrhages, burn, acute hypovolemia and shock in conditions like blood protozoan diseases, diarrhoea etc., severe dehydration, persistent and bloody diarrhoea, peritonitis, infectious gastroenteritis in dogs and cats	Large Animals : 8-10 ml/kg b.wt./day, up to maximum 20 ml/kg b.wt./day by IV route. Small Animals : 10-20 ml/kg b.wt./day by IV route. The daily dose and rate of infusion depend on animal's blood loss, need for maintenance. Restoration of hemodynamic and hemodilution	100 and 500 ml (with IV set) pack

TRIBIVET

Composition :	Indications :	Dosage :	Presentation :
Each ml contains: Thiamine Hydrochloride 50 mg Pyridoxine Hydrochloride 50 mg Cyanocobalamin 500mcg	Adjunct to antibiotic / anthelmintic / flukicide administration, Non-specific Anorexia, Liver distress and damage, Convalescence, Debility, Anaemia, During Pregnancy, Lactation, In breeding Bulls & Stallions and Nervine disorders	Large animals: 5-10 ml Sheep, Goat and Swine: 1-2 ml. Dog and Cat: 0.5-2 ml. IM or IV route	30 ml and 100 ml vials

TRIBIVET Bolus

Composition :	Indications :	Dosage :	Presentation :
Each bolus contains: Thiamine 75 mg Riboflavin 60 mg Pyridoxine 15 mg Niacinamide 400 mg Cyanocobalamin 12.5 mg Folic acid 50 mg Cobalt chloride 22 mg Choline 100 mg	Aids in better recovery from disease, recumbency, debility, weakness and convalescence	Large Animals: 2 bolus daily Calf, Sheep & Goat: 1 bolus daily	Strip of 4 boli

TRIBIVET M

Composition :	Indications :	Dosage :	Presentation :
Each ml contains: Methylcobalamine:500 mcg Pyridoxine hcl : 50 mg Nicotinamide : 50 mg	Neurological disorders, Nervine weakness, paralysis, paraplegia, Neuro-muscular disorders	Large animals: 5-10 ml Small animals: 3-5 ml IM or IV route	30 ml and 100 ml vials

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Zoctim

Composition :	Indications :	Dosage :	Presentation :
Each 2.5 gm vial contains: Ceftizoxime 2.5 gm Each 3 gm vial contains: Ceftizoxime 3 gm	Mastitis	Cattle and Buffalo: 5-10 mg/kg b.wt. repeat within 96 hrs if required. IM or IV route	2.5 gm and 3 gm vial in combipacks along with disposable sterile syringe, needle and WFI

Zoctim TAZO

Composition :	Indications :	Dosage :	Presentation :
Each vial contains: Ceftizoxime 3000 mg Tazobactam 375 mg	Mastitis	Cattle and Buffaloes: 5 mg/kg b. wt. If required can be repeated after 96 hours IM/IV route	3.375 gm combipack with sterile WFI, disposable syringe and needle

ZUBION

Composition :	Indications :	Dosage :	Presentation :
Each ml contains: Buparvaquone 50 mg	Clinical and Subclinical Theileriosis	1 ml/ 20 kg b.wt. by IM route into neck muscle. In severe cases repeat within 48-72 hrs.	2 ml, 20 ml and 30 ml amber coloured vials with disposable sterile syringe, needle and swab

ZUBION-F

Composition:	Indications:	Dosage:	Presentation:
Each ml contains Buparvaquone 50 mg Furosemide 55 mg	Theileriosis associated with pulmonary edema	1 ml/ 20 kg b. wt. IM route	30 ml vial

Ensure A Faster Recovery from Various Disease Conditions

TRIBIVET®
Bolus

A Superior Blend of B-Complex Vitamins and Cobalt

- Improves Nutrient Digestion & Absorption
- Augments Liver Functions
- Enhances Vitality & Faster Recovery

Available in strip of 4 boli & box of 10 Strips

An Ideal Choice for Follow Up Therapy

® - Registered Trademark of Intas

3D Red

Composition:	Indications :	Dosage :	Presentation :
Each 10 ml contains Calcium gluconate 140 mg Ferric ammonium citrate containing elemental iron eq to 54 mg Copper sulphate 40 mg Cobalt chloride 20 mg Niacinamide 18 mg Biotin 30 mcg Folic acid 3 mg Vit B_{12} 125 mcg Pyridoxine 4 mg	As a regular supplement during Peri-partum period Parasitic anemia Calf anemia Piglet anemia Adjunct to anti-protozoals Adjunct to anthelmintic Anemia of unknown origin	Cattle and Buffalo: 40-50 ml daily Calves, Sheep, Goat and Pig: 10-15 ml daily Lamb, Kid and Piglet: 5-7 ml daily Orally	500 ml bottle

AC-VET FORTE

Composition :	Indications :	Dosage :	Presentation :
Each 3 gm vial contains Ampicillin sodium 1.5 gm Cloxacillin sodium 1.5 gm	Wound infections, Abscesses, Pneumonia, Broncho-pneumonia, Foot Rot, Laminitis and Secondary Bacterial Infections	6-10 mg/kg b.wt. daily for 3-5 days. IM or IV route	3 gm vial with WFI

AC-VET MAX

Composition :	Indications :	Dosage :	Presentation :
Each 4.5 gm vial contains Ampicillin sodium 2.25 gm Cloxacillin sodium 2.25 gm	Wound infections, Abscesses, Pneumonia, Broncho-pneumonia, Foot Rot, Laminitis and Secondary Bacterial Infections	6-10 mg/kg b.wt. daily for 3-5 days. IM or IV route	4.5 gm vial with WFI

Bloatarid

Composition :	Indications :	Dosage :	Presentation :
Each 10 ml contain Dried Aluminium hydroxide 600 mg Magnesium hydroxide 300 mg Simethicone 400 mg Sorbitol solution 70% 100 mg Dill oil 50 mg	Acute and Chronic Bloat	Cattle and Buffaloes : 100 ml Sheep and Goat : 20 ml Orally or Intraruminally	100 ml bottle

BOVIHeal

Composition :	Indications :	Dosage :	Presentation :
Each bolus contains: Advanced Combination of Vitamins, Minerals, Amino acids and Enzymes, fortified with Specific herbs	Accelerates healing process in deep seated wounds, contaminated wounds and surgical wounds. Helps in rapid recovery from generalized skin lesions (FMD, LSD, Pox). Improves healing of udder tissue, sole ulcers and foot rot.	Cattle, Buffalo, Camel and Horse - 2 boli Calf, Sheep, Goat and Pig - 1 bolus daily for four days Orally	Strip of 8 boli

Bufzone

Composition :	Indications :	Dosage :	Presentation :
Each 200 gm sachet contains Rumen Buffer, Yeast, Metabolic Booster	Supports healthy digestion and rumination, ruminal acidosis	Cattle and Buffaloes : 200 gm Calves and Heifers : 60-80 gm Sheep and goat: 50 gm Daily for 3-4 days Orally	200 gm sachet

CafPlan

Composition :	Indications :	Dosage :	Presentation :
Each 3 kg powder contains Bypass protein, Bypass fat, yeast and minerals	For growth in calves and early maturity of heifers	50 gm twice daily along with feed Orally	3 kg pack

CALRIZE Vet

Composition :	Indications :	Dosage :	Presentation :
Each bottle contains 43.5 gm ionic Calcium with Energy fortified with phosphorous, magnesium, Vitamin D_3, Vitamin B_{12} and energy	Before and after parturition and during hypocalcaemia	300 gm at an interval of 12 hours before and after parturition and in hypocalcaemia conditions Orally	300 gm Bottle

CALSHAKTI

Composition :	Indications :	Dosage :	Presentation :
Each 100 ml contains: Calcium 1700 mg Phosphorus 850 mg Vitamin D_3 8000 IU Vitamin B_{12} 100 mcg Extract of *Asparagus racemosus* (Shatavari) 1000 mg *Leptadenia reticulata* (Jivanti) 1000 mg *Piper longum* 400 mg	During Pregnancy, Post-Partum, peak lactation period as well as growth in young calves	Cattle, Buffalo and Camel 100 ml Calf 40 ml Sheep and Goat 10 ml Daily Orally	500 ml and 1 litre bottles 2.5 litre, 5 litre, 7.5 litre and 10 litre plastic jars

CALSHAKTI -DS

Composition :	Indications :	Dosage :	Presentation :
Each 100 ml contains: Calcium 3500 mg Phosphorus 1750 mg Vitamin D_3 16000 IU Vitamin B_{12} 200 mcg Carbohydrate 40% Extract of *Asparagus racemosus* 1000 mg *Leptadinea reticulata* 1000 mg *Piper longum* 400 mg	For better milk production in Lactating animals For Better growth and development in Pregnant and Young animals	High Yielders : 100 ml/day Cattle/Buffalo : 50 ml daily Sheep and goat : 5 ml daily Calves : 20 ml daily Orally	1 ltr, 2.5 ltr, 5 ltr and 20 ltr packs

CALSHAKTI PLATINA

Composition :	Indications :	Dosage :	Presentation :
Each 100 ml contains: Chelated Calcium 3500 mg Phosphorus 1750 mg Cobalt 500 mg Zinc 500 mg Copper 50 mg Magnesium 60 mg Vitamin D_3 16000 IU Vitamin B_{12} 200 mcg *Asparagus racemosus* (Shatavari) 1000 mg *Leptadinea reticulata* (Jivanti) 1000 mg *Piper longum* 400 mg	In Pregnant and Lactating Animals: for Better Milk Production In Young Animals : for Better Growth and Development	High Yielders : 50 ml twice daily Cattle and Buffalo : 25 ml twice daily Sheep and goat : 5 ml daily Calves : 20 ml daily Orally	1 ltr, 5 ltr, 10 ltr and 20 ltr packs

CALSHAKTI SMART

Composition:	Indications :	Dosage :	Presentation :
Each 165 gm contains Calcium 35000 mg Phosphorus 17500 mg Vitamin – D_3 160000 IU Vitamin – B_{12} 2000 mcg *Leptadenia reticulate* 10000 mg *Asperagus racemosus* 10000 mg *Piper longum* 4000 mg	For improving milk production	165 gm to be dissolved in 1 litre of water and administered at the dose rate of 50 ml daily in Cattle and Buffalo, 100 ml daily in High yielders and 20 ml daily in calves	165 gm and 825 gm packs pouch

CALSHAKTI HD Gel

Composition :	Indications :	Dosage :	Presentation :
Each 300 gm contains Calcium: 35 gm Phosphorus: 17.5 gm Vitamin D_3: 40000 IU Vitamin B_{12}: 500 mcg Extract of *Asparagus racemosus* 5.8 gm *Lepidium sativum* 26.4 gm *Withania somnifera* 8 mg *Tinospora cordifolia* 5.8 gm	Helps in achieving early and higher peak milk yield, Minimizes milk depression rate, Prevents milk fever and its relapse, Prevents seasonal milk fluctuations	For quick and sustained peak milk yield: 1 bottle on Every 10th day, For Preventing Milk Fever 1st bottle: 12 hrs before calving, 2nd bottle: 12 hrs after calving, 3rd bottle: 36 hrs after calving	300 gm Drench bottle

CHROMYEAST

Composition :	Indications :	Dosage :	Presentation :
Each gram contains *Saccharomyces cerevisiae* 5 Billion CFU *Lactobacillus sporogenes* 200 Million CFU Fructo-oligosaccharide 100 mg	To improve dry matter intake To optimise feed and fibre digestion For Augment SNF and Milk fat For improving FCR and Productivity	Cattle and Buffalo: 10 gm daily Orally	250 gm and 1 kg pouch

Concimax

Composition:	Indications:	Dosage:	Presentation:
Each Herbo Mineral bolus contains: Hingula, Nag, Vanga, Ferrous, Processed in Aprajita, Kamal, Durva, Putrajivak, Yastimadhu and Majith.	For improving conception rate	One bolus daily after A.I. for 14 days. Orally	Available in strip of 7 boli and Box of 2 strips

E-Booster

Composition :	Indications :	Dosage :	Presentation :
Each 1 litre contains: Gluconeogenic Precursor fortified with Nicotinamide and Cyanocobalamin	Negative Energy Balance, Ketosis, Pre and Post partum, Peak Lactation As supportive in hemoprotozoal infections	Cattle and Buffalo: 200 ml twice daily for first two days, followed by 100 ml daily for next two days Orally	500 ml and 1 ltr bottles

ENROTAS BH

Composition :	Indications :	Dosage :	Presentation :
Each ml contains: Enrofloxacin 100 mg and Bromhexine hydrochloride 7.5 mg	Respiratory tract infections, Urinary tract infections, Skin and Soft Tissue infections, Mixed Bacterial and Mycoplasmal Infection	Sheep and Goat 1 ml for 10.5 kg. b. wt. for 3 -5 days Orally	100 ml, 250 ml, 500 ml and 1 ltr bottles

Ecotas BOLUS

Composition :	Indications :	Dosage :	Presentation :
Each Bolus contains: *Saccharomyces cerevisiae* $25X10^9$ CFU *Lactobacillus sporogenes* $20X10^6$ CFU *Aspergillus oryzae* $20X10^6$ CFU Fructo oligosaccharide 250 mg Biotin 10 mg DL-Methionine 1 gm Zinc Sulphate 200 mg Cobalt Sulphate 40 mg Copper Sulphate 100 mg	Prolonged Off-feed condition, Adjunct to Antibiotics and Antidiarrhoeals, Post weaning micro-floral replacer	Cattle and Buffalo : 2 boli daily for 4 days. Sheep and Goat : 1 boli daily for 4 days Orally	Strip of 8 boli in a unit carton

Exoheal

Composition :	Indications :	Dosage :	Presentation :
Each 10 ml contains extracts from *Eucalyptus globulus* 12.5 gm *Pinus longifolia* 15 gm *Cedrus deodara* 10 gm	All Types of Wounds, Yoke and Rope galls, FMD lesions and Foot Rot, Dermatomycosis, Mange, Eczema, Ringworm, Tail affections, Fly repellent and Post shearing Lesions	Spray liberally on affected area	75 ml and 100 ml aerosal spray

FENTAS BOLUS

Composition :	Indications :	Dosage :	Presentation :
Each 1.5 gm bolus contains: Fenbendazole 1.5 gm Each 3 gm bolus contains: Fenbendazole 3 gm	Anthelmintic against Nematode, Cestode and Trematode infestations	1 bolus per 200-300 kg b.wt. (1.5 gm bolus) 1 bolus per 300-600 kg b.wt. (3 gm bolus) Orally	Bolus 1.5 gm: Strip of 4's, box of 5 Strip. Bolus 3 gm: Strip of 1 bolus.

FENTAS PLUS

Composition :	Indications :	Dosage :	Presentation :
Each ml of Suspension contains: Fenbendazole 1.5%w/v Praziquantel 0.5%w/v Each Tablets contains: Fenbendazole 150 mg Praziquantel 50 mg	Broad spectrum anthelmintic against Tapeworms, Roundworms, Hookworms and Whipworms in small animals	Suspension: Sheep,Goat and Pig – 1ml per 3 kg b.wt. Tablet: Calf, Sheep, Goat and Pig – 1 tablet per 30 kg b.wt. Orally	30 ml, 100 ml, 500 ml and 1 ltr suspension bottles Strip of 10 Tablets

FENTAS XP

Composition :	Indications :	Dosage :	Presentation :
Each uncoated bolus contains: Fenbendazole 4500 mg Ivermectin 150 mg	Broad spectrum endo and ecto-parasitic for control and prevention	1 bolus for 450 kg b. wt. Orally	4.5 gm bolus in a strip

FlobacSA

Composition :	Indications :	Dosage :	Presentation :
Each ml contains: Enrofloxacin 100 mg Benzyl alcohol 20 mg	H.S. Pneumonia, Pleuropneumonia, Salmonellosis, Colibacillosis, Pneumo-enteritis, Cystitis, Nephritis, Endometritis, CBPP, CCPP and other bacterial infections.	Livestock : 30 ml/ 400 kg b.wt. Canine : 1 ml/ 30 kg b.wt. Pig : 3 ml/ 40 kg b.wt. Single injection by slow IV or IM or SC route	30 ml, 50 ml and 100 ml vial

FLUMITAS

Composition:	Indications:	Dosage:	Presentation:
Each ml contains: Flumethrin 10 mg	For control and management of all tick species including strains resistant to carbamates, amidines, chlorinated hydrocarbons, organophosphates and organochlorine group of insecticides.	Apply with self applicator bottle at a dose rate 1 ml/10 kg b. wt. evenly on mid line of back from front of shoulder to tail setting.	50 ml squeezable bottle

Gropomo ORAL

Composition :	Indications :	Dosage :	Presentation :
Each litre contains : Vitamin A : 3.12 gm Vitamin D_3 : 83 mg Vitamin E : 2 gm Vitamin B_6 : 0.6 gm Vitamin B_{12} : 0.04 gm Vitamin K : 0.4 gm Nicotinamide : 13.2 gm Calcium pantothenate : 4.84 gm Choline chloride : 1.5 gm Folic acid : 0.11 gm L-Lysine HCL : 1 gm DL – Methionine : 2 gm	For Better Growth in Lamb, Kid, Sheep and Goat	Lamb and Kid : 5 ml/day Sheep and Goat : 10 ml/day Orally minimum for 10 days	500 ml bottles

HALOTAS

Composition :	Indications :	Dosage :	Presentation :
Each bolus contains : Halquinol 1.5 gm	For treatment of intestinal infection caused by bacteria, protozoa and fungi. Specially indicated for Calf scour and coccidiosis	Calf, Sheep, Goat and Pig: ½ - 1 bolus twice daily for 3-5 days Cattle and Buffalo: 1-2 bolus twice daily for 3-5 days Orally	Strip of 12 boli

HYPORiD

Composition :	Indications :	Dosage :	Presentation :
Anionic feed supplement for management of hypocalcaemia	For prevention of Hypocalcaemia and as a Supportive Supplement along with IV Calcium for Management of Clinical Hypocalcaemia	Feeding schedule: 90 gm twice daily Orally For Healthy animals: 5 days before parturition For animals with history of Hypocalcaemia: 10 days before parturition In treatment of Milk Fever: Along with IV calcium for 5 days Orally	90 gm pouch and 10 pouch in one pack

Intacal-IM

Composition :	Indications :	Dosage :	Presentation :
Each ml contains: Calcium Levulinate 76.4 mg Vitamin D_3 5000 IU Vitamin B_{12} 50 mcg	To avoid changes of Milk Fever As a supportive after IV Calcium in Clinical Milk Fever For providing muscular tonocity in Prolapse, ROP and Dystocia For normal foetal growth in pregnancy For weak and debilitated animals during hypothermia	Cattle/Buffalo : 10-15 ml thrice in a week for 2 weeks Pre-partum and Post-partum Cattle and Buffalo: 15-20 ml thrice in a week (upto 6 administrations) Debilitated Animals: 10 ml thrice a week for 1-2 weeks Sheep and Goat : 1-3 ml thrice a week for 1-2 weeks IM route	45 ml vial

INTABOLITE

Composition:	Indications:	Dosage:	Presentation:
Anionic Feed supplement with Immunity boosters	For Smooth Calving For Prevention of Hypocalcaemia As a supportive supplement along with IV Calcium for management of clinical Hypocalcaemia	Cattle and Buffalo: 50 gms twice daily 10 days before parturition In Treatment of Milk Fever: Along with IV Calcium for 10 days Orally	1 kg Jar (50 gm x 20 Sachets) 2 kg Bag (50 gm x 20 Sachets)

INTALYTE ORAL

Composition :	Indications :	Dosage :	Presentation :
Each 30 gm contains Sodium chloride : 7.75 gm Potassium chloride : 2.5 gm Calcium propionate : 800 mg Magnesium sulphate: 200 mg Fortified with Vitamin A, Vitamin D_3 and Vitamin E	Supportive after IV fluid, General dehydration, fluid loss conditions, diarrhoea, calf scour, heat stress During toxemia/septicemia, supporting to mastitis, metritis and freshly calved animals	Dissolve 30 gm in 1 litre of water Twice daily Orally	30 and 300 gm sachets

INTAVITA-ORAL NH

Composition :	Indications :	Dosage :	Presentation :
Each ml contains: Vitamin A 12000 IU Vitamin D_3 6000 IU Vitamin E 48 mg Vitamin H 50 mcg Nicotinamide 3 mg	For Better Growth, Enhanced Immune Response – Post Vaccination, Faster Recovery During Convalescence Period, Improved Udder Health and Summer Stress	Cattle and Buffalo: 10 ml Calf, Sheep and Goat: 5 ml Dog : 2-5 ml daily Poultry (For every 100 bird in drinking water) Chicks : 5 ml Growers : 7 ml Layers : 10 ml Daily Orally	50 ml, 100 ml, 250 ml, 500 ml and 1 ltr. bottles

Livotas

Composition :	Indications :	Dosage :	Presentation :
Each 10 ml contains extract derived from *Andrographis paniculata* 400 mg, *Eclipta alba* 300 mg, *Phyllanthus niruri* 250 mg, *Boerhavia diffusa* 100 mg, *Picrorhiza kurroa* 50 mg, *Cichorium intybus* 50 mg, *Silybum marianum* 100 mg, *Taraxacum officinalis* 50 mg, *Glyeyrrhiza glabra* 100 mg, *Curcuma longa* 100 mg	For optimizing liver function Anorexia due to hepatic disorders Liver dysfunction Post deworming stress on liver Decrease productivity For improving digestive performance and FCR	Cattle and Buffalo :30-40 ml Heifer and Calves :15-20 ml Sheep and Goat :7-10 ml To be administered once daily Orally Poultry (For every 100 birds in drinking water) Chicks : 5 ml Growers : 10 ml Layers and Broilers:20 ml Daily Orally	200 ml, 500 ml and 1 ltr bottle, 2.5 ltr and 5 ltr plastic jar

Lornitas

Composition :	Indications :	Dosage :	Presentation :
Each 5 ml contains: Levofloxacin 100 mg Omidazole 200 mg	Mixed G.I Tract Infections	Cattle, Buffalo, Sheep and Goat: 5 ml/ 20 kg b.wt. for 3-5 days Orally	75 ml and 150 ml pet bottles

Mammidium

Composition :	Indications :	Dosage :	Presentation :
Each 50 gm contains: Tri Sodium Citrate 25 gm, Vitamin A 70, 000 IU, Vitamin D_3 20,000 IU, Vitamin E 1000 IU, Niacin 2000 mg, Thiamine 200 mg, Riboflavin 200 mg, Pantothenic Acid 50 mg, Biotin 20 mg, Methionine 10gm, Manganese Sulphat 4 gm, Copper Sulphate 1200 mg, Zinc Sulphate 500 mg, Selenium 4 mg, Live Yeast Spore 50000 million CFU	Sub-Clinical Mastitis and As an adjunct to Antibiotic therapy in Clinical Mastitis	50 gm daily for 4 days by mixing in jaggery as an electuary Orally	50 gm amber glass bottle and 200 gm pack

Mammigard

Composition :	Indications :	Dosage :	Presentation :
Each 10 gm powder contains: unique herbs, vitamins and minerals for better udder care and immunity	Improves udder health Minimizes chances of mastitis Improves immune status of transition animals	Cattle and Buffalo- 10 gms twice daily for 10 days before parturition Orally	200 gm sachet

Milkout

Composition:	Indications:	Dosage:	Presentation:
Herbal Galactogogue fortified with Minerals	For optimum milk production and easy milk letdown, Agalactia and hypogalactia	Milk Letdown and optimum milk production -15 gm twice daily 30 minutes prior milking. Agalactia/Hypogalactia- 30gm twice daily for 5 days	300 gm and 900 gm jar with measuring spoon

Milkout LD

Composition :	Indications :	Dosage :	Presentation :
Each bolus contains: Extracts from *Asparagus recemosus, Acorus calamus, Nardostachys jatamansi, Pueraria tuberosa* and *Withania somnifera*	Assists in easy let down of milk Improves milk production in conditions like agalactia and hypogalactia Helpful in easy milking of disturbed animals with calf death and abortion	Cattle and Buffalo : 3 bolus twice daily prior to each milking Sheep and Goat : 1 bolus twice daily prior to each milking Orally	Strip of 6 bolus x 5 Strips

Minfa

Composition :	Indications :	Dosage :	Presentation :
Each kg has nutritional value of Calcium 240 gm, Phosphorus 120 gm, Copper 312 mg, Cobalt 45 mg, Magnesium 2.114 gm, Iron 979 mg, Zinc 2.13 gm, Iodine 1.6 mg, Bioactive Chromium 65 mg, DL Methionine 1.920 gm, L-Lysine monohydro-chloride 4.4 gm	Chromium enriched mineral mixture useful in improving milk production, overall growth, development and enhances reproductive performances.	Cattle, Buffalo and Horse: 30-50 gm daily Calf: 10 gm daily Swine :1 kg to be mixed in 100 kg feed Orally	1 kg and 10 kg polybags

MINFA GOLD

Composition :	Indications :	Dosage :	Presentation :
Each 1.2 kg has nutritional value of Chelated Calcium 255 gm, Phosphorus 127.5 gm, Magnesium 6.0 gm, Manganese 1.5 gm, Iron 1.5 gm, Iodine 325 mg, Copper 4.2 gm, Zinc 9.6 gm, Cobalt 150 mg, Sulphur 7.2gm, Potassium 100mg, Sodium 6 mg, Selenium 10 mg, Vitamin A 700000IU, Vitamin D_3 70000 IU, Vitamin E 250 mg, Nicotinamide 1000 mg, Chromium 78 mg	For Maintenance, Better Growth, Improved Productive and Reproductive Performance	Cow and Buffaloes : For Maintenance and Growth : 30 gm/day orally For Improved Productivity and Reproductive Performance : 50 gm/day orally Calves, Sheep, Goats and Pigs : 25-30 gm/day orally Horse : 50 gm/day orally Or 1-2 Kg to be mixed in 100 kg of feed	1.2 kg, 2.5 kg, 6 kg polybags, 24 kg plastic bucket and 30 kg polybag

Minotas

Composition :	Indications :	Dosage :	Presentation :
Each bolus contains: Copper 250 mg, Zinc 500 mg, Iodine (EDDI) 50 mg, Selenium 3 mg, Cobalt 60 mg, Manganese 600 mg, Vitamin E 500 IU, Vitamin A 8000 IU	Anoestrus, Silent Heat, Delayed Puberty, Delayed Ovulation and Other Reproductive Disorders	Cows, Buffaloes and Heifers: 1 boli daily for 7 days Sheep and Goat: 1 boli every alternate day for 1 week Orally	Strip of 7 boli in a box

Minotas XL

Composition:	Indications :	Dosage :	Presentation :
Each bolus contains: Copper 300 mg, Zinc 600 mg, Iodine (EDDI) 50 mg, Selenium 3 mg, Cobalt 90 mg, Manganese 700 mg, Chromium 5 mg, Iron 50 mg, Vitamin A 12000 IU, Vitamin E 500 IU, Musta *(Cyperus rotundus)* 50 mg, Lodhra *(Symplocos racemosa)* 50 mg, Chanaka *(Cicer arietinum)* 90 mg	A combination of minerals, vitamins and herbs for Non-responsive Anestrous An-ovulatory Anestrous Silent Heat and Delayed Ovulation	Cattle and Buffalo: 1 bolus daily for 7 days. Orally	7 boli in a box

NEOZIDE PLUS

Composition :	Indications :	Dosage :	Presentation :
Each ml of suspension contains Oxyclozanide 6% w/v, Levamisole HCl 3% w/v Each bolus contains Oxyclozanide 1000 mg, Levamisole HCl 500 mg	Broad Spectrum Anthelmintic for the treatment and control of Round worms, Fascioliasis and Amphistomiasis.	Cattle, Buffalo and Camel: 1 bolus/ 100 kg b. wt. Suspension: Cattle, Buffalo, Camel, Sheep and Goat: 1 ml/ 4 kg b. wt. Orally	Strip of 4 boli, 90 ml, 500 ml and 1 litre bottles

NEOMEC Oral

Composition :	Indications :	Dosage :	Presentation :
Ivermectin 0.08% w/v	For the treatment of Round worms, Lung worms, Nasal bots, Cattle grubs, Lice and Mites	Livestock: 1 ml/ 4 kg b.wt. Orally	100 ml, 500 ml and 1 ltr bottles

NEOZIDE

Composition :	Indications :	Dosage :	Presentation :
Each bolus contains: Oxyclozanide 1 gm Each ml suspension contains: Oxyclozanide 3.4% w/v	Liver flukes, Amphistomes and Nasal Schistosomiasis	Cattle, Buffalo and Camel: 1 bolus/ 100 kg b. wt. 90 ml/ 300 kg b. wt Sheep and Goat : 5 ml/ 15 kg b. wt. Orally	Strip of 4 boli in a box of 10 strips 90 ml and 1 litre bottle

OLgard

Composition :	Indications :	Dosage :	Presentation :
Each ml contains Triclabendazole 5% w/v Ivermectin 0.1% w/v	For treatment and control of Round worms, Lung worms, Immature and mature Liver flukes, Nasal bots and Itch mites	Sheep and Goat : 1 ml/ 5 kg b. wt. Orally	250 ml, 500 ml and 1 ltr bottle

PABADINE Bolus

Composition :	Indications :	Dosage :	Presentation :
Each bolus contains: Sulphadimidine 5 gm	Calf Diarrhoea, Calf Scours, Bacterial Enteritis, Septicemia, H.S., Foot Rot, Bacterial Pneumonia, Metritis, Actinomycosis, Actinobacillosis, Toxoplasmosis and Secondary Bacterial Infections	1 boli/ 50 kg b.wt. followed by half dose Orally	Strip of 4's Box of 30 strips

PACHO MAX

Compositions:	Indications:	Dosage:	Presentation:
A unique blend of 25 herbs having 5 potent phytochemicals	Digestive and appetite stimulant As a carminative tonic during anorexia. To overcome dyspepsia by improving digestion, To enhance gastrointestinal motility and health	Large animals- 15 gm twice daily orally Small animals- 7.5 gm twice daily orally for 3-5 days	Sachet of 15 gm, Box of 40 sachets

ProShe

Composition:	Indications:	Dosage:	Presentation:
Each 10 ml contains Tankan Kshar 100 mg Extract derived from Ashoka chhal 333 mg Gokharu 240 mg Lodra 250 mg Chitrak mool 250 mg Harmal 163 mg Manjishtha 100 mg Ajwain 100 mg	Helps in expulsion of placenta Enhances uterine involution Prevents uterine bleeding Aids in timely removal of lochia	Large animal- 100-125 ml twice daily for 3 to 5 days Small animal- 30-40 ml twice daily for 3-5 days In case of retention of placenta, the dose should be tripled and repeated every three hours until the foetal membranes are expelled Orally	450 ml and 900 ml bottles

PSR

Composition :	Indications :	Dosage :	Presentation :
Each 100 ml contains: Eranda oil 10 gm (*Ricinus communis*) Eucalyptus oil 5 gm (*Eucalyptus globulus*) Neem 3 gm (*Azadirachta indica*) Tulsi oil 1 gm (*Ocimum basilicum*) Menthol 1 gm (*Mentha piperita*) Camphor 1 gm (*Cinnamomum camphora*) Vitamin E 200 mg (*Tocopheryl acetate*)	Mastitis, Udder sores and Teat cracks for its anti-inflammatory and emollient effect	Spray liberally on udder twice daily until complete cure is achieved	100 ml aerosol spray

QuinIntas

Composition :	Indications :	Dosage :	Presentation :
Each ml contains: Enrofloxacin 100 mg	H.S. Pneumonia, Pleuropneumonia, Salmonellosis, Colibacillosis, Pneumoenteritis, Cystitis, Nephritis, Endometritis, CBPP, CCPP and other bacterial infections.	1 ml/ 20 kg b.wt. daily for 3-5 days. IM or IV route	15 ml, 50 ml and 100 ml vials

Ropitas

Composition :	Indications :	Dosage :	Presentation :
Each bolus contains : *Quercus infectoria* 20 mg *Cissampelos pareira* 10 mg *Curcuma longa* 50 mg *Mentha piperita* 100 mg Tankan kshar 100 mg	Retention of placenta	4 Boli intra uterine	Container of 4 boli with hand gloves

Rumentas

Composition :	Indications :	Dosage :	Presentation :
Each bolus contains Antimony Potassium Tartrate 2 gm Ferrous Sulphate 2 gm Copper Sulphate 50 mg Cobalt Chloride 100 mg	An ideal rumenotoric, Provides excellent results in Anorexia and Simple Indigestion	Large animal: 2 boli Small animal: 1 boli For 2-3 days twice daily Orally	Strip of 4's Box of 30 strips

TICSOP
MEDICATED SOAP

Compositions:	Indications:	Dosage:	Presentation:
Permethrin(25:75) 5.0%w/w Cetrimide 1.0% w/w Eucalyptus oil 2.0% w/w Neem oil 0.5% w/w *Aloe Vera* 1.0% w/w Glycerine 2.0% w/w Vitamin E oil 0.2% w/w Soap Noodles q.s.	To get rid of all types of ectoparasites. To protect livestock from tick-borne diseases. Useful in treating dermatophytosis, itching, eczema, and psoroptic mange infestation. Helps in healing of dry, flaky skin and skin rashes.	Wet the animal's skin, apply soap and make a lather. Massage from shoulder to tail. Rinse with water. Repeat if needed.	75 gm soap

Tinix Vet

Composition:	Indications:	Dosage:	Presentation:
Each ml contains Deltamethrin 12.5 mg	For prevention and control of ectoparasitic infestations *viz* ticks lice, mites and flies	To be diluted and used as spray or dip (2-4 ml / liter of water) Cattle shed : 10 ml in 5 liter of water per 100m^3 surface	15 ml and 50 ml bottles

TRIBIVET ORAL

Composition :	Indications :	Dosage :	Presentation :
Each 15ml contains: Thiamine 100 mg Mecobalamine 550 mcg Pyridoxine 6 mg Niacinamide 50 mg Biotin 300 mcg Choline 75 mg Zinc 10 mg Copper 2 mg Manganese 3 mg Chromium 30 mcg Cobalt 12 mg Magnesium 6 mg L-Lysine 50 mg *Bacopa monnieri* 45 mg *Evolvulus alsinoides* 15 mg *Phyllanthus emblica* 10 mg *Centella asiatica* 20 mg	Rapid recovery during disease conditions, weakness, recumbency and debility Aids in management of nervine incoordination As a metabolic aid in downer cow and other production associated diseases	Cattle, Buffalo, Horse and Camel : 100 ml daily Sheep, Goat, Pig and Calf : 20 ml daily Orally	200 ml and 500 ml amber bottle

Tritop

Composition :	Indications :	Dosage :	Presentation :
Each ml contains: Amitraz 1% w/v Cypermetrhin 1% w/v Piperonyl butoxide 5% w/v Excipients q.s.	For control and management of all types of ticks, lice, mites and biting louse	Apply Tritop pour- on topically at the dose rate of 1 ml/ 10 kg b.wt. along the back line from top of shoulder to tail setting	40 ml plastic bottle

VOXETO

Composition:	Indications :	Dosage :	Presentation :
Each 50 gm contains extracts derived from *Azadirachta indica* 7% w/w, *Curcuma longa* : 1.50% w/w, *Trichosanthes dioica*: 0.50 % w/w, *Jasminum grandiflorum* : 0.50 % w/w, *Pongamia glabra* : 1% w/w, *Rubia cordifolia* : 1% w/w, *Terminalia chebhula* : 0.50 % w/w, *Glycyrrhiza glabra* : 3.75 % w/w, *Symplocos racemosa* : 0.50 % w/w, *Ichnocarpus frutescens* : 0.50% w/w, *Nymphaea alba* : 0.50 % w/w	Ringworm, Eczema, Dermatitis, Pyoderma, Pruritus, Mange, Maggot infestation, Dermatomycosis and other Fungal infections, Foot rot, Foot lesions in FMD, All types wounds, surgical wounds and burns.	Clean the affected area and apply Voxeto once in a day at least for 5 -10 days.	50 gm tube

ZenVet

Composition :	Indications :	Dosage :	Presentation :
Each ml of solution contains Closantel 15% w/v Each bolus contains Closantel 1000 mg	Broad Spectrum Endectocide for treatment of Round worms, Liver Flukes and External parasites like Ticks, Lice and Mite	Solution: Nematodes and Cestodes – 1-1.5 ml per 15-20 kg b.wt. Ectoparasites and Liverflukes – 1-1.5 ml per 10-15 kg b.wt. Bolus: Nematodes and Cestodes – 1 boli per 100 kg b.wt. Ectoparasites and Liverflukes – 1 boli per 66 kg b.wt. Orally	Strip of 4 boli, 6 gm bolus, 30 ml, 100 ml, 200 ml, 300 ml and 500 ml bottles

AEI

Composition :	Indications :	Dosage :	Presentation :
Each ml contains: Elemental Iodine 150 mg Vitamin E Acetate 10 mg Vitamin A 20000 IU	Poor reproductive performance, Irregular oestrus cycle, Anestrus, Poor conception rate, Repeat breeding, Delayed puberty, Silent heat and Development of Reproductive organs	Large ruminants : 2.5-5 ml Small ruminants : 0.5 ml IM Route	5 ml vial

Cflox-Tz I.U.

Composition :	Indications :	Dosage :	Presentation :
Each 5 ml contains: Ciprofloxacin 125 mg Tinidazone 150 mg	Repeat breeder condition, Endometritis, Metritis, Pyometra, Retention of placena and Prolapse of uterus	30-60 ml by IU route	Bottle of 60 ml RTU suspension

ESTROMAX

Composition :	Indications :	Dosage :	Presentation :
HMTBa chelated Minerals and β- Carotene fortified with Herbs	Anestrous due to Smooth or Inactive Ovaries Post-Partum Anestrous Regulation of Estrous Signs and Estrous Cycle	1-2 bolus daily for 10 days Orally	Strip of 5 boli

Feritas Bolus

Composition :	Indications :	Dosage :	Presentation :
Each bolus contains: Ferrous Fumarate 1500 mg Vitamin B_{12} 75 mcg Folic Acid 7500 mcg	Post Antiparasitic treatment in case of Ecto and Endoparasitic infestation, Better growth of young calves and more than one week old piglets, Pregnant animals, Follow up therapy after Feritas Inj.	Cattle and Horse: 2 boli daily for 10-15 days (Dose may differ as per severity of anaemia) Calf, Sheep and Goat: 1/2 bolus daily for 10-15 days Orally	Strip of 5 boli Box of 2 strips

Feritas Inj.

Composition :	Indications :	Dosage :	Presentation :
Each ml contains: Iron Sorbitol citric acid complex eq to elemental Iron 50 mg Folic acid 500 mcg Hydroxycobalamin 50 mcg	Iron deficiency and other related problems *viz.* anaemia, As an adjunct to anti-haemoprotozoan therapy	1 ml/ 50 kg b.wt. IM route	10 ml vial

Gynarich

Composition :	Indications :	Dosage :	Presentation :
Each ml contains Buserelin 4 mcg	Repeat Breeding Cystic Ovarian Degeneration Ovulation Synchronization Improvement of Conception Rate	Cattle and Buffalo : 10 - 20 mcg Mare : 20-40 mcg IM or IV or SC route	2.5 ml and 5 ml vials along with disposable sterile syringe, needle and swab. 10 ml vial

INTAVITA

Composition	Indications :	Dosage :	Presentation :
Each ml contains: Vitamin A 2,50,000 IU Vitamin D_3 25,000 IU Vitamin E 100 IU (as Alpha-Tocopheryl acetate)	Infertility, Aspermatogenesis, Rickets, Osteomalacia and Stress conditions like Pregnancy, Lactation, Climate extremes, Parasitic infestation and Transportation	Calf: 2-4 ml, Cattle and Buffalo, 6-10 ml, Horse : 4 ml, Ewe, Ram and Colt: 2 ml, Swine: 1 ml IM route only	10 ml vial

INTAVITA-i

Composition	Indications :	Dosage :	Presentation :
Each ml contains: Vitamin A 2,50,000 IU Vitamin D_3 25,000 IU Vitamin E Acetate 100 IU Biotin 12.5 mcg	Post partum anestrus, Delayed maturity and Infertility	Cattle and Buffalo : 5 ml/ 300 kg b. wt. IM route only	5 ml and 10 ml vials

Lenovo-IU

Composition :	Indications :	Dosage :	Presentation :
Each ml contains: Levofloxacin 20 mg Ornidazole 25 mg Alpha tocopherol 5 mg	Repeat breeding of Infectious origin, Endometritis/Metritis and Pyometra (after removal of pus), Uterine Prolapse & Retained Placenta	30-60 ml by IU route	RTU solution in 60 ml bottle along with a full length hand glove

LUBITAS

Composition :	Indications :	Dosage :	Presentation :
Each 200 ml contains: Propylene Glycol, Carboxymethyl Cellulose Sodium, Methyl Paraben, Propyl Paraben	Obstetrical Examinations, Artificial Insemination, Pregnancy Diagnosis, Ultrasonography Dystocia, Uterine Torsion, Prolapse, Assistive Reproductive Examinations	Apply liberal quantity of lubricating jelly to a wet glove or instrument before insertion	200 ml bottle

Minfa STRONG

Composition :	Indications :	Dosage :	Presentation :
Each kg contains : Vitamin A 7,00,000 IU, Vitamin D_3 70,000 IU, Vitamin E 250 mg, Cobalt 150 mg, Copper 3500 mg, Iodine 325 mg, Iron 1500 mg, Magnesium 6000 mg, Manganese 1500 mg, Potassium 100 mg, Sulphur 7200 mg, Zinc 9600 mg, Calcium 240 mg, Phosphorus 120 mg, Chromium 65 mg	For improving reproductive performance	Cow, Buffalo and Heifer : 50 gm daily Calf : 20 gm daily Orally	1 kg, 5 kg and 20 kg polybags

Nexbolic

Composition :	Indications :	Dosage :	Presentation :
Each ml contains: Methylergometrine: 0.2 mg	Delayed Uterine Involution, Post-Partum Hemorrhages, Adjunct in Management of Uterine Prolapse and Caesarean Section	Cattle, Buffalo and Mare: 2-5 mg/ animal (IM/IV route) Sheep, Goat and Sow: 0.5-1 mg/ animal (IM route)	20 ml vials

NoviZac

Composition :	Indications :	Dosage :	Presentation :
Each combi-kit contains: Vial A: Each ml of 30ml contains: Sodium Dihydrogen Phosphate Dihydrate 30 mg Disodium Hydrogen Phosphate Dodecahydrate 230 mg Vial B: Each ml of 20 ml contains: Inosine 12 mg Sodium Pyruvate 12 mg	Reproductive Problems, Malnutrition and Debility, Metabolic Disorders and for Enhancing Performance	25 ml reconstituted solution on day 1 and day 2 in General Deficiency. 50-100 ml reconstituted solution on day 1 and 25 ml reconstituted solution to be continued from day 2 onwards until symptoms disappear in Post Parturient Haemoglobinuria. IM or IV or SC route	Combi-kit of 30 ml and 20 ml vials

Pragma

Composition :	Indications :	Dosage :	Presentation :
Each ml contains Cloprostenol 250 mcg	CL regression, Chronic Endometritis/Pyometra, Oestrus Synchronization, Induction of Parturition and Pregnancy Termination.	Cattle and Buffaloes: 2 ml Mare: 0.5-1 ml upto 400 kg b.wt. and 1-2 ml beyong 400 kg b. wt. Sow: 1 ml IM route	A tray pack containing 2ml vial with disposable sterile syringe, needle and swab

Pragma D

Composition :	Indications :	Dosage :	Presentation :
Each ml contains D-Cloprostenol 75 mcg	Corpus luteum regression, Chronic Endometritis, Pyometra, Oestrus Synchronization, Induction of Parturition and Pregnancy Termination.	Cattle and buffaloes: 2 ml Mare: 0.3-1 ml Sheep: 1 ml Sow: 1 ml IM route	2 ml vial with disposable sterile syringe, needle and swab

PROGESYN

Composition :	Indications :	Dosage :	Presentation :
Each ml contains: Hydroxyprogesterone caproate 250 mg Benzyl alcohol 0.02 ml In an oily base q.s.	Habitual abortion Threatened abortions Uterine prolapse	Cattle and Buffaloes Habitual abortions : 3 ml after 45 days of pregnancy and to be repeated 4-5 times at every 10 days interval Threatened abortion: 3 ml IM for 3 days and followed by weekly injection for next 3 weeks Post partum uterine prolapse: 3 ml IM at 2 days interval for 3 times	3 ml ampoule with sterile disposable syringe and needle.

PROGIMAX

Composition :	Indications :	Dosage :	Presentation :
Each bolus contains: Omega Fatty Acid, Amino Acids and Multi-Vitamins Fortified with Herbs	To improve corpus luteum health, strengthening endometrium to support developing embryo and foetus for maintenance of pregnancy	1-2 bolus daily orally for 10 days after AI	Available in Strip of 1 Bolus and Box of 10 Strips

Synkomet

Composition :	Indications :	Dosage :	Presentation :
Each ml contains: Butaphosphan 100 mg Cyanocobalamin 0.05 mg	Metabolic booster in conditions of Hypocalcemia, Ketosis, Negative energy balance and prolonged off fed Also Recommended in cases of Infertility, low reproductive performance, boosting immunity, overcoming conditions of poor nutrition and growth challenge in young ones, for improving muscle and overall performance	Large animals : 10-25 ml Calf and Foal : 5-12 ml Sheep and Goat : 2.5-5 ml Swine : 2.5-10 ml Dog : 0.5-5 ml Cat : 0.5-2.5 ml Poultry : 1 ml If required, to be repeated IM/IV/SC route	30 ml and 100 ml vials

UNIZIF

Composition :	Indications :	Dosage :	Presentation :
Each ml contains Flunixin 50 mg Meglumine	Inflammation and pyrexia associated with Bovine Respiratory disease, Metritis, Endotoxemia, Acute bovine mastitis. Musculoskeletal disorders and colic in horses.	Cattle, Camel, Sheep and Goat: 1-2 ml/45 kg b. wt. by slow IV or IM route. Horse: 1 ml/45 kg b. wt. by slow IV route or IM route. Pigs: 1-2 ml/45 kg b. wt. by SC or slow IV route.	20 ml and 100 ml vial

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UNIZIF PLUS

Composition :	Indications :	Dosage :	Presentation :
Each bolus contains: Flunixin Meglumine:1000mg Serratiopeptidase: 100 mg	Infectious inflammatory conditions associated with metritis, endometritis, vaginits, pneumonia, endotoxemia, mastitis, musculoskeletal disorders, colic	1 bolus upto 300 kg b.wt. and 2 bolus for more than 300 kg b.wt.	Available in Strip of 2 boli

Xyrofur

Composition :	Indications :	Dosage :	Presentation :
Each 0.25 gm vial contains : Ceftiofur 0.25 gm Each 0.5 gm vial contains : Ceftiofur 0.5 gm Each 1 gm vial contains : Ceftiofur 1 gm	Respiratory tract infections like H.S., Pneumonia, Bronchopneumonia Uterine tract infections like Metritis, Pyometra, Vaginitis, Cervicitis Other bacterial infections like Foot Rot (Acute Interdigital Necrobacillosis) Urinary tract infections	Cattle, Sheep and Goat :1.1-2.2 mg/kg b. wt. Buffalo :2-2.4 mg/kg b. wt. Horse:2.2-4.4 mg/kg b. wt. Swine: 3-5 mg/kg b. wt. IM route Dog : 2.2 mg/kg b. wt. SC route daily for 3-5 days	250 mg, 500 mg and 1 gm vials with WFI

Xyrofur Tazo

Composition :	Indications:	Dosage :	Presentation:
Each vial contains: Ceftiofur 1000 mg Tazobactam 125 mg	Severe Respiratory tract infections like Hemorrhagic Septicemia, Pneumonia, Bronchopeumonia, Stubborn Uterine Infections like Endometritis, Metritis, Pyometra, Vaginitis, Cervicitis Other critical bacterial infections like Foot Rot (Acute Interdigital Necrobacillosis), Urinary tract infections	Cattle, Sheep and Goat: 1.1-2.2 mg /kg b.wt. Buffalo: 2-2.4 mg/kg b.wt. Horse: 2.2-4.4 mg/kg b. wt. Swine: 3-5 mg/kg b. wt. IM route Dog: 2.2 mg/kg b. wt. SC route daily for 3-5 days	1.125 gm vial with sterile WFI, disposable syringe and needle

Maximize the Bovine Reproductive Performance with

ESTROMAX®

Double Hydroxy-MHA Chelated Minerals and β-Carotene Fortified with Herbs

Ensures Proper Follicular Development

Triggers Estrogen Release for an Ideal Estrous

Available in Strip of 5 Boli and Box of 2 Strips

Usage : 1-2 bolus daily for 10 days before AI

Supportive Usage : Adjunct use in anestrous due to cystic ovaries: 1-2 bolus daily till AI (along with GPG protocol)

PROGIMAX®

Omega Fatty Acid, Amino Acids & Multi-Vitamins Fortified with Herbs

Maintains CL Health

Promotes Progesterone Synthesis

Available in strip of 1 bolus and box of 10 strips

Usage : 1-2 bolus daily for 10 days after AI

Supportive Usage : 1-2 bolus daily for 10 days along with progesterone ***PROGESYN*** during pregnancy

AmbiFlush

Composition :	Indications :	Dosage :	Presentation :
Chlorhexidine gluconate 0.15% w/v Propylene Glycol 10% w/v Tris EDTA and Aqueous Base Q.S.	For treatment of moderate to severe Otitis externa Ceruminolytic to dissolve excessive wax build up, eliminate dirt and flushing ear canal Prevents ear infection and maintains healthy ear	1-2 times daily in each affected ears for at least 10 days in chronic ear infections or once a week for prevention of infection and clearance of excessive wax and debris	100 ml bottle

BONTAB

Composition :	Indications :	Dosage :	Presentation :
Nutritional Value per tablet Calcium 600 mg Phosphorous 464 mg Magnesium 20 mg Vitamin D_3 400 IU	Supports growth of skeletal system especially bones and teeth. Recommended during increased nutritional demand for pregnant, nursing and complete lactation phase in she dogs and for prevention of osteoporosis, osteomalacia and rickets	1 tablet - upto 20 kg b.wt. 2 tablets – for more than 20 kg b.wt. Orally	Bottle of 30 tablets

CaniShot Cv

Composition :	Indications :	Dosage :	Presentation :
Each ml contains Inactivated Canine Corona Virus (CCV strain K378)	For active immunization and control of Canine Corona Virus infection	Initial vaccination : 8-9 week after birth Second vaccination : 11-12 weeks after birth Third vaccination : 14-15 weeks after birth Booster vaccination : Annually, SC route	1 ml dose vial

CaniShot DHPPL

Composition :	Indications :	Dosage :	Presentation :
Each ml after reconstitution contains: CaniShot DHPP (Live-freeze-dried combine DHPP vaccine) Canine distemper virus (CDV strain Onderstepoort) Canine adenovirus type-2 (CAV-2 strain Manhattan) Canine parvovirus (CPV strain 780916-LP) Canine parainfluenza virus (CPiV strain D008) CaniShot Lepto (Leptospira inactivated vaccine) *Leptospira canicola* *Leptospira icterohaemorrhagiae*	An aid in the prevention of Canine Distempers Virus, Infectious Canine Hepatitis, Canine Parvo virus. Canine Parainfluenza Virus and Leptospirosis infections in dogs.	1 ml (1 Dose) After reconstitution with enclosed diluents Initial vaccination: 8-9 weeks Second vaccination: 12-14 weeks Booster Vaccination: Annually	1 Dose (1 ml of reconstituted solution)

CaniShot K5

Composition :	Indications :	Dosage :	Presentation :
Each ml after reconstitution contains Canine Distemper virus Canine Adenovirus type 2 Canine Parvovirus Canine Parainfluenza virus.	For Active immunization of dogs against Canine Distemper, Canine adenovirus 2 (Infectious Canine Hepatitis and respiratory disease), Canine Parvovirus (CPV) and Canine Parainfluenza virus	Initial vaccination : 6-7 weeks after birth Second vaccination : 8-9 weeks after birth Third vaccination : 11-14 weeks after birth Booster vaccination : Annually. SC route	Single dose vial along with diluent

CaniShot RV-F

Composition :	Indications :	Dosage :	Presentation :
Each ml after reconstitution contains Killed Rabies Virus Vaccine	For Active immunization and control of Rabies infection	Initial vaccination : 3-4 month or older animals Booster vaccination: Annually SC or IM route	Single dose vial along with diluent

CefPET Suspension

Composition :	Indications :	Dosage :	Presentation :
Each 5 ml after reconstitution contains Cefpodoxime 100 mg	Skin Infections, Respiratory Tract Infections, Urinary Tract Infections, G. I. Tract Infections, Wound and Abscesses	5-10 mg/kg b. wt. once a day orally	30 ml bottle

CefPET Tablet

Composition :	Indications :	Dosage :	Presentation :
Each uncoated tablet contains Cefpodoxime 100 mg	Skin Infections, Respiratory Tract Infections, Urinary Tract Infections, G. I. Tract Infections, Wound and Abscesses	5-10 mg/kg b. wt. once a day orally	Strip of 10 tablets

CefPET XL Tablet

Composition :	Indications :	Dosage :	Presentation :
Each uncoated tablet contains Cefpodoxime 200 mg	Skin Infections, Respiratory Tract Infections, Urinary Tract Infections, G. I. Tract Infections, Wound and Abscesses	5-10 mg/kg b.wt. once a day orally	Strip of 10 tablets

CefPET CLV 325

Composition :	Indications :	Dosage :	Presentation :
Each tablet contains: Cefpodoxime 200 mg Clavulanic Acid 125 mg	Skin and Soft Tissue Infections Peri-operative Care, GI Infections UTI, Upper Respiratory Tract Infections, Lower Respiratory Tract Infections	Cefpodoxime proxetil 5-10 mg/kg b. wt. Once-a-day Orally	Strip of 10 tablets

Conaseb

Composition :	Indications :	Dosage :	Presentation :
Ketoconazole Nitrate 2% w/v Chlorhexidine Gluconate 2% w/v Cetrimide 0.1% w/v	Infectious dermatitis, Malassezia infection, dermatophytosis, pyoderma, intertrigo, impetigo, folliculitis and pododermatitis	Wet the coat thoroughly with warm water. Apply sufficient shampoo to create a rich lather. Allow it to remain on coat for 5-10 minutes and then rinse thoroughly with clean water. Initially two to three times for four weeks then reducing to once a week	100 ml and 200 ml flip-top bottles

CotGlo

Composition :	Indications :	Dosage :	Presentation :
Each 10 ml Contains: Omega 6- 8000 mg (Organic), Omega 3- 800 mg (Fish oil), Vitamin A- 100000 IU, Vitamin D3- 50000 IU, Vitamin E- 100 IU, Vitamin H- 500 mcg, Zinc- 20 mg, Selenium- 10 mcg, Fish flavor	Stops hair shedding, dry, flaky skin. Boosts Immune system support. Promotes healthy skin and glossy coat. Use as supplement to prevent all types of skin related diseases like pyoderma, mange or fungal skin dieaseas.	Puppy Dogs: Small Breeds: 1.5-2.5 ml, twice a day, orally. Puppy Dogs: Large Breeds: 3-5 ml, twice a day, orally. Adult dog: Small Breeds : 5-10 ml, twice a day, orally. Adult dog: Large Breeds: 10-15 ml, twice a day, orally. Cats: All Breeds: 2.5-5 ml, twice a day, orally	250 ml bottle with measuring spoon in a carton box

D'Mag PET SPRAY

Composition :	Indications :	Dosage :	Presentation :
Gamma Benzene Hexachloride 0.1% w/v Proflavine Hemisulphate 0.1% w/v Cetrimide 0.45% w/v Eucalyptus oil, Turpentine oil and Neem oil as base	Maggoted wound and other infected wound, fly repellant	Spray liberally twice daily	60 ml and 120 ml aerosal spray with nozzle

Doody Off

Composition :	Indications :	Dosage :	Presentation :
Each 3 gm tablet contains : Kaolin 1 gm Pectin 50 mg *Enterococcus faecium* 0.6 Biliion CFU	Diarrhea, Poor stool conditions, Upset digestive system, Conditions associated with frequent indigestion, Restore gastrointestinal microbiota and pH	Dog : 1 chewable tablet per 9 kg b. wt., orally Cats, kittens and puppies : 1/2 - 1 chewable tablet, orally. Repeat the dose every eight hours	Strip of 10 soft chews Bottle of 30 soft chews

Eazypet

Composition :	Indications :	Dosage :	Presentation :
Each uncoated tablet contains Praziquantel 50 mg Pyrantel Pamoate 144 mg Fenbendazole 500 mg	Roundworms, Hookworms, Whipworms and Tapeworms Infestation	1 tablet / 10 kg b. wt. For best results, 2 treatments are recommended Orally	Strip of 2 tablets Strip of 10 tablets

Eazypet PUPPY

Composition	Indications	Dosage	Presentation
Each ml contains Pyrantel Embonate 14.4 mg Febantel 15.0 mg	For control and treatment of gastrointestinal roundworms including Ascarids *(Toxocara canis; Toxascaris leonina)*; Hookworms *(Ancylostoma caninum; Uncinaria stenocephala)* and Whipworm *(Trichuris vulpis)*	1 ml/kg b.wt. of suspension in puppies and young dogs within the age of one year. Orally	20 ml bottle along with calibrated dropper

Feritas Pet

Composition :	Indications :	Dosage :	Presentation :
Each 10 ml contains: Chelated Ferrous Glycinate: 100 mg (eq. to 20 mg Iron) Chelated Copper Glycinate: 50 mg (eq. to 10 mg Copper) Chelated Cobalt Glycinate: 40 mg (eq. to 4 mg Cobalt) Thiamine (Vit. B_1): 2 mg Riboflavin (Vit.B_2): 1 mg Niacin (Vit.B_3): 10 mg Pyridoxine (Vit.B_6): 1 mg Folic Acid (Vit.B_9): 0.2 mg Cyanocobalamin (Vit. B_{12}): 20 mcg Biotin (Vit.B_7): 75 mcg Cholecalciferol (Vit. D): 400 IU, Vit. E: 10 IU *Withania Somnifera:* 80 mg *Emblica officinalis:* 30 mg	Anemia due to Blood loss Anemia due to Tick fever Lack of production of Blood cells Auto immune diseases	Dogs: 5 ml/ 20 kg b. wt. twice a day Cats: 0.5 ml/ 5 kg b. wt. twice a day Orally	200 ml bottle with measuring cap

FELICOTT

Composition :	Indications :	Dosage :	Presentation :
Oatmeal 2% *Aloe vera* Extract 3% Vitamin E 200 IU Vitamin A 10 IU Fruit extracts of papaya, *Mangifera indica* and *Psidium guajava* 3000 mg. Natural fragrance Vanilla / Almond	Regular bathing shampoo for cats, especially made for sensitive and dry skin	Apply the appropriate amount tailored to your pet's specific breed and coat type for best results	200 ml Bottle with pump

Furwipes

Composition :	Indications :	Dosage :	Presentation :
Each wipes contains: Avocado oil, Tea tree oil, Lemongrass oil, *Aloe vera* extract, Chamomile extract, Disodium EDTA, Polysorbate, DMDM hydantoin, Sodium benzoate, Glycerin, Phenoxyethanol, Propylene glycol, Fragrance	For regular cleaning of paws, fur and face after walks or outdoor activities. To gently remove dirt, wax and debris from the outer ear. For safe cleaning around the eyes, removing tear stains or discharge. Ideal for breeds with folds or wrinkles to prevent odor and irritation. For touch-ups or maintaining freshness between baths. Quick clean-ups and convenient for on-the-go hygiene during trips or Vet visits. Gentle enough for cleaning delicate areas.	Number of wipes depends on the specific cleaning needs and areas	50 wipes pouch with outer carton and 2 wipes sachet with outer carton

Griptol-N SUSPENSION

Composition :	Indications :	Dosage :	Presentation :
Each 5 ml contains Levofloxacin 100 mg Ornidazole 200 mg	GI infection caused by gram negative bacteria like *E.coli*, Salmonella, *Shigella* spp., gram positive bacteria, Aerobes, Anaerobes and protozoa like - *Eimeria* spp. Amoeba, Giardia and Trichomonas	Dog: 1 ml/ 4 kg b.wt. BID for 3-5 days Orally	60 ml bottle with measuring and feeding spoon

GUTS-UP

Composition :	Indications :	Dosage :	Presentation :
Each Soft Chew contains: Fungal Diastase 10 mg Bromelain 5.5 mg Protease 4.4 mg Lipase 4.4 mg Amylase 4.4 mg Cellulase 4.4 mg Lactobacillus 5 types pre-mix, prebiotic inulin 20 mg and xylo-oligosaccharide	Gastric upset due to change in food, diarrhoea or poor stool condition, constipation, gas or bloating and corrects frequent indigestion problem in senior dogs.	Below 10 kg - 1 chewable tablet 10-25 kg - 2 chewable tablets Above 25 kg - 3 Chewable tablets	Strips of 30 chewable tablets

Izopet

Composition :	Indications :	Dosage :	Presentation :
Each 1 ml contains: Itraconazole 10 mg	Indicated for the treatment of fungal / yeast infections viz. Dermatophytosis, Malasseziosis, Blastomycosis, Cryptococcosis, Histoplasmosis, Aspergillosis Candidiasis, Coccidioidomycosis, Sporotrichosis	Dogs and cats: 5 mg/kg orally, once daily. Pulse therapy is generally followed for longer treatments	100 ml amber coloured medical grade glass bottle

Intacal Pet

Composition :	Indications :	Dosage :	Presentation :
Each 20 ml provides Calcium Gluconate 325.6 mg Phosphorus 162.8 mg Vitamin D_3 1600 IU Vitamin B_{12} 20 mcg Potassium Chloride 250 mcg Sodium Chloride 250 mcg Magnesium Sulphate 10 mg Manganese Sulphate 1 mg Zinc Sulphate 15 mg Pantothenic Acid 800 mcg Folic Acid 0.04 mg	Essential Minerals and Vitamins Supplements Aids in Bone and Teeth Development Supports Healthy Development of Foetus and Lactation Strengthens Tissue Integrity and Skin Defense	Pups: 5 ml twice daily Adult dog / Bitches: 10 ml twice daily Orally	200 ml and 450 ml bottles

Intacal Pet MAX

Composition :	Indications :	Dosage :	Presentation :
Each 10 ml contains: Calcium (MCHC) 175 mg Phosphorus (MCHC) 140 mg Vitamin D_3 500 IU Vitamin B_{12} 10 mcg Vitmin B_5 2 mg Magnesium 12 mg Folic acid 0.02 mg Zinc Sulfate 5 mg Manganese Sulfate 0.25 mg Menoquinone (Vit. K_2) 100 mcg Chicken flesh flavor	Recommended during pregnancy and lactation, For healthy development of bone and teeth, To prevent calcium and phosphorus deficiency in pica, rickets and osteomalacia	Kitens: 2.5 ml twice a day Pups and Cat: 5 ml twice a day Adult Dogs: 10 ml twice a day During pregnancy and lactation: 15 ml- 20 ml twice a day Exotic pets and birds: 0.25 ml - 0.5 ml once a day	250 ml bottle with measuring cup

INTACEF PET

Composition :	Indications :	Dosage :	Presentation :
Each vial contains Ceftriaxone 500 mg	Broncho-pneumonia, Nephritis, Cystitis, Endometritis, Metritis, Pyometra, Osteo-Arthritis and Peri-operative care	Dog and Cat : 15-25 mg/kg b.wt. daily for 3-5 days. IM or IV route	500 mg vial with WFI.

INTACEF Tazo PET

Composition :	Indications :	Dosage :	Presentation :
Each vial contains Ceftriaxone 500 mg Tazobactam 62.50 mg	Pneumonia, Cystitis, Metritis, Infectious Osteoarthritis and Peri-operative care	Dog and Cat: 15-25 mg/kg b.wt. daily for 3-5 days. IM or IV route	562.50 mg vial in combipack along with disposable sterile syringe, needle and WFI

KisKin CREAM & LOTION

Composition	Indications :	Dosage :	Presentation :
Clobetasol propionate 0.025% w/v Ofloxacin 0.1% w/v Miconazole nitrate 2.0% w/v Zinc Sulphate 3.0% w/v	Eczematous Dermatosis complicated by bacterial and fungal infections. Allergic Dermatitis, Pyoderma and Ring worm. Surgical, fungal / complexed wounds, abrasions, cuts and burns	Apply topically after proper cleaning of the affected area or wound for 3-4 times a day.	A tube of 20 gm and 30 ml / 100 ml lotion

LIVOTAS Pet

Composition :	Indications :	Dosage :	Presentation :
Each 10 ml contains extracts derived from *Silbum marianum* 100 mg *Andrographis paniculata* 400 mg *Eclipta alba* 300 mg *Phyllanthus niruri* 250 mg *Boerhavia diffusa* 50 mg *Picrorhiza kurroa* 20 mg *Cichorium intybus* 50 mg *Curcuma longa* 60 mg *Tephrosia purpurea* 250 mg *Lawsonia alba* 120 mg *Solanum nigrum* 100 mg *Taraxacum officianalis* 50 mg *Phyllanthus embica* 175 mg *Ocimum tenuiflorum* 100 mg *Tinospora cordifolia* 150 mg	Aids in restoration of liver health and normal function Improves digestive performance during inappetence. Improves overall performance in debility, post-deworming and convalescence period As a supportive tonic in management of viral and bacterial infections Augments healthy living and general performance	Puppies -1-2 ml twice daily Small breeds (<10 kg)- 2.5-5 ml twice daily Medium breeds (10-15 kg)- 5 ml-7.5 ml twice daily Large breeds (> 15 kg)- 10 ml twice daily Orally	200 ml bottle

MINMATE

Composition :	Indications :	Dosage :	Presentation :
Calcium: 120 mg Vitamin A: 1500 IU Phosphorus: 60 mg Vitamin D_3: 150 IU Potassium: 10 mg Vitamin E: 30 IU Magnesium: 25 mg Thiamine (Vitamin B_1): 0.5 mg Iron: 3 mg Riboflavin (Vitamin B_2): 1 mg Copper: 0.1 mg Pantothenic Acid (Vitamin B_5): 4 mg Manganese: 0.25 mg Niacin (Vitamin B_3): 10 mg Zinc: 3 mg Pyridoxine (Vitamin B_6): 0.4 mg Iodine: 0.05 mg Folic Acid (Vitamin B_9): 0.08 mg Selenium: 0.01 mg Cyanocobalamin (Vitamin B_{12}): 0.008 mg Cobalt: 10 mcg; Biotin (Vitamin B_7): 0.01 mg Inositol: 2 mg Choline: 40 mg Linoleic Acid: 20 mg Ascorbic Acid: 5 mg Eicosapentaenoic Acid (EPA): 32 mg Methionine: 10 mg Docosahexaenoic Acid (DHA): 22 mg N-Acetylcysteine: 15 mg	Recommended in dogs and cats for: Healthy growth in puppies and kittens Maintenance of healthy skin and coat Maintenance of general health in geriatric pets, security and watchdogs Optimum immune response immediately after vaccination Optimum fertility in breeding dogs and cats Maintenance of healthy pregnancy in she dogs and queens Improvement of stamina	Puppies, kittens and Cats: ½ soft tablet per day; Dogs up to 15 kg b. wt.: ½ soft tablet per day; Dogs from 15-30 kg b. wt.: 1 soft tablet per day and Dogs above 30 kg b. wt.: 2 soft tablets per day	Bottle of 30 Soft Tablets

Marbomet

Composition :	Indications :	Dosage :	Presentation :
Marbomet 50 mg Each tablet contains: Marbofloxacin – 50 mg Marbomet – 150 mg Each tablet contains: Marbofloxacin – 150 mg	Urinary Tract infections, Respiratory Tract infections, Soft tissue infections and Skin infections	2-5 mg/kg b.wt. administered once daily Orally	Marbomet 50 mg – Strips of 5 tablets Marbomet 150 mg - Strip of 10 tablets

MELONEX Chewable Tablets

Composition :	Indications :	Dosage :	Presentation :
Each uncoated chewable tablet contains: Meloxicam 2.5 mg	Indicated for Arthritis, Osteoarthritis Musculoskeletal disorders, Otitis, Dermatitis and Perioperative Infections	0.2 mg/kg b.wt. on day one, followed by 0.1 mg/kg b.wt. once daily from 2nd day untill desired results are observed	Strip of 10 Chewable tablets

MELONEX Injection

Composition :	Indications :	Dosage :	Presentation :
Each ml contains: Meloxicam 5 mg	Indicated for Arthritis, Osteoarthritis Musculoskeletal disorders, Otitis, Dermatitis and Perioperative Infections	By parental route: I.M.,I.V., or S.C. 0.2-0.5 ml/10 kg b.wt	Vial of 2 ml

MELONEX Suspension

Composition :	Indications :	Dosage :	Presentation :
Each ml contains Meloxicam 1.5 mg	Musculoskeletal conditions like Sprain, Lamness, Colic, Otitis, Arthritis and Osteoarthritis, Degenerative joint disorder, Fracture and Post operative surgical conditions	0.2 mg/kg b.wt. on first day followed by 0.1 mg/kg b.wt. daily Orally	10 ml bottle with dispenser

Micodin MEDICATED SHAMPOO

Composition :	Indications :	Dosage :	Presentation :
Chlorhexidine gluconate 2% w/v Miconazole nitrate 2% w/v	Seborrheic dermatitis (Malasezzia pachydermatis / Staphylococcus) Pruritus,Erythema Exudation, Scaly, Greasy and Smelly skin As an adjunct topical therapy in Pyoderma, Demodicosis.	Apply sufficient shampoo to create a rich lather over the entire body. Allow it to remain on hair for 5 to 10 minutes, and then rinse thoroughly with clean water. Can be repeated initially two to three times a week for four weeks, then reducing to once a week.	100 ml and 200 ml Flip-top bottles

Nayflee Spray

Composition :	Indications :	Dosage :	Presentation :
Fipronil 0.25% w/v	For effective treatment and prevention of all stages of ectoparasites including Flea, Ticks, Lice and Mites in dogs and cats	3-6 ml/kg b.wt. depending on length of body coat. The dose can be achieved with 5-10 pump applications per kg b.wt.	100 ml spray.

Nayflee PLUS
SPOT-ON SOLUTION

Composition :	Indications :	Dosage :	Presentation :
Each pipette (0.5 ml) contains Fipronil- 9.8% w/v (S)-Methoprene- 11.8% w/v	Treatment and control of Fleas, Ticks, Lice and Flea eggs	1 pipette per cat as a spot on	0.5 ml pipettes

Nayflee PLUS

Composition :	Indications :	Dosage :	Presentation :
Each pipette contains Fipronil 9.8% w/v S-Methoprene 8.8% w/v	Treatment and control of flea, flea eggs, ticks and lice infestation in dogs.	1 pipette is a complete dose for corresponding b. wt. 2-10 kg 0.67 ml 10-20 kg 1.34 ml 20-40 kg 2.68 ml More than 40 kg 4.02 ml	0.67 ml, 1.34 ml, 2.68 ml and 4.02 ml pipettes

NEOMEC TABLET

Composition	Indications	Dosage	Presentation
Each uncoated tablet contains Ivermectin 10 mg	Generalised Demodicosis, Scabies, Ear mites and other mange infestations Effective against mature and immature stages of common endoparasite like Ascaris, Hookworms and Whipworms	Dog: 0.2-0.5 mg/kg b.wt. (1/2 - 1 tablet for 20 kg) Sheep, Goat, Calf, Swine and Rabbit: ½ tablet for 25 kg b.wt. Orally	Strip of 5 tablets and Strip of 10 tablets

OPTIPUP

Composition :	Indications :	Dosage :	Presentation :
Each 100 gm contains Essential Amino Acids-Arginine 620 mg, Lysine 770 mg, Methionine 833 mg, Cysteine 100 mg, Taurine 35 mg, Essential Fatty Acids-DHA 400 mg, EPA 100 mg, Linoleic acid 1000 mg, Macro Minerals-Calcium 1000 mg, Phosphorus 800 mg, Sodium 300 mg, Chloride 450 mg, Potassium 600 mg, Magnesium 28 mg, Trace Minerals-Copper 73 mcg, Zinc 2.5 mg, Iron (SunActive) 8 mg, Iodine 28 mg, Cobalt 5 mcg, Selenium 11 mcg, Manganese 25 mcg Vitamins-Vitamin A 1750 IU, Vitamin D_3 280 IU, Vitamin E 5 IU, Vitamin K 28 IU, Thiamine 280 mcg, Riboflavin 420 mcg, Pyridoxine 245 mcg, Niacin 1.8 mg, Folic acid 30 mcg, Calcium Pantothenate 2.10 mg, Choline 35 mg, Vitamin B_{12} 1.05 mcg, Biotin 10.5 mcg, Ascorbic Acid 55 IU, Inositol 20 mg, Probiotics and Prebiotics *Bacillus subtilis* 1 x 10^7 CFU FOS (Fructo-Oligosaccharides) 1 gm MOS (Manno-Oligosaccharides) 0.5 gm	Weaning food, Growth enhancer, Milk replacer. Protein supplement, Food for sick pets, Topping on home food, Improves weight gain, Prevents nutritional deficiencies, Improves immunity	Boil drinking water for 5 minutes and leave it till lukewarm. Then, take the amount of OPTIPUP needed for one serving as and mix it with the warm water. The mixing ratio is 10 gm of OPTIPUP to be dissolved in 30 ml of warm water and in multiples of same. Stir until it turns into a smooth mixture. Use the prepared food within 30 minutes and discard the unused food.	400 gm packs

ORIDOT

Composition :	Indications :	Dosage :	Presentation :
Each ml of suspension contains: Marbofloxacin 3.0 mg Clotrimazole 10.0 mg Dexamethasone acetate equivalent to Dexamethasone 0.9 mg Oil base q.s.	Otitis of both bacterial and fungal origin	Apply ten drops into the ear once daily for 7-14 days. After 7 days of treatment, evaluate the necessity to extend the treatment	10 ml bottle

Ordelyte Pet

Composition :	Indications :	Dosage :	Presentation :
Each 10 ml contains: Glucose 2.23 gm Glycine 0.31 gm Sodium chloride 0.43 gm Monobasic potassium phosphate 0.20 gm Citric acid monohydrate 0.03 gm Potassium citrate 0.01 gm and Excipients q.s	Treatment of mild to moderate dehydration, Helps to recover electrolyte balance, Supports in gastrointestinal upsets and anorexia, Provides effective support for treating diarrhoea and vomiting, Assists with heat-stress, hyperthermia and heat-stroke	Administer orally through dosing syringe or directly in the drinking dish for voluntary consumption. For 40 kg b. wt. - 48 gm powder in 1.5 L - 2 L water For 30 - 40 kg b. wt. - 40 gm powder in 1.25 L - 1.5 L water For 20 - 30 kg b. wt. - 32 gm powder in 1 L - 1.25 L water For 10 - 20 kg b. wt. - 24 gm powder in 750 ml - 1 L water Below 10 kg b. wt. - 16 gm powder in 500 ml - 750 ml water	100 gm pack

PLASMUP Pet

Composition :	Indications :	Dosage :	Presentation :
Each 100 ml contains: Hydroxyethyl starch (130/0.4) 6.0 gm Sodium chloride 0.9 gm Water for injection q.s.	To treat acute hypovolemia and shock in conditions like Blood protozoan diseases, diarrhoea, etc. Treatment and prophylaxis of hypovolemia, Accidental haemorrhages, Surgical blood loss, Severe dehydration, Persistent and bloody diarrhoea, Hemorrhages, burn, Peritonitis, Infectious gastroenteritis	Dog and Cat: 10-20 ml/kg b. wt./day, IV route The daily dose and rate of infusion depend on animal's blood loss. On need for maintenance or restoration of hemodynamic and on hemodilution (dilution effect).	250 ml sterile, non-pyrogenic single dose polyethylene container.

Pomisol EAR DROPS

Composition :	Indication :	Dosage :	Presentation :
Ofloxacin 0.3% w/v Clotrimazole 1.0% w/v Betamethasone Dipropionate 0.025% w/v Lignocaine Hydrochloride 2.0% w/v	Acute and Chronic Otitis extema or Otitis media perpetuated by bacterial and/or fungi Yeast infections like Malassezia pachydermatis	Administer liberally 8–10 drops in each affected ear twice daily.	15 ml bottle

Procott
Dog Soap

Composition:	Indications :	Dosage :	Presentation :
Extracts of *Melia azadirachta, Lawsonia alba, Cocos nucifera, Anethum sowa, Eucalyptus globules, Aloe vera,* Avocado oil and Vitamin E	Regular bath soap for effective conditioning and soothing action on the coat.	Apply Procott soap along with water to work up rich lather. Allow it to remain on coat for 5 to 10 minutes and then rinse thoroughly.	75 gm soap

Procott
PROFESSIONAL

Composition :	Indications :	Dosage :	Presentation :
Melia Azradiracta 5 gm *Lawsonia Alba* 5 gm *Embellica officinalis* 3.3 gm *Centilla Asiatica* 10 gm *Aloe Barbadensis* 10 gm *Trigonella Foenum graecum* 7 gm *Withania Somnifera* 5 gm *Camella Sinensis* 5 gm *Terminalia chebula* 3.3 gm Rose Petals 4 gm Lemon grass 2.5 gm Avocado oil 4 gm Macadamia oil 2gm Coconut oil 5 gm Vitamin E 200 IU Excipents q.s	Concentrated grooming shampoo for regular bathing	Dilution ratio of 1 part shampoo to 10 parts water, based on coat type	1 liter Bottle with pump

Procott SHAMPOO

Composition :	Indications :	Dosage :	Presentation :
Each ml contains extracts of *Melia azadirachta* 17.5%, *Lawsonia alba* 17.5%, *Cocos nucifera* 6%, *Anethum sowa* 5%, *Eucalyptus globules* 3%, *Aloe vera* 3%, Avocado oil 1%,Vitamin E_2%, Lemon grass: 0.5% Macadamia oil : 0.05%	Herbal shampoo for getting rid of foul odour, Effective Soothing, Cooling and Protecting against Allergy	Apply Procott shampoo liberally to work up rich lather. Allow it to remain on coat for 5 to 10 minutes and then rinse thoroughly with clean water.	275 ml and 500 ml bottles

SELGINPET

Composition :	Indications :	Dosage :	Presentation :
Each uncoated chewable tablet contains: Selegiline hydrochloride: 10 mg	For control of clinical signs of behavioural changes associated with cognitive dysfunction syndrome (CDS) and uncomplicated pituitary dependent hyperadrenocorticism (PDH) in middle-aged and senile dogs and cats.	The recommended dosage for control of clinical signs associated with Canine CDS is 0.5-1.0 mg/kg once daily and Feline CDS is 0.25-0.5 mg/kg once daily. For control of clinical signs associated with Canine PDH the dose is 1.0 mg/kg once daily and Feline PDH is 0.5 mg/kg. If no improvement is observed after 1-2 months of therapy, dosage may be increased to maximum of 2.0 mg/kg and 1.0 mg/kg once daily for dogs and cats respectively.	Strips of 10 tablets

Serliv

Composition :	Indications :	Dosage :	Presentation :
Active ingredients per soft chews *Valeriana wallichii* (tagar) extract - 300 mg Thiamine mononitrate 100mg Ginger 100 mg L-tryptophan 50 mg Jatamansi (spikenard) extract 300 mg Ashwagandha extracts 100 mg	Calming supplement for dogs and cats	Below 10 kg - 1 chewable tablet 10-25 kg - 2 chewable tablets Above 25 kg - 3 chewable tablets	Strips of 3 chewable tablets

SOFTAS SHAMPOO

Composition :	Indications :	Dosage :	Presentation :
Permethrin 1% w/w *Aloe Vera* 0.5% w/w	Ectoparasitic infestation of Ticks, Fleas and Lice	Apply Softas shampoo liberally to work up rich lather. Allow to remain in coat for 5 to 10 minutes and then rinse thoroughly with clean water. Softas shampoo can be used on all dogs except nursing bitches and pups under 3 months of age.	200 ml bottle

SOFTAS SOAP

Composition :	Indications :	Dosage :	Presentation :
Permethrin 1% w/w *Aloe Vera* 0.5% w/w	Ectoparasitic infestation of Ticks, Fleas and Lice	Apply soap liberally to work up rich lather. Allow soap to remain on coat for 5 to 10 minutes and then rinse thoroughly with clean water.	75 gm soap

SOFTASMAX SOAP

Composition :	Indications :	Dosage :	Presentation :
Permethrin 2% w/w Miconazole 2% w/w *Aloe Vera* 0.5% w/w	Ectoparasitic infestation of Ticks, Fleas, Lice and fungal infestation	Apply Softas max soap liberally to work up rich lather. Allow lather to remain in coat for 5 to 10 min and then rinse thoroughly with clean water.	75 gm soap

SOFTASPLUS SHAMPOO

Composition :	Indications :	Dosage :	Presentation :
Permethrin 2% w/w *Aloe Vera* 0.5% w/w	Ectoparasitic infestation of Ticks, Fleas and Lice	Apply Softas plus liberally to work up rich lather. Allow lather to remain in coat for 5 to 10 min and then rinse thoroughly with clean water.	200 ml bottle

SOFTASMAX Shampoo

Composition :	Indications :	Dosage :	Presentation :
Permethrin: 2% w/v Miconazole: 2% w/v *Aloe Vera:* 0.5% w/v	For treatment and control of stubborn ectoparasites, fungal infections and associated alopecia	Apply shampoo liberally to workup rich lather. Allow leather to remain on coat for atleast 5 -10 min. and then rinse thoroughly with clean water. Use 2-3 times a week initially, followed by once weekly or as per need.	Bottle of 200 ml

SOOTHE & SHINE

Composition :	Indications :	Dosage :	Presentation :
Oatmeal 2% *Aloe vera* Extract 3% Vitamin E 200 IU Vitamin A 10 IU Fruit extracts of Papaya, Mango and Guava 3000 mg Natural fragrance vanilla/almond	Regular bathing shampoo for dog, especially made for sensitive and dry skin	Apply the appropriate amount tailored to your pet's specific breed and coat type for best results	200 ml Bottle with pump

SYNOCUR

Composition :	Indications :	Dosage :	Presentation :
Each ml contains: Pentosan polysulfate sodium 100 mg Benzyl alcohol 0.01 ml Water for Injections q.s.	Osteo-arthritis (non-infectious arthrosis), especially in condition affecting multiple joints Osteo-chondrosis dissecans Traumatic joints Peri-articular inflammation Lameness Degenerative joint disease	3 mg / kg b. wt. given intramuscularly or subcutaneously with an interval of 5 - 7 days between each injection for a period of 4 weeks. Repeat with a gap of one month. The course of treatment is to be given 3 times a year depending on the animal recovery.	2 ml vial

SynoPet

Composition :	Indications :	Dosage :	Presentation :
Each 4 g contains Glucosamine 440.92 mg Chondroitin sulphate 352.74 mg Methyl sulfonylmethane 200 mg EPA and DHA 50 mg Curcumin 6.3 mg Bromelain 18 mg Manganese 40 mg Ascorbic acid 30 mg Vitamin E 10 IU	Joint supplement for assisting and supporting older dogs in preventing wearing and tearing of cartilages, tendons and ligaments Aids faster fracture healing process Helps in faster recovery during convalescence of surgical procedure Supports animal during stress and straining Other includes hip dysplasia, Arthritis, Joint disorders	Dogs-Upto 10 kg- 4 gm daily (1 scoop) Upto 10-20 kg - 6 gm daily (1and ½ scoop) Above 20 kg- 8 gm daily (2 scoop) Cats- upto 5 kg-2 gm daily (1/2 scoop) Above 5 kg-4 gm daily (1 scoop) Orally	120 gm bottle

SynoPet HA

Composition :	Indications :	Dosage :	Presentation :
Each tablet contains: Glucosamine HCl – 450 mg Chondroitin sulphate – 330 mg Hyaluronic Acid – 18 mg Dimethylglycine- 100 mg Methylsulfonylmethane (MSM) – 200 mg EPA and DHA – 50 mg Curcumin – 6.3 mg Manganese glycinate – 40 mg Bromelain – 18 mg Ascorbic acid – 30 mg Vitamin E - 10 IU *Boswellia serrata* – 50 mg	Management of osteoarthritis, hip and elbow dysplasia Support older dogs in preventing routine wear and tear of cartilage, tendons and ligaments Strengthening the joints in growing animals and watch dogs	15- 20 kg b.wt -1 Tab/ day 20 kg - 40 kg b. wt. - 2 Tab/ day Over 40 kg b. wt. - 3 Tab/ day Orally	Strip of 15 tablets

TakfaPet

Composition :	Indications :	Dosage :	Presentation :
Lipid based Tacrolimus 0.02% w/v Alpha Tocopherol 0.006%	Canine Atopic Dermatitis	Twice daily till symptoms disappear	50 ml spray bottle

TRIBIVET

Composition :	Indications :	Dosage :	Presentation :
Each ml contains: Thiamine Hydrochloride 50 mg Pyridoxine Hydrochloride 50 mg Cyanocobalamin 500 mcg	During liver distress and damage, Convalesence, Debility, Anaemia and Dyspepsia. Adjunct to antibiotics and dewormers. During pregnancy and lactation.	Dog and Cat: 0.5-2 ml. IM or IV route	2 ml vial

Zip Vit

Composition :	Indications :	Dosage :	Presentation :
Each 10 ml contains Vit A 1000 IU, Vit D_3 80 IU, Vit E 5 IU, Vit B_1 2 mg, Vit B_2 2 mg, Vit B_3 10 mg, Vit B_5 10 mg, Vit B_6 2 mg, Folic Acid 1 mg, Vit B_{12} 5 mcg, Choline 60 mg, L- Threonine 26 mg, L- Valine 30 mg, L- Methionine 12 mg, L- Isoleucine 16 mg, L- Leucine 20 mg, L- Phenyl alanine 22 mg, L- Tryptophan 10 mg, L- Lysine 44 mg, L- Arginine 65 mg, L- Histidine 10 mg, L- Carnitine 20 mg, Ornithine 8 mg, L- Cysteine 4 mg and Taurine 50 mg	Debility, Dyspepsia, Boosts Immunity, During all phases of Pregnancy, In convalescence and recovery period, Post Anti-infective, Post-Operative care and Post-deworming	Dogs and Cats: 0.5 ml/kg b. wt. twice daily Pregnant and Lactating dogs, cats and their young ones: 2 ml/ 3 kg b. wt. weight, twice daily Birds: 0.2 ml/ bird, twice daily (considering b.wt. of 500 gm per bird) Orally	200 ml bottle

Zip Vit Drops

Composition :	Indications :	Dosage :	Presentation :
Each ml contains L-Arginine-2 mg, L-Histidine - 0.1 mg, L-Isoleucine-0.7 mg, L-Leucine - 2.2 mg, L-Lysine-4 mg, L-Methionine-1 mg, L-Phenyl alanine – 0.6 mg, L-Threonine-0.5 mg, L-Tryptophan - 0.5 mg, L-Valine -0.8 mg, Taurine-1 mg, L-Glutamine-3 mg, L-Cysteine-0.5 mg, Choline - 10 mg, Biotin-0.2 mcg, DHA -0.2 mg, Ornithine-1 mg, Vitamin A - 800 IU, Vitamin D_3 -400 IU, Vitamin E - 6 mg, Vitamin B_1-0.6 mg, Vitamin B_2 -1.3 mg, Vitamin B_3-4 mg, Vitamin B_5 - 4 mg, Vitamin B_6 - 0.5 mg, Vitamin C - 50 mg, Vitamin B_9 - 50 mcg, Vitamin B_{12} - 1 mcg	For Healthy growth in puppies, kittens and birds Ensure sociability and trainability in little ones For Better Immune response after vaccination To prevent nutritional deficiency conditions in growing animals	For Puppies: 2-6 weeks of age Small Breeds – 0.5 ml to 0.75 ml daily Large Breeds – 0.75 ml-1 ml daily 6-10 weeks of age Small Breeds – 1 ml to 1.5 ml daily Large Breeds- 1.5 ml to 2 ml daily Kittens: 0.25 ml daily Pet Birds: 0.1-0.15 ml daily Orally	30 ml bottle with dispensing dropper

NUVO
A Division of Intas Animal Health

ZooLac PROPASTE

Composition :	Indications :	Dosage :	Presentation :
Lactobacillus acidophilus as a postbiotic	Control and Prevent Diarrhea Regulation of intestinal microflora due to imbalance or dysbiosis Prevention of secondary adverse effects of oral antibiotic treatment Controls and prevents secondary microbial gut contamination Prophylaxis during critical periods like stress, parturition, lactation, transportation, climate, food alteration etc.	<10 kg -1 ml, 10-25 kg- 2 ml, 25-50 kg- 3 ml >50 kg- 5 ml 2-3 times daily Orally	15 ml and 32 ml pre-filled feeding syringe

Zymopet

Composition :	Indications :	Dosage :	Presentation :
Each 5 ml contains: Alpha-Amylase 50 mg Papain 6 mg Cinnamon oil 0.2 mg Cardamom oil 0.4 mg Caraway oil 0.4 mg Dill oil 0.05 ml Fennel oil 0.0035 ml	Digestive upsets, Inappetence, Abdominal cramps, Gripping colic, Flatulence and Low weight gain	Pups: 0.5 ml-1 ml B.I.D. Small Breeds: 1 ml-1.5 ml B.I.D. Large Breeds: 1.5ml-2ml B.I.D. Cats: 0.5 ml-1 ml B.I.D. Orally	30 ml bottle along with feeding dropper

Comprehensive Approach for Tough Fungal Dermatitis. Uncompromised Efficacy with Safety!

Izopet
Itraconazole Oral Solution
Uncompromised Efficacy Against Pathogenic Fungi

Conaseb
Ketoconazole Shampoo
Innovation in Management of Recurrent Dermatitis

ASIMOULT

Composition :	Indications :	Dosage :	Presentation :
Chelated Macro and Micro Mineral Supplement	Stimulates and Regulates Moulting. Prevents and controls loose shell disease in Shrimps and Prawns. Helps for quick formation of hardened outer shell layer Acts as growth promoter in Shrimps and Prawns Makes the Shrimp and Prawn strong to fight diseases	1 kg in 100 kg of Feed during the highly critical phase of Moulting on a regular basis	1 kg bag

BACZIL

Composition :	Indications :	Dosage :	Presentation :
Synergistic blend of Essential oils, Medium chain glycerides, Nucleotides, Oligosaccharides, Fermentation extracts, Minerals and extracts of *Curcuma longa*, *Ocimum sanctum* etc.	Protects against pathogenic bacteria (including vibrio) and fungi Helps in increasing nutrient absorption Eliminates the additional use of synthetic anti-bacterials and anti-fungals	Regular Application - 0.5 gm/kg feed For curative use - 1 gm/kg of feed	100 gm bottle with measuring spoon

Eraze WFS

Composition :	Indications :	Dosage :	Presentation :
Nanobiotechnology based IgY antibodies fortified with Silver Nanoparticles, immunity enhances and Natural Herbal Extracts	Prevent Vibrio attack on shrimp cells / tissue Fight and Neutralizes Vibrio and Gregarines Increases shrimp immunity and prevents Secondary infection Minimizes Cannibalism and Maximizes Survivability Minimizes Feed Wastage and Optimizes FCR	Prevention - 5 gm/kg feed in two alternate meals from 7th day of culture (DOC) and continue till end of culture Post-Infection - 5 gm/kg feed in all four meals for seven days followed by 5 gm/kg feed in two alternate meals for seven days	1 kg jar

Eraze WSS

Composition :	Indications :	Dosage :	Presentation :
Nanobiotechnology based IgY antibodies fortified with Silver Nanoparticles, Immunity enhances and natural herbal extracts	Prevent white spot syndrome (WSS) virus entry into shrimp cells / tissue Fight and Neutralizes WSS Virus Increases Shrimp Immunity and Prevents Secondary Infection Minimizes Cannibalism and Maximizes Survivability Minimizes Feed Wastage and Optimizes FCR	5 gm/kg feed in All four meals for 7 days – followed by 5 gm/kg feed in two alternate meals for seven days From 7th day of culture (DOC)-If prone areas with history of WSS - Continue in alternate meal @ 5 gm/kg feed – till end of culture	1 kg jar

FAB EAST

Composition :	Indications :	Dosage :	Presentation :
Biologically Active *Saccharomyces cerevisiae* with Mineral, Vitamins, Amino Acids and Specialized Growth factors	Improves digestion, weight gain and Optimizes FCR Promotes healthy cartilage, exoskeleton and skin. Anti-bacterial and Anti-protozoal properties Enhance Immunity. Helps in Plankton development - Stabilizes pond pH	Feed – 10 gm/kg Plankton development - 500 gm for 50 litres slurry For pond application- 1 kg/ acre or as directed by Aquaculture consultant	1 kg polybag

GERMICIDAA

Composition :	Indications :	Dosage :	Presentation :
Each gm contains Sodium chloride: 1.5% w/w and salt containing Potassium mono-persulphate/ Potassium hydrogen sulphate/ Potassium sulphate: 49.8% w/w	For effective control of virus, bacteria, fungi and molds in pond's ecosystem.	Before Stocking – 1 kg/ acre During Culture – 0.5 kg/ acre repeat every 21 days For Treatment – 1 kg/ acre repeat every 3-4 days	500 gm bottle and 5 kg bucket

Gropomo AQUA

Composition :		Indications :	Dosage :	Presentation :
Each 100 gm contains:		Enhance growth and survival of seed and post larva in fish, prawn and shrimp Improves health and strength	1 kg in a ton of feed	1 kg jar
Vitamin A	500000 I.U			
Vitamin D	329000 I.U			
Vitamin E	200 I.U			
Vitamin B_1	300 mg			
Vitamin B_6	60 mg			
Vitamin B_{12}	400 mcg			
Vitamin K	40 mg			
Nicotinamide	1.32 gm			
Calcium pantothenate	440 mg			
Folic acid	10 mg			
Choline chloride	150 mg			
L-Lysine	1 gm			
L-Methionine	2 gm			
L-Tryptophan	20 mg			

Growout

Composition :	Indications :	Dosage :	Presentation :
A Synergistic blend of Non-chemical, Non-toxic and Geologically Complex Nano-biotechnology based Siliceous Micronutrients *viz*. Si, Fe, Ca, Mg, Mn, Al, phosphorous and nitrogen	Increases the Photosynthetic capacity of the pond. Creates Live feed in the pond. Important for PL shrimp and fish Fingerlings after stocking. Reduces Usage of feed during blind feeding phase. Optimizes feeding efficiency and FCR. Reduces the overall feed utilization. Boosts Immunity and reduces disease incidence.	Fill the water after pond preparation. Use disinfectant (Germicidaa) and leave water for 48-72 hours. Apply Growout @ 10-15 kg/ acre in the morning @ 08 AM. Release Post larvae / Fingerlings after 24- 48 hours. During Running culture - Apply Growout @ 5-10 kg/ acre once every 15 days of culture in the morning @ 08 AM. Do not feed for 2 hours before and after application	10 kg bags

Livotas Gel

Composition :	Indications :	Dosage :	Presentation :
Each 10 ml contains extracts derived from *Andrographis paniculata* 400 mg *Eclipta alba* 300 mg *Phylanthus niruri* 250 mg *Boerhavia diffusa* 100 mg *Picrorhiza kurroa* 50 mg *Cichorium intybus* 50 mg *Silybum marianum* 100 mg *Traxacum officinalis* 50 mg *Curcuma longa* 100 mg *Glycrrhiza glabra* 100 mg	Improves functional efficiency of Liver and Hepatopancreas Promotes digestibility and better utilization of nutrients Bio-neutrallises toxins and chemicals in feed and water Helps early harvesting	10 ml/kg of feed upto 10 weeks 25 ml/kg of feed, 11 weeks and onwards	5 ltr jar and 30 ltr drum

MilpOnd Hydro

Composition :	Indications :	Dosage :	Presentation :
Each gm contains Bacillus sp., Lactobacillus sp., Saccharomyces sp. and Aspergillus sp.- 2 Billion CFU and Enzymes	Removes organic load and reduces pollution of pond, Reduces ammonia levels, Inhibits pathogenic bacteria and toxin release, Ensures healthy environment by reducing BOD and increasing DO levels, Reduces water exchange frequency, Reduces the mortality rate of prawn, fish and shrimp	As per the age of the stock and the stocking density	250 gm pack

MilpOnd Terra

Composition :	Indications :	Dosage :	Presentation :
Each ml contains Rhodococcus and Rhodobacter sp.– 2 Billion CFU	Utilizes H_2S and Biodegrades sludge Maintains Optimum Scale of Water pH Increases Beneficial Microorganism communities	For Pond Preparation: 5 to 10 ltr/acre. During Culture Period: 5 to 10 ltr/acre. Repeat after 15 days. For better result do weekly rotation of Milpond Hydro and Terra	20 ltr jar

MilpOnd Vital

Composition :	Indications :	Dosage :	Presentation :
Each 500 gm contains 750 Billions CFU of Bacillus subtilis	Promotes life of prawn and shrimp Reduces digestive upsets and improves gut conditions. Aids in digestion and absorption. Synthesizes B-Complex and Vitamin-K, Prevents auto- intoxication and restores bowel health. Improves feed utilization and FCR.	Prawn and Shrimp: 10 gm/kg feed Fish: 5 gm/kg feed	500 gm pack

MilpOnd Vital Plus

Composition :	Indications :	Dosage :	Presentation :
Each gm contains Bacillus sp., Lactobacillus sp. and Saccharomyces sp. – 430 Million CFU fortified with enzymes, Vitamins, Herbal Mineral Complex, Spirulina and Sea weed extract	Ensures healthy balanced gut microflora and improves feed utilization, enhances FCR and reduces digestive upsets Reduces adverse effects of pathogens Enhances immune response, reduces disease incidence and mortality. Improves growth, resistance and quality of Shrimp, Prawn and Fish	Prawn and Shrimp: 10 gm/kg feed Fish: 5 gm/kg feed	250 gm pack

Minfa Active

Composition :	Indications :	Dosage :	Presentation :
Copper, Cobalt, Magnesium, Iron, Zinc, Iodine, Bioactive Chromium, DL-Methionine, L-Lysine Mono Hydrochloride, Calcium and Phosphorus	For Maintenance of health, growth and productivity of fish, shrimp and other aquatic animals. Also provides nutrient balance in pond water	Shrimp and Fish – 10 gm/kg feed Recommended Use: For optimum mineral concentration During Pond Preparation: 10 kg/acre, During Culture Period: 10-20 kg/acre once in every 15 days	10 kg bag

Minfa Aqua

Composition :	Indications :	Dosage :	Presentation :
A Unique combination of minerals	Helpful in osmoregulation and metabolic functions. Higher survival rate and optimum growth. Ensure higher production.	For use in pond. During culture: 5-10 kg/ acres on regular basis	10 kg polybag

Minfa-FS

Composition :	Indications :	Dosage :	Presentation :
Mineral Mixture of Calcium, Copper, Cobalt, Zinc, Magnesium, Phosphorus, Potassium, Iodine and Sulphur.	Optimum production and maintenance of healthy stock of fish, prawn, shrimp and other aquatic animals.	Shrimp and Fish: 10 gm/kg feed Recommended Use: During pond preparation: 15 kg/acre. During Culture: 10-20 kg/acre, Repeat once in every 15 days.	10 kg and 30 kg polybags

ODOJECT

Composition :	Indications :	Dosage :	Presentation :
Concentrated Yucca Extract (30%) fortified with Probiotics and Natural Bacterial Growth Stimulants	Reduces and eliminates toxic ammonia, H_2S and other noxious gases. Degrades organic waste and detoxifies pond water. Promotes healthy pond environment and reduces mortality rates.	For avoiding ammonia accumulation: 500 gm/acre once every 15 days. In case of high ammonia accumulation use for 2 days in row	500 gm and 1 kg packs

Oxygro

Composition :	Indications :	Dosage :	Presentation :
Nutrients that help to produce oxygen for long duration in aquaculture ponds	Releases dissolved oxygen levels and enhances the total DO levels in the pond. Helps to reduce COD , BOD and toxic gases/pond pollution. Reduces Nitrite and Hydrogen sulfide level.	1 kg per hectare of pond in low oxygen levels 3-5 kg per hectare of pond in severe oxygen deficiency	500 gm and 2 kg jars

Oxygro FA

Composition :	Indications :	Dosage :	Presentation :
Nutrients for faster Oxygen production in aquaculture ponds	Releases dissolved oxygen levels and enhances the total DO levels in the pond. Helps to reduce COD, BOD and toxic gases/ pond pollution. Reduces Nitrite and Hydrogen sulfide level.	For resolving surfacing of Shrimp/ Fish: 4-6 kg/hectare For increasing feed intake: 3 kg/ hectare For increasing Moulting Efficiency and detaching Zoothamnium after moulting: 6 kg/ hectare	2 kg jar

POLUZAP

Composition :	Indications :	Dosage :	Presentation :
Natural Zeolite	Binds and neutralises toxins Purifies and Improves water quality Improves dissolved oxygen content Absorbs Ammonia, H_2S, CO_2 and other poisonous gases Absorbs bad odors and makes the habitat clean and healthy	Pond preparation 50 kg/acre During culture 15-20 kg/acre	25 kg polybag

REMORBUS

Composition :	Indications :	Dosage :	Presentation :
Each 100 gm has nutritional value of: Vitamin C: 50 gm Protein hydrolysate: 10 gm Vitamin B_{12}: 10 mcg Amla: 5 gm	For Superior Immunity and Disease Resistance Better Feed Intake, FCR and Enhanced Growth Rate Superior chitin synthesis	0.5 to 2.0 gm/kg of feed regularly	1 kg jar

SANIPOND

Composition :	Indications :	Dosage :	Presentation :
Each 100 gm contains: Didecyldimethyl Ammonium Chloride: 7 gm	Broad spectrum bactericidal, fungicidal and mould inhibitor Active even in presence of organic matter Stablizes pond water pH Safe for Zooplankton and Phytoplankton	5 to10 lit/ha pond with an average depth of 1 meter For treatment @ 5 to 10 ltr/ha for 1 meter depth	500 ml bottle and 5 ltr jar

SoilFix

Composition :	Indications :	Dosage :	Presentation :
Each gm contains 5 billion CFU Probiotic strains of: *Bacillus subtilis* *Bacillus licheniformis* *Bacillus polymyxa* *Bacillus megaterium* *Bacillus circulans* *Bacillus coagulans*	Biodegrades sludge, Increases beneficial Microbiota Reduces organic load Enhances natural nitrification cycle for oxidizing ammonia to form nitrites and nitrates Utilizes and restricts further development of H_2S and other noxious gases Maintains the optimum scale of water pH Improves overall soil quality Increases pond productivity Improves shrimp / fish / aquatic animal health	For prevention of organic waste accumulation 300 gm/ acre of pond area with one meter depth, Once every 15 days For reducing accumulated organic waste 500 gm/ acre of pond area with one meter depth	1 Kg bucket

3DX-P

Composition:	Indications :	Dosage :	Presentation :
Didecyl Dimethyl Ammonium Chloride (DDAC)-7.5% N-Akyl-N-Benzyl-N, N-Dimethyl Benzyl Ammonium Chloride-5% Poly (Hwhamethylene) Biguanide Hydrochloride	Disinfectant for Routine Use For spray in Presence of Bird Biosecurity Water Sanitation	Spray : 5 ml / litre of water Water sanitation: 1 ml/ 5 litre of water	1 and 5 ltr. bottle

Altenol-BT

Composition :	Indications :	Dosage :	Presentation :
Ca-butyrate Soluble tanin	For ensuring better gut integrity, Improving gut health and Reducing wet dropping	200-500 gm/ton of feed	15 kg bag

Avired

Composition:		Indications :	Dosage :	Presentation :
Each 10 ml contains :		Anemia and Dermatitis, Improving body weight and FCR	Chicks : 30-50 gm/ 1000 bird Grower : 50 gm/ 1000 birds Broiler : 200 gm/ 1000 birds Layer: 200 gm/ 1000 birds Breeder: 400 gm/ 1000 birds	1 kg, 5 kg and 20 kg packs
Ferric Ammonium Citrate	625 mg			
Copper Sulphate	50 mg			
Cobalt Chloride	1 mg			
Folic Acid	0.75 mg			
Vit B_{12}	50 mcg			
Malt extract	2.15 gm			
Vit D_3	875 IU			
Niacinamide	27 mg			
Biotin	150 mcg			
Vit A	500 IU			
Vit C	6.25 mg			
Vit K	1.26 mg			
Vit E	2.5 mg			
Selenium	1 mg			
Zinc sulphate	25 mg			

Desofur

Composition :	Indications :	Dosage :	Presentation :
Ceftiofur Sodium - 4 gm	To control *E. coli* infection to reduce Early Chick Mortality (ECM)	0.2 mg in day old chick	4 gm vial

enzytas XL

Composition :	Indications :	Dosage :	Presentation :
Blend of Enzymes, Phytase and Direct Feed Microbes	For Maximal Utilization of NSP Least Cost Feed Formulation	250 gm/ton of feed	25 kg bag

Galvotyl

Composition :	Indications :	Dosage :	Presentation :
Tylvalosin 3% and Chlortetracycline 9%	Prevention and Treatment of Mycoplasma	Broiler: 200 gm/ton of feed Breeder and Layer : 500 gm/ton of feed	5 kg drum

Galvotyl Plus

Composition :	Indications :	Dosage :	Presentation :
Tylvalosin Tartrate - 62.5% W/W	Drug of choice for respiratory infection Prevention and treatment of Mycoplasmosis	20-25 mg/kg b.wt.	250 gm and 1 kg packs

GERMICIDAA-P

Composition :	Indications :	Dosage :	Presentation :
Potassium Monopersulphate Compound 49.8%, Potassium Monopersulphate, Potassium Hydrogen sulphate, Potassium Sulphate (triple salt) and Sodium Dichloroisocyanurate 5%	For Water Sanitization, as Spray for Terminal disinfection Hatchery spray/mop, Foot-dip	1 gm/ 5-10 litre of water	100 gm and 500 gm bottle

Glosacc AV

Composition :	Indications :	Dosage :	Presentation :
Amino Acids, Vitamins, Minerals, Organic Acid and Plant Extracts	To Promote Growth To Overcome Nutritional Deficiency	1 ml/ltr. of Drinking water	1 ltr. bottle

Glovimix-FS

Composition :	Indications :	Dosage :	Presentation :
Organic acids and salts : Acetate, Acetic acid, Formic acid, Fumaric acid, Ca propionate, Sodium benzoate, Sodium Citrate, Sodium Metabisulfite, Calcium lactate, Phosphoric acid HSCAS etc.	Feed and Gut acidifier	1-2 kg/ton of feed	30 kg drum

GutShine-ws

Composition :	Indications :	Dosage :	Presentation :
Probiotics 5.5* 10^9 cfu/g, Prebiotics, Enzymes and Natural Growth Promoters	Wet manure, Rejuvenation of gut microflora	100 gm/ton 1 gm/lit of water	500 gm pack with measuring spoon

HEPATAS

Composition :	Indications :	Dosage :	Presentation :
Liver extract, Choline Chloride, Yeast Extract, Vitamins, Amino Acids and Minerals	Liquid Liver Supplement	15 ml/100 birds	1 ltr. and 5 ltr. bottle

HEPATAS-FS

Composition :	Indications :	Dosage :	Presentation :
A Blend of Choline chloride, Tricholine citrate, DL-Methionine, Protein hydrolysate, Live Yeast, Liver Extract, Iron, Zinc, Copper, Vit E and Selenium, Methyl donors in a base of liver stimulant herbs	Hepatic Stimulant and Production Enhancer	500 gm-1 kg/ton of feed	25 kg bag

Immutas WS

Composition :	Indications :	Dosage :	Presentation :
Beta-glucans, Nucleotide and Immuno nutrients	Immuno-booster	100 ml/ 1000 birds	1 liter bottle

Immutas Plus

Composition :	Indications :	Dosage :	Presentation :
Beta Glucans, Nucleotide and Immuno nutrients	Immuno-booster	100 gm/ton of feed	10 kg bag

Intachol

Composition :	Indications :	Dosage :	Presentation :
Bioactive Phytochemicals : Phyllanthin, Andrographolide, Bitter and Betain	To Improve Liver health To prevent Fatty Liver condition	500-1000 gm/ton of feed	25 kg

Intamulin-10

Composition :	Indications :	Dosage :	Presentation :
Tiamulin Hydrogen Fumarate 10% w/w	Prevention of Mycoplasma, Spirochetes and other Gram positive bacteria	200 gm/ton feed	1 kg and 25 kg bags

Intamulin-80

Composition :	Indications :	Dosage :	Presentation :
Tiamulin Hydrogen Fumarate 80% w/w	Prevention and treatment of Mycoplasma, Spirochetes and other Gram positive bacteria	In Water : Treatment : 38-50 mg/kg b. wt., Prevention: 19-25 mg/kg b. wt., In Feed: Treatment: 40-50 gm/ 100 kg for 3-5 days. Prevention: 20-25 gm/ 100 kg for 2 days at an interval of 3-4 weeks	1 kg jar

INTATOX

Composition :	Indications :	Dosage :	Presentation :
Repotentiated HSCAS and Dipolar Clay Illitis	Mycotoxin Binder	1 kg/ton of feed (below moisture level 15%); 1.5 kg/ton of feed (above moisture level 15%	25 kg bag

Intavit-P

Composition :	Indications :	Dosage :	Presentation :
Each ml contains: Vitamin A concentrate oil (as palmitate)- 2000 IU Vitamin D_3 -2000 IU α- Tocopheryl acetate (Vitamin E)-4 mg, Niacinamide-10 mg, Thiamine Hydrochloride-10 mg, Pyridoxine Hydrochloride - 5 mg, Riboflavin Sodium Phosphate-1 mg, D-Panthenol-1 mg, Vitamin B_{12}-10 mcg, D-Biotin-10 mcg, Calcium glycerophosphate- 10 mg Phenol- 0.5% w/v	Prevention and Treatment of Metabolic disorders and as adjunct therapy in disease outbreaks for restoration	0.5 ml-1 ml/kg b.wt.	100 ml vial

Klengard-P

Composition :	Indications :	Dosage :	Presentation :
Each tablet contains: Sodium Dichloroisocyanurate (NaDCC): 5 gm	Water sanitizer and disinfectant	1 tab for 1600-1200 litres	Container of 10 tablets

Lecitas

Composition :	Indications :	Dosage :	Presentation :
Phospholipids, Lysophospholipids, Lysolipids, Lysophosphatidylcholine, Bile Salts, Lipase	For Efficient Digestion of Fat	500 gm/ton of feed	25 kg bag

Minotas-AV

Composition :	Indications :	Dosage :	Presentation :
Each kg contains: Zinc : 60 gm Manganese : 60 gm Copper : 10 gm Iron : 60 gm Cobalt 400 mg Chromium 200 mg Iodine : 2 gm Selenium : 300 mg	Mineral Deficiency	Broiler and Layer : 500 gm/ton of feed; Breeders: 1 kg/ton of feed	25 kg bag

NEOMEC-P

Composition :	Indications :	Dosage :	Presentation :
Ivermectin 0.08% w/v	Endo-ectoparasiticidal	1 ml/ 2.5 kg b.wt.	1 ltr. and 5 ltr. bottle

Ordelyte

Composition :	Indications :	Dosage :	Presentation :
Each gm contain : Sodium chloride 8 mg Potassium chloride 50 mg Sodium Bicarbonate 30 mg Sodium acid phosphate 8 mg Sodium citrate 65 mg Calcium lactate 17 mg Magnesium sulphate 10 mg Vitamin C 13 mg Lactose 5 mg Betain 5 mg Glycine 2.5 mg Lactobacillus spore 30 million	Electrolyte	1-2 gm/ltr. of water or 1 kg/ton of feed	1 kg and 20 kg drum

Phiva-10

Composition :	Indications :	Dosage :	Presentation :
Phytase Enzyme 10,000 IU/gm	For better digestion of phytates	50 gm/ton of feed	10 kg bag

PULMOLIV BH

Composition :	Indications :	Dosage :	Presentation :
Each ml contains Levofloxacin hemihydrate - 100 mg Bromhexine hydrochloride - 7.5 mg	To control and treat respiratory infections like CRD, Salmonellosis, Coryza, Collibacillosis	10 mg/kg b.wt. or 1 ml 10 kg b.wt. Orally	1 lit. and 5 lit

RUNEON

Composition :	Indications :	Dosage :	Presentation :
Bile acid 30%	Emulsifier and Hepotoprotector	150 gm/ton	1 kg bag

Subtide

Composition :	Indications :	Dosage :	Presentation :
Antimicrobial Peptide, Cecropin II and *Bacillus subtilis*	For control and management of Necrotic enteritis	100 to 200 gm/ton of feed	1 kg pack

Tylomax

Composition :	Indications :	Dosage :	Presentation :
Each ml contains Tylosin Tartrate 200 mg	To prevent and treat Chronic Respiratory Disease (CRD)	10 mg/kg b.wt.	100 ml vial

Veterinary Footprints

Lyon Veterinary College (1761)
World's First Veterinary College

Lahore Veterinary College (1882)
First Veterinary College of
Unpartitioned India

Bombay Veterinary College (1886)
India's First Veterinary College

Imperial Veterinary Research Institute,
Mukteshwar (1893)

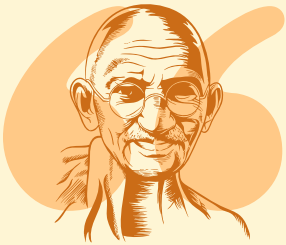
Veterinary Footprints

Remount Veterinary Corps Centre and College (RVCC & C), Meerut (1920)

Mahatma Gandhi and Jill Cow at ICAR-NDRI, Bengaluru (1927)

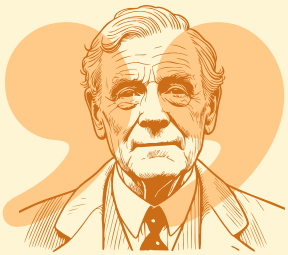
Tamil Nadu Veterinary and Animal Sciences University (TANUVAS), Chennai (1989)
First Veterinary University

Tata Trust Small Animal Hospital, Mumbai (2024)
India's Largest Tertiary Care Hospital For Pets



"The greatness of a nation and its moral progress can be judged by the way its animals are treated"
– Mahatma Gandhi

"If having a soul means being able to feel love and loyalty and gratitude, then animals are better off than a lot of humans."
- Dr. James Harriot



"Some people talk to animals.
Not many listen though.
That's the problem"
– A.A. Milne

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INTAS ANIMAL HEALTH

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