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Ministry of Labor and Skills

ANIMAL HEALTH

Level – II

Based on March, 2022 Version -4 Occupational Standard



Module Title: Identifying Basic Veterinary Drugs and Chemicals

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Ministry of Labor and Skills

Table of Contents

Introduction to the Module 1

LO #1- Identify the importance and sources of drugs 2

Instruction sheet 2

Information Sheet 1 3

Self-check 1 19

LO #2- Understand disposition and fate of drugs 20

Instruction sheet 20

Information Sheet 2 21

Self-check 2 35

LO #3- Identify basic categories of therapeutics drugs 36

Instruction sheet 36

Information Sheet 3 37

Self-check 3 46

Reference Materials 47

Introduction to the Module

This module covers the knowledge, skills and attitude required to develop understanding of basic terminologies, importance of basic veterinary drugs, chemotherapeutic drugs including antimicrobial, anthelminthic, acaroids, antifungal agents, antiprotozoal drugs, antiseptics and disinfectants. It also covers the knowledge required to identify route of drug administration for various species of animals.

LG #14	LO #1- Identify the importance and Sources of drugs

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Basic terminologies in veterinary pharmacology
- Describing the importance of drug information
- Main sources and origin of drugs
  - ✓Sources of Drugs
  - ✓Rational Use of Veterinary Drugs
  - ✓Process of drug development
- Workplace procedures in veterinary drug use

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Define basic terminologies used in veterinary pharmacology
- Describe the general information on the importance of drugs
- Identify the main sources and origin of drugs

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the information Sheets
4. Accomplish the Self-checks

Information Sheet 1

1.1 Basic terminologies in veterinary pharmacology

A. Terms related to chemotherapy

- **Chemotherapy** is the application of chemicals for the treatment or prevention of diseases specifically caused by microorganisms, parasitic diseases or cancer cells
- **Antimicrobials** are agents which are used against microorganism, either to inhibit their growth or multiplication, or to kill them. They include antibiotics and chemotherapeutics or chemotherapeutic agents.
- **Antibiotics** are the agents which are usually produced by non pathogenic microorganism (bacteria, fungi) and are used for either killing or inhibiting the growth of other pathogenic microorganism, without affecting the host tissue. Penicillin's aminoglycosides chlormphenicol and tetracycline's. Penicillin's aminoglycosides chlormphenicol and tetracycline's.
- **Antiseptics** are drugs that are applied to living tissues to kill or inhibit the growth of bacteria i.e. alcohol and iodine preparation.
- **Disinfectants** are able to kill bacteria when applied to non-living materials i.e. surface acting compounds, $KMnO_4$.
- **Germicides** anything that destroys bacteria hut not necessarily spores i.e. 70% ethanol, 1% iodine.
- **Fungicides** anything that destroys fungi i.e. acids such as benzoic, salicylic have been used for many years as fungistatic agents.
- **Sporocides** aything that destroys spores i.e. 8% formaldehyde and 2% glutaraldehydc.
- **Bacteriostatic** refers to the idea, those agents who inhibit the growth or multiplication of microorganism rather than direct killing effect. Chloramphenicol tetracycline sulfonamides and erythromycin are examples.
- **Bactericidal** refers to the ability to kill the microorganism i.e. penicillin, cephalosporin, amino glycosides, fluorquinolones and rifampin.
- **Antimicrobial spectrum** refers to the range of activity of a compound.

- ✓ A broad spectrum antimicrobial drugs can affect a wide variety of microorganisms, usually including gram + ye and gram -ye bacteria i.e. sulfonamide, Chloramphenicol e.t.c.
- ✓ Narrow spectrum antimicrobials are only effective either against gram +ve or gram -ye bacteria but not against both; flucloxacillin phenoxy methyl penicillin are examples.

- **MIC** (minimum inhibitory concentration) Bacteriostatic activity of a chemotherapeutic agent is usually expressed as the lowest concentration (MIC) at which the drug inhibits multiplication of the susceptible microorganism. MBC bactericidal activity refers to the ability to kill microorganism expressed as the minimal bactericidal concentration (MBC).
- **Pharmacokinetics**
  - ✓ what the patient does to the drug i.e. ADME
- **Pharmacodynamics**
  - ✓ What the drug does to the patient

  For example, erythromycin stimulates gut motilin receptors and may induce nausea
- **Immunity**
  - ✓ What the patient does to the pathogen
- **Sepsis**
  - ✓ What the pathogen does to the patient
- **Resistance**
  - ✓ What the pathogen does to the drug
- **Selective toxicity**
  - ✓ What the drug does to the pathogen

B. Terms related to Pharmacy

- There are many abbreviations and terms that veterinarians use on drug prescriptions. Veterinary technicians should be able to understand those abbreviations and convert them into drug labels or instructions that pet owners will understand. You should also be able to interpret abbreviations to make up drugs or fluids as directed by a veterinarian. This Power Page lists abbreviations commonly used on veterinary prescriptions. Bold terms are the most commonly used and are most important.

Table 1.1. Abbreviations Describing Route of Administration

Abbreviation	Meaning	From Latin (if applicable)	Example
PO	By mouth (orally)	Per os	Give 1 tab PO
SQ,SC,suc,suq	Subcutaneous(ly)		Give 1 ml SQ
IM	Intramuscular(ly)		Inject 1 ml IM
IV	Intravenous(ly)		Inject 1 ml IV
IP	Intraperitoneal(ly) (into the abdominal cavity)		Inject 1 ml 20 ml IP
OD	Right eye	Oculus dexter	Instill 1 drop OD
OS	Left eye	Oculus sinister	Instill 1 drop OS
OU	Both eyes	Oculus uterque	Instill 1 drop OU
AD	Right ear	Aurio dextra	Apply small amount AD
AS(Sometimes AL)	Left ear	Aurio sinister (or laeva)	Apply small amount AS
AU	Both ears	Aurio utrae	Apply small amount AU
ID	Intradermal		Inject 0.2 ml ID

Table 1.2 Abbreviations Describing Quantity or Dose

Abbreviation	Unit of Measure	Equivalent To
Lb (or lbs)	pound(s)	pound(s) 16 oz
mg	Milligram	0 .001 gram
g	Gram	0 .001 kg
kg	Kilogram	2.2 lb
U	Unit	Often short for international unit
U (of blood)	Unit of blood	The quantity of blood (plus anticoagulant) collected from a blood donor. For blood components, this is the volume of that component that would be present in a unit of blood. Typically, the volume is 250 ml of whole blood for dogs and 50 ml for cats.
IU (or UI)	International unit	Quantity varies for different drugs or vitamins. This is an agreed upon measure of the amount of a vitamin or drug causes a certain effect.
gr	Grain	64.7989 mg
mEq	Milliequivalent	One-thousandth of a molar equivalent of a chemical
ml	Milliliter	0 .001 liter
oz	Ounce	1/16 of a pound (30 grams
qs	Quantity sufficient	
tbsp	Tablespoon	15 ml
tsp	Teaspoon	5 ml
dr	Dram (drachm)	1/16 of an ounce (28.8 grams) A fluid dram is 1/8 of a fluid ounce
cc	Cubic centimeter	1 ml

Table 1.3. Other Abbreviations

Abbreviation	Meaning
Sig	Write on label
Stat	Immediately
Susp	Suspension
Tab	Tablet
Syr	Syrup
Cap	Capsule
Amp	Ampule
DAW	Dispense as written

1.2. Describing the importance of drug information

Introduction to drug information: Drug information (DI) is the information pertaining to medications. The pharmacist can serve as a resource issues regarding cost effective medication and use, medication policy decisions, medication information resources selection, or practice related issues. The goal of DI is to enhance the quality of patient care, improve patient outcomes and ensure the prudent use of resources. Drug informatics is the electronically management of drug information. The Drug Information System allows authorized health care providers to access your medication profile and to contribute medication-related information to it. Having access to your medication profile when and where it is needed helps your healthcare providers make better decisions about your care

A. **The purpose** of drug information center is to provide authentic individualized, accurate, relevant and unbiased drug information to the consumers and healthcare professionals regarding medication related inquiries to the nation for health care and drug safety aspects by answering their call regarding the all critical.
B. **Importance of DI**: Whether you're using prescription medicines, over the counter products, sunscreens or supplements, reading the labels will make sure you're using them properly and getting all of the benefits. It can also help prevent harmful side effects.
C. **Sources if DI:** Drug information was sourced from colleagues, reference books, pharmaceutical sales representatives-PSRs, promotion materials, scientific papers/journals/internet, and drug promotion forum/product launches.

1.3. Main sources and origin of drugs

1.3.1. Sources of Drugs

Introduction: Sources of drugs may be natural, synthetic, and biosynthetic. Drugs of plant, animal, microbiological, marine, mineral, geographical origins constitute the natural sources. The entire plant, plant parts, secretion, and exudates of plants are the sources of plant.

- Drugs are obtained from six major sources:
  - ✓ Plant sources.
  - ✓ Animal sources.
  - ✓ Mineral/ Earth sources.
  - ✓ Microbiological sources.
  - ✓ Semi synthetic sources/ Synthetic sources.
  - ✓ Recombinant DNA technology.

1.3.2. Rational Use of Veterinary Drugs

Rational use of veterinary drugs means sick animals receive medications appropriate to their clinical needs, in doses that meet their own individual requirements, for an adequate period, and at the lowest cost whereas irrational use of drug means misuse of drugs by the patient (i.e., patients receive). Rational use of drugs in veterinary medicine has numerous benefits, such as increasing efficacy, decreasing the potential adverse effects, reducing risk of drug residue and combating development of microorganism's drug resistance. Veterinarians estimate that 300 drugs have been approved for use in companion animals like dogs, cats and horses. Many of the compounds contain active ingredients that are identical to those in human drugs; some are used for the same purpose, but have different brand names

1.3.3. Process of drug development

A. **Discovery and Development**: Research for a new drug begins in the laboratory
B. **Preclinical Research**: Drugs undergo laboratory and animal testing to answer basic questions about safety.
C. **Clinical Research**: Drugs are tested on people to make sure they are safe and effective.

D. **Food and Drug Authority (FDA) Review:** FDA review teams thoroughly examine all of the submitted data related to the drug or device and make a decision to approve or not to approve it.

E. **FDA Post-Market Safety Monitoring**: FDA monitors all drug and device safety once products are available for use by the public

A. Step 1: Discovery and development

I. Discovery

- Typically, researchers discover new drugs through:
  - ✓ New insights into a disease process that allow researchers to design a product to stop or reverse the effects of the disease.
  - ✓ Many tests of molecular compounds to find possible beneficial effects against any of a large number of diseases.
  - ✓ Existing treatments that have unanticipated effects.
  - ✓ New technologies, such as those that provide new ways to target medical products to specific sites within the body or to manipulate genetic material. At this stage in the process, thousands of compounds may be potential candidates for development as a medical treatment. After early testing, however, only a small number of compounds look promising and call for further study.

II. Development

- Once researchers identify a promising compound for development, they conduct experiments to gather information on:
  - ✓ How it is absorbed, distributed, metabolized, and excreted.
  - ✓ Its potential benefits and mechanisms of action.
  - ✓ The best dosage.
  - ✓ The best way to give the drug (such as by mouth or injection).
  - ✓ Side effects or adverse events that can often be referred to as toxicity.
  - ✓ How it affects different groups of people (such as by gender, race, or ethnicity) differently.

- ✓ How it interacts with other drugs and treatments.
- ✓ Its effectiveness as compared
- ✓ With similar drugs.

B. Step 2: Preclinical Research

Before testing a drug in people, researchers must find out whether it has the potential to cause serious harm, also called toxicity. The two types of preclinical research are:

- In Vitro
- In Vivo

Food and Drug Authority requires researchers to use good laboratory practices (GLP), defined in medical product development regulations, for preclinical laboratory studies. The GLP regulations are found in 21 CFR Part 58.1: Good Laboratory Practice for Nonclinical Laboratory Studies. These regulations set the minimum basic requirements for:

- study conduct
- personnel
- facilities
- equipment
- written protocols
- operating procedures
- Study reports and a system of quality assurance oversight for each study to help assure the safety of FDA-regulated product. Usually, preclinical studies are not very large. However, these studies must provide detailed information on dosing and toxicity levels. After preclinical testing, researchers review their findings and decide whether the drug should be tested in people.

C. Step 3: Clinical Research

While preclinical research answers basic questions about a drug's safety, it is not a substitute for studies of ways the drug will interact with the human body. "Clinical research" refers to studies, or trials, that are done in people. As the developers design the clinical study, they will consider what they want to accomplish for each of the different Clinical Research Phases and begin the Investigational New Drug Process (IND), a process they must go through before clinical research begins. On this page you will find information on:

- Designing Clinical Trials
- Clinical Research Phase Studies
- The Investigational New Drug Process
- Asking for FDA Assistance
- FDA IND Review Team
- Approval

I. Designing Clinical Trials

Researchers design clinical trials to answer specific research questions related to a medical product. These trials follow a specific study plan, called a protocol, that is developed by the researcher or manufacturer. Before a clinical trial begins, researchers review prior information about the drug to develop research questions and objectives. Then, they decide:

- Who qualifies to participate (selection criteria)
- How many people will be part of the study
- How long the study will last
- Whether there will be a control group and other ways to limit research bias
- How the drug will be given to patients and at what dosage
- What assessments will be conducted, when, and what data will be collected
- How the data will be reviewed and analyzed

Clinical trials follow a typical series from early, small-scale, Phase 1 studies to late-stage, large scale, Phase 3 studies.

II. The Investigational New Drug Process

Drug developers, or sponsors, must submit an Investigational New Drug (IND) application to FDA before beginning clinical research.

In the IND application, developers must include:

- Animal study data and toxicity (side effects that cause great harm) data
- Manufacturing information
- Clinical protocols (study plans) for studies to be conducted
- Data from any prior human research
- Information about the investigator

D. Step 4: Food and Drug Authority drug review

If a drug developer has evidence from its early tests and preclinical and clinical research that a drug is safe and effective for its intended use, the company can file an application to market the drug. The

FDA review team thoroughly examines all submitted data on the drug and makes a decision to approve or not to approve it.

Find out how the FDA is Speeding Up the Approval Process.

I. New Drug Application

A New Drug Application (NDA) tells the full story of a drug. Its purpose is to demonstrate that a drug is safe and effective for its intended use in the population studied. A drug developer must include everything about a drug—from preclinical data to Phase 3 trial data-in an NDA. Developers must include reports on all studies, data, and analyses. Along with clinical results, developers must include:

- Proposed labeling
- Safety updates
- Drug abuse information
- Patent information
- Any data from studies that may have been conducted outside the United States
- Institutional review board compliance information
- Directions for use

II. Food and Drug Authority Review

Once FDA receives an NDA, the review team decides if it is complete. If it is not complete, the review team can refuse to file the NDA. If it is complete, the review team has 6 to 10 months to make a decision on whether to approve the drug. The process includes the following:

- Each member of the review team conducts a full review of his or her section of the application. For example, the medical officer and the statistician review clinical data, while a pharmacologist reviews the data from animal studies. Within each technical discipline represented on the team, there is also a supervisory review.
- FDA inspectors travel to clinical study sites to conduct a routine inspection. The Agency looks for evidence of fabrication, manipulation, or withholding of data.
- The project manager assembles all individual reviews and other documents, such as the inspection report, into an “action package.” This document becomes the record for FDA review. The review team issues a recommendation, and a senior FDA official makes a decision.

III. Food and Drug Authority Approval

In cases where FDA determines that a drug has been shown to be safe and effective for its intended use, it is then necessary to work with the applicant to develop and refine prescribing information. This is referred to as "labeling." Labeling accurately and objectively describes the basis for approval and how best to use the drug. Often, though, remaining issues need to be resolved before the drug can be approved for marketing. Sometimes FDA requires the developer to address questions based on existing data. In other cases, FDA requires additional studies. At this point, the developer can decide whether or not to continue further development. If a developer disagrees with an FDA decision, there are mechanisms for formal appeal.

IV. Food and Drug Authority Advisory Committees

Often, the NDA contains sufficient data for FDA to determine the safety and effectiveness of a drug. Sometimes, though, questions arise that require additional consideration. In these cases, FDA may organize a meeting of one of its Advisory Committees to get independent, expert advice and to permit the public to make comments. These Advisory Committees include a Patient Representative that provides input from the patient perspective. Learn more about FDA Advisory Committees.

E. Step 5: Food and Drug Authority Post-market drug safety monitoring

Even though clinical trials provide important information on a drug's efficacy and safety, it is impossible to have complete information about the safety of a drug at the time of approval. Despite the rigorous steps in the process of drug development, limitations exist. Therefore, the true picture of a product's safety actually evolves over the months and even years that make up a product's lifetime in the marketplace. FDA reviews reports of problems with prescription and over-the-counter drugs, and can decide to add cautions to the dosage or usage information, as well as other measures for more serious issues. On this page you will find information on:

- Supplemental Applications
- INDs for Marketed Drugs
- Manufacturer Inspections
- Drug Advertising
- Generic Drugs
- Reporting Problems
- Active Surveillance

I. Supplemental Applications

Developers must file a supplemental application if they wish to make any significant changes from the original NDA. Generally, any changes in formulation, labeling, or dosage strength must be approved by FDA before they can be made.

II. INDs for Marketed Drugs

If sponsors want to further develop an approved drug for a new use, dosage strength, new form, or different form (such as an injectable or oral liquid, as opposed to tablet form), or if they want to conduct other clinical research or a post-market safety study, they would do so under an IND.

III. Manufacturer Inspections

FDA officials conduct routine inspections of drug manufacturing facilities across the United States, and abroad if approved products are manufactured overseas. Manufacturers may be informed of inspections in advance, or the inspections may be unannounced. Inspections may be routine or caused by a particular problem or concern. The purpose of these inspections is to make sure that developers are following good manufacturer practice. FDA can shut down a facility if minimum standards are not met.

IV. Drug Advertising

FDA regulates prescription drug advertisements and promotional labeling. By law, a developer is prohibited from advertising unapproved uses of their product. All advertisements, such as product claims or reminder ads, cannot be false or misleading. They must contain truthful information about a drug's effectiveness, side effects, and prescribing information. These advertisements can be found in medical journals, newspapers, and magazines, and on the Internet, television, or radio. Promotional labeling differs from drug advertisements in the way it is distributed. Pharmaceutical companies give out brochures or other promotional materials to physicians or consumers. The drug's prescribing information must accompany promotional labeling. Learn more at Prescription Drug Advertising.

V. Generic Drugs

New drugs are patent protected when they are approved for marketing. This means that only the sponsor has the right to market the drug exclusively. Once the patent expires, other drug manufacturers

can develop the drug, which will be known as a generic version of the drug. Generic drugs are comparable to brand name drugs and must have the same:

- Dosage form
- Strength
- Safety
- Quality
- Performance characteristics
- Intended use

Because generic drugs are comparable to drugs already on the market, generic drug manufacturers do not have to conduct clinical trials to demonstrate that their product is safe and effective. Instead, they conduct bio-equivalence studies and file an Abbreviated New Drug Application.

VI. Reporting Problems

FDA has several programs that allow manufacturers, health professionals, and consumers to report problems associated with approved drugs. Med Watch is a gateway for reporting problems with medical products (drugs and devices) and learning about new safety information. You can subscribe to regular Med Watch safety alerts. Medical Product Safety Network (Med Sun) monitors the safety and effectiveness of medical devices. FDA recruits 350 healthcare providers throughout the United States to report any medical device problems that result in serious injury or death. Each month, FDA publishes the Med Sun newsletter. The newsletter gives consumers important information about medical device safety.

VII. Active Surveillance

Under the Sentinel Initiative, FDA is developing a new national system to more quickly spot possible safety issues. The system will use very large existing electronic health databases—like electronic health records systems, administrative and insurance claims databases, and registries-to keep an eye on the safety of approved medical products in real time. This tool will add to, but not replace, FDA's existing post market safety assessment tools. Learn more about the Sentinel Initiative and its major activities.

1.4. Workplace procedures in veterinary drug use

Ensure that hazardous drugs are prepared or administered only by trained personnel in designated areas that are limited to authorized personnel. Post a sign to warn employees that they are working in

an environment where hazardous drugs are handled. Warn employees who are pregnant, breastfeeding, or of reproductive age of the potential health effects, especially during the first trimester when a woman may not know she is pregnant. Document and retain evidence that workers have been trained in and understand these procedures. Veterinary healthcare employees working where hazardous drugs are handled may face health risks. Many of these workers treat small companion animals (primarily cats and dogs), but also larger animals such as horses, with antineoplastic and other drugs that may be hazardous to humans. NIOSH recommends establishing a program to provide appropriate protective measures for veterinary healthcare workers exposed to hazardous drugs. Hazardous drugs are defined as having specific health effects (such as skin rashes, cancer, and reproductive effects) and high toxicity at low doses. Most hazardous drugs in veterinary medicine are used to treat animal illnesses such as cancer. The risk of exposure for veterinary health care workers is similar to that for human healthcare settings. In the veterinary workplace, the number-one hazard is animal restraint," Best said. The most-frequently reported injuries are animal bites and scratches received while restraining animals.

Use of veterinary drugs is important that these regulatory controls include programs to ensure that human food obtained from treated animals is safe and that all potential toxicological and microbiological hazards that may be associated with the use of veterinary medicines have been adequately evaluated. Teamwork is an essential part of workplace success. Everything tends to run smoother if everyone works together as a team. Effort from every team member has to be taken for every team to be successful and to reach the end goal. In veterinary medicine the end goal may be saving a patient's life:

- **Receiving and Storage** „ Begin exposure control when hazardous drugs enter the facility. „ Ensure that all personnel are able to identify hazardous inventory upon arrival. Handle all hazardous inventories with gloves. Label clearly with a hazardous designation. „ Store hazardous drugs separately from other inventory, and separate from food/drink. „ Keep a spill kit available in case inventory arrives damaged.

- **Drug Preparation** „ Prohibit eating, drinking, chewing gum, applying cosmetics, or storing food or drinks within the hazardous drug preparation area. „ Use PPE, including chemotherapy gloves,

non-permeable gowns, respiratory protection, under pads, eye and/or splash protection, shoe covers and spill kit. „ Use a proper containment device: preferably a 100% vented biological safety cabinet or compounding aseptic containment isolator. A horizontal laminar flow hood (clean bench) only protects the drug and not the worker. Use a proper closed-system drug transfer device (CSTD) in low-volume facilities (e.g. 2 or less drug preparations per week) without a clean room. „ Properly clean all equipment, counters, and other surfaces. No universal cleaner exists for all chemotherapy drugs. Bleach solution can be used to disinfect and a strong detergent and water rinse may remove most drug residues. Repeating the cleaning steps should provide addition drug removal. „ Wash hands with soap and water after drug compounding.

- **Drug Transportation** when drug preparation is complete, seals the final product in a plastic bag or other sealable container before taking it out of the ventilated cabinet. Seal and wipe all waste containers inside the ventilated cabinet before removing them from the cabinet. Store and transport hazardous drugs in closed containers that minimize the risk of breakage.

- **Drug Administration** „ Use dedicated cages, kennels or stalls with dedicated drains for animals undergoing treatment with hazardous drugs. „ Use proper PPE and technique during administration. Attach drug administration sets to the IV bag, and prime them before adding the drug to the bag. Prime tubing in the containment device or with non-toxic solution whenever possible. Remove the IV bag and tubing intact, dispose of items directly in a chemotherapy waste container, and close the lid. Remove outer gloves and gowns, and bag them for disposal in the chemotherapy waste container at the location where drug administration was performed. „ Wash hands with soap and water after administering the drug.

- **Waste Cleaning and Disposal** PPE should be worn during waste cleanup and disposal procedures, and footwear should not be worn outside the facility. Dispose of all hazardous drug waste according to Federal, State, and local regulations (separately from regular waste). Double-bag all chemotherapy waste including partially filled vials, undispensed products, unused IVs, needles and syringes, gloves, gowns, mats, and contaminated materials from spill cleanups or animal bodily fluids/waste. „ Place materials with trace wastes (those that contain less than 3% by weight of the original quantity of hazardous drugs)-such as needles, empty vials

and syringes, gloves, gowns, and tubing-in chemotherapy waste containers. Assure that such containers protect from sharps injuries. Do not use red sharps containers for drug disposal. „ Dispose of P-listed arsenic trioxide and its containers and any bulk amounts of U-listed drugs in hazardous waste containers at an EPA/Resource Conservation and Recovery ACT (RCRA) - permitted incinerator. „ Consider disposing of other bulk hazardous drugs (expired or unused vials, ampoules, syringes, bags, and bottles of hazardous drugs or solutions of any other items with more than trace contamination) in a manner similar to that required for RCRA-defined hazardous wastes. Avoid using sprayers or pressure washers to clean the cages, kennels or stalls of treated animals to minimize the aerosolization of hazardous wastes. Clean the cages and kennels of treated animals with disposable towels if possible and use disposable towels to clean bodily waste from treated animals.

- **Spill Control** Manage hazardous drug spills according to the established, written policies and procedures for each workplace. Ensure that the written policies and procedures address PPE required for various spill sizes, the possible spreading of material, restricted access to hazardous drug spills, and signs to be posted. „ Ensure that cleanup of a large spill is handled by workers who are trained in handling hazardous materials. As required by OSHA, follow a complete respiratory protection program, including fit-testing, if you wear respirators such as those contained in some spill kits. Use NIOSH-certified respirators. Surgical masks do not provide adequate protection. Dispose of all spill cleanup materials in a hazardous chemical waste container, in accordance with EPA/ RCRA regulations regarding hazardous waste-not in a chemotherapy waste or biohazard container.

- **Reducing the hazards** of handling chemotherapeutics
  - ✓ Two pairs of latex gloves or one pair of heavy autopsy gloves should be worn during administration of any chemotherapeutic drug regardless of the route of administration
  - ✓ Intravenous administration should be performed through a well-placed indwelling catheter. Liberally flush the catheter before administration of the drug to ensure proper placement and patency of the catheter

- ✓ Perivascular injection (extravagation) of some agents will result in severe tissue necrosis. Flushing with saline after administration of the drug will remove residual drug from inside the catheter.
- ✓ To reduce drug aerosolization or to capture leakage from the needle after administration is completed, place an alcohol-moistened cotton ball under the needle before withdrawing the needle from the catheter.
- ✓ Recapping, crushing, or clipping used needles and/or syringes should be avoided since this may aerosolize drugs or cause injury.

Self-check 1	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below.

Test I: much A to B (4 point)

A	**B**
_____ **1.** Bactericidal	A. Animals, plants, microbes, minerals
_____ **2.** Antimicrobial spectrum	B. Intraperitoneal
_____ **3.** Antiseptics	C. By mouth
_____ **4.** Disinfectants	D. What the drug dose to the patient
_____ **5.** Pharmacokinetics	E. What the patient dose to the drug
_____ **6.** Pharmacodynamics	F. apply to living tissue to kill microbes
_____ **7.** PO	G apply to non living things to reduce microbes
_____ **8.** IP	H range of activity of a drug
_____ **9.** Sources of drug	I kill microbes

Test II: Short Answer Questions (3 points each)

1. Define Bacteriostatic drugs?
2. List all sources of drugs?
3. What is the difference between antiseptics and disinfectants?

Notice: Scoring rates above **22** is satisfactory and less than that is not satisfactory

LG #15	LO #2- Understand disposition and fate of drugs

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Pharmacokinetics and pharmacodynamics of drugs and chemicals
- Routes and sites of veterinary drug administration
- Precaution and instructions on veterinary drugs and chemicals
- Residual and side effects of drugs

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Describee the general information on drug absorption, distribution, metabolism and elimination
- Understand the basic veterinary drugs and chemicals production, expiry date, withdrawal period, precaution, and manufacturers' instruction
- Identify for various species of animals, dosage form, Route and sites of drug administration
- Understand residual and side effects of basic veterinary drugs and chemicals

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the information Sheets
4. Accomplish the Self-checks

"

Information Sheet 2

2.1. Pharmacokinetics and pharmacodynamics of drugs and chemicals

2.1.1. Pharmacokinetics

- Determine the fate of drug administered to a living organism
- What the body does to the drug
- Focused on the extent and rate of absorption, distribution, metabolism and excretion
- Pharmacia" meaning drug and "kinetikos" meaning putting in motion

A. Importance of knowing the pharmacokinetics of a drug

- To choose proper route of administration
- To determine the amount of the drug to be administered (dose)
- To determine the frequency of repeated therapy
- To produce therapeutic response with minimum side effects or toxicities
- To establishing withdrawal period for meat, egg and milk consumption when drugs are given for food producing animals.
- Four components of pharmacokinetics are:
  - ✓ **Absorption**
    - Absorption is the transfer of drugs from the site of administration to the circulatory system
    - Is it necessary for all drugs?
    - If local action is required, absorption has a disadvantage
    - if systemic effect is needed, absorption is essential
    - a drug must cross one or more tissue membrane(s) in its movement to the systemic circulation
    - **Factors affecting drug absorption**
      - **Drug Solubility**
        - Drug solubility is the mass of drug that can be dissolved per unit of solvent

- Water and lipids are two opposite extremities of solvent in drug solubility
- Drugs which dissolve in lipid solvent are more easily absorbed through the membrane than drugs which tend to dissolve more in water.

Size of the Drug

- Particle (molecular) size of the drug varies from small molecule (nitrous oxide, 44 DA) to very large molecule such as peptides (proteins) (>2000 DA)
- However, the vast majority of drugs have a molecular weight between 100 and 1000
- Small molecules diffuse more rapidly than large molecules
- pH **of the Drug**
- Most drugs are either weak acid or weak base
- Acid is a chemical that can donate H+
- Base is a chemical that can accept H+

Blood Flow to the Administration Site

- Drug absorption is high in well blood perfused tissue
- For example, muscle has better perfusion than skin; hence absorption will be better in intramuscular injection than Intradermal or subcutaneous injections

Contact Time at Absorption Site

- If the drug has less contact time with the absorption site, the probability to be absorbed will be very low
- For example, if an animal has diarrhoea, the contact time between the drug and the absorption site (intestine) will be less, so fewer drugs will be absorbed
- Conversely, if the contact time is prolonged, more drugs will be absorbed than expected
- For example in animal with constipation, the intestinal empty will be delayed, so more drugs may be absorbed.

Blood Perfusion

- Blood perfusion to the heart, lungs, liver and kidneys is high

- These organs are well exposed to the drug where as skin and depot fat has lower perfusion so drug reach here more slowly
- Heart failure or shock can reduce blood perfusion.

Tendency to Bind with Other Tissues

- Some drugs bind not only with plasma proteins but also to other tissues as well
- For example, tetracyclines bind to bone and tooth
- aminoglycosides bind to renal tubular epithelium and vestibular system
- highly lipid soluble drugs accumulate in fat (for example, thiopental)
- This binding serves as reservoir that prolongs the drug's action
- On the other hand such accumulation also can produce local toxicity as in the case aminoglycosides in renal tubule and vestibular system

Capillary Permeability: -

- The ability of a drug to reach various tissues will depend on the permeability of the capillaries at the site in question
- Drugs can pass through the endothelial cells or between them through the gap junctions but these varies between tissues
- For example, the capillaries in liver are extremely permeable, while those at the blood-brain barrier lie at the other extreme

✓ **Liberation**

Liberation is the process in which a pharmaceutical substance is released from the formulation it is delivered in. This must occur before the drug can be absorbed into the body.

✓ **Distribution**

Distribution is the process in which a pharmaceutical substance is dispersed through the fluids and tissues in the body. The pharmacokinetic parameters for distribution include:

- Apparent volume of distribution: amount of drug in body / drug concentration in plasma
- Unbound fraction: unbound drug concentration in plasma / total drug concentration in plasma

- ✓ **Metabolism**
  - Metabolism is the process in which a pharmaceutical substance is transformed into other substances, called metabolites, in the body. The pharmacokinetic parameters for metabolism include:
  - Metabolic clearance: drug metabolism rate / drug concentration in plasma.
- ✓ **Excretion**
  - Excretion is the process in which a pharmaceutical substance is removed from the body. In rare cases, some drugs may never be completely excreted from the body. They then irreversibly accumulate in the tissues. The pharmacokinetic parameters for excretion include:

2.1.2. Pharmacodynamics

Introduction: Pharmacodynamics is the study of a drug's molecular, biochemical, and physiologic effects or actions. It comes from the Greek words "pharmakon," meaning "drug," and "dynamikos," meaning "power." All drugs produce their effects by interacting with biological structures or targets at the molecular level to induce a change in how the target molecule functions in regard to subsequent intermolecular interactions. These interactions include receptor binding, post-receptor effects, and chemical interactions. Examples of these types of interactions include (1) drugs binding to an active site of an enzyme, (2) drugs that interact with cell surface signaling proteins to disrupt downstream signaling, and (3) drugs that act by binding molecules like tumor necrosis factor.

- Pharmacodynamics is the study of the mechanism of action of a drug and its effect on the body
- That is ‘what a drug does to the body’? Or
- in another word, Pharmacodynamics is the study of the molecular, biochemical, and physiological effects of drugs on cellular systems and their mechanisms of action
- It determines the therapeutic and adverse effects of a particular drug
- **Importance:** A thorough understanding of drug action is the basis for
  - ✓ The rational therapeutic use of a drug
  - ✓ The design of new and superior therapeutic agents (effective + safe)
  - ✓ Understanding dose-effect relationships

- **A fundamental principle of pharmacodynamics is that drugs only modify underlying biochemical and physiological process.**
- **D**rugs exert their effect through: -
  - ✓ Interaction with macromolecules in the body such as enzymes, receptors, transporters or membranes or cell components (like DNA)
  - ✓ Due to their unique physicochemical properties, antacids, osmotic diuretics, chelating agents, urinary acidifying and alkalinizing agents.

- **Pharmacodynamics actions include**:
  - ✓ Stimulating activity by directly inhibiting a receptor and its downstream effects
  - ✓ Depressing activity by direct receptor inhibition and its downstream effects
  - ✓ Antagonistic or blocking a receptor by binding to it, but not activating it
  - ✓ Stabilizing action, where the drug apparently behaves as neither an agonist nor antagonist
  - ✓ Direct chemical reactions (beneficially in therapy and also as an adverse event)

2.2. Routes and sites of veterinary drug administration

2.2.1. Drug administration

Drug administration means the giving of a single dose of medication to a specific patient as a result of an order of a physician or other authorized medical practitioner.

- **Dosage calculation:** Solutions are mixtures of substances that are not usually combined with each other. They consist of a solvent (the dissolving substance), and a solute (the dissolved substance). Suspensions are mixtures containing very large particles of solute. They settle out on standing and need to be shaken before administration as different parts of the mixture will not contain equal amounts of solute. The amount of solute dissolved in the solvent is referred to as the concentration of the substance.
  - ✓ Concentrations can be expressed as: parts weight per volume (w/v) for liquids
  - ✓ volume per volume (v/v) for liquids
  - ✓ Weight per weight (w/w) for solids.
  - ✓ Most veterinary preparations are expressed as w/v. For example, diazepam is available as a 5 mg/ml solution for injection. Electrolyte solutions are often expressed in terms of

milliequivalent per liter (mEq/L). IU stands for International Units and is used for the measurement of drugs and vitamins. Webster's Dictionary defines IU as: 'a quantity of a biologic (such as a vitamin) that produces a particular biological effect agreed upon as an international standard'. What this means is that IU is dependent on the potency of the substance, and each substance would have a different IU to milligram conversion. For example, 1000 IU of vitamin C would have a different weight than 1000 IU of vitamin

- To work out how many ml of a drug a patient requires, just remember two things:

A. $$\text{Dose} = \frac{\text{body weight} \times \text{dosage}}{\text{Concentration of drug}}$$

(i.e. divide what you need by what you have got).

B. To get percentage solution into **mg/ml, just multiply by 10**.

- Example 1 A 20 kg dog requires a drug at 10 mg/kg. It is available in a 2% solution. How many ml does it need? •
  - ✓ Apply rule number 2: there are 20 mg/ml in this solution (2% × 10) • Apply rule number 1: dose = (20 kg × 10 mg/kg) 20 mg/ml the units cancel themselves out, leaving you with the answer in ml – Dose = 10 ml.
- Example 2 a cat weighs 11 pounds, and requires a drug, dose rate 1 mg/kg. The solution is 0.5%. How many ml does it need? To convert pounds to kilos, you divide by 2.2 (Box 3.1 shows some of the conversions).
  - ✓ Cat weighs 11 ÷ 2.2 = 5 kg
  - ✓ Solution contains: 0.5 × 10 = 5 mg/ml, so dose = (5 kg × 1 mg/kg) 5 mg/ml Dose = 1 ml
- Example 3 a dog weighs 25 kg and needs an agent with a concentration of 125 mg/ml. The dose rate is 0.5 mg/kg. How many ml are required?
  - ✓ There is no need to work out the drug concentration because it is stated for you as 125 mg/ml: dose = (25 kg × 0.5 mg/kg) 125 mg/ml Dose = 0.1 ml.

2.2.2. Routes of administration:

- Oral.
- Rectal.
- Parenterally
- Sublingual.
- Topical.
- – Intravenous, intramuscular, subcutaneous

- In a busy veterinary practice, a veterinary technician often administers treatments ordered by the veterinarian. Proper administration techniques should be used along with accurate documentation on the medical record. Additionally, a veterinary technician must be knowledgeable about dosage forms, syringe construction, and hatch marks and must be able to draw correct amounts of medication within a syringe, know the six rights of drug administration, be capable of administering medication by all available routes, be knowledgeable in the area of client education regarding drugs, and know how to properly handle controlled substances. Proper documentation of administered treatments is of utmost importance and ensures that the same treatment is not repeated by other veterinary personnel.

2.2.3. Sites of veterinary drug administration

Intramuscular injections are given into a muscle body where the circulating blood in the surrounding area of the injection absorbs the medicine. It is best to provide medicines in a low-value carcass area, which is on the neck in front of the shoulder for most species. The most common injection sites are:

- Deltoid muscle of the arm. The deltoid muscle is the site most typically used for vaccines. ...
- Vastus lateralis muscle of the thigh. ...
- Ventrogluteal muscle of the hip. ...
- Dorsogluteal muscles of the buttocks.

On larger animals the **jugular vein** is the most common intravenous injection site. To find this vein press your thumb into the jugular furrow near the juncture of the animal's neck and shoulder (below the location of the intended shot).

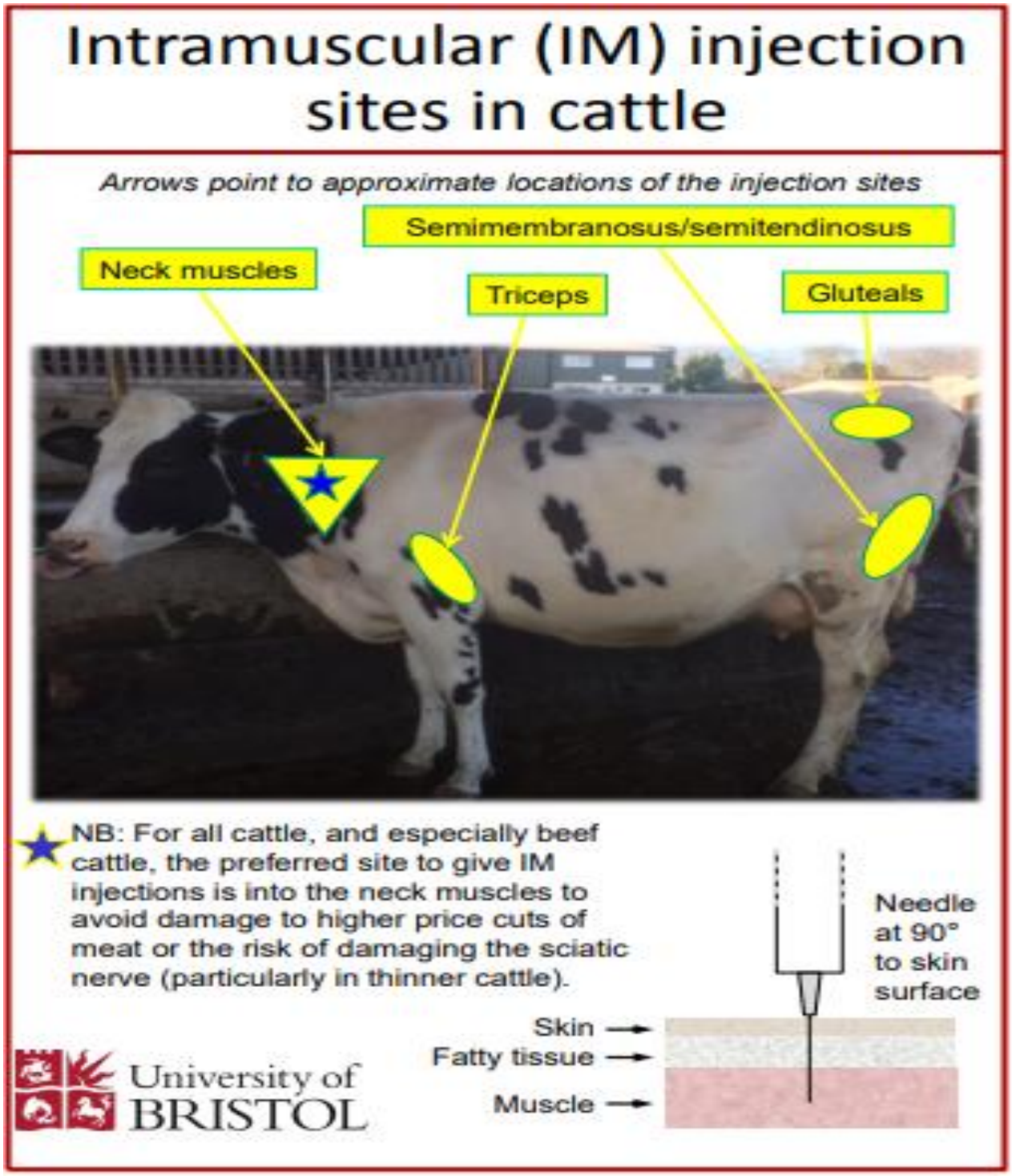


Figure 2.1. Intera-muscular injection sites in cattle

Source: (https://www.bristol.ac.uk/media-library/sites/vetscience/documents/clinical-skills/Locating%20Cattle%20and%20Sheep%20Injection%20Sites.pdf access on 03.09.2022)

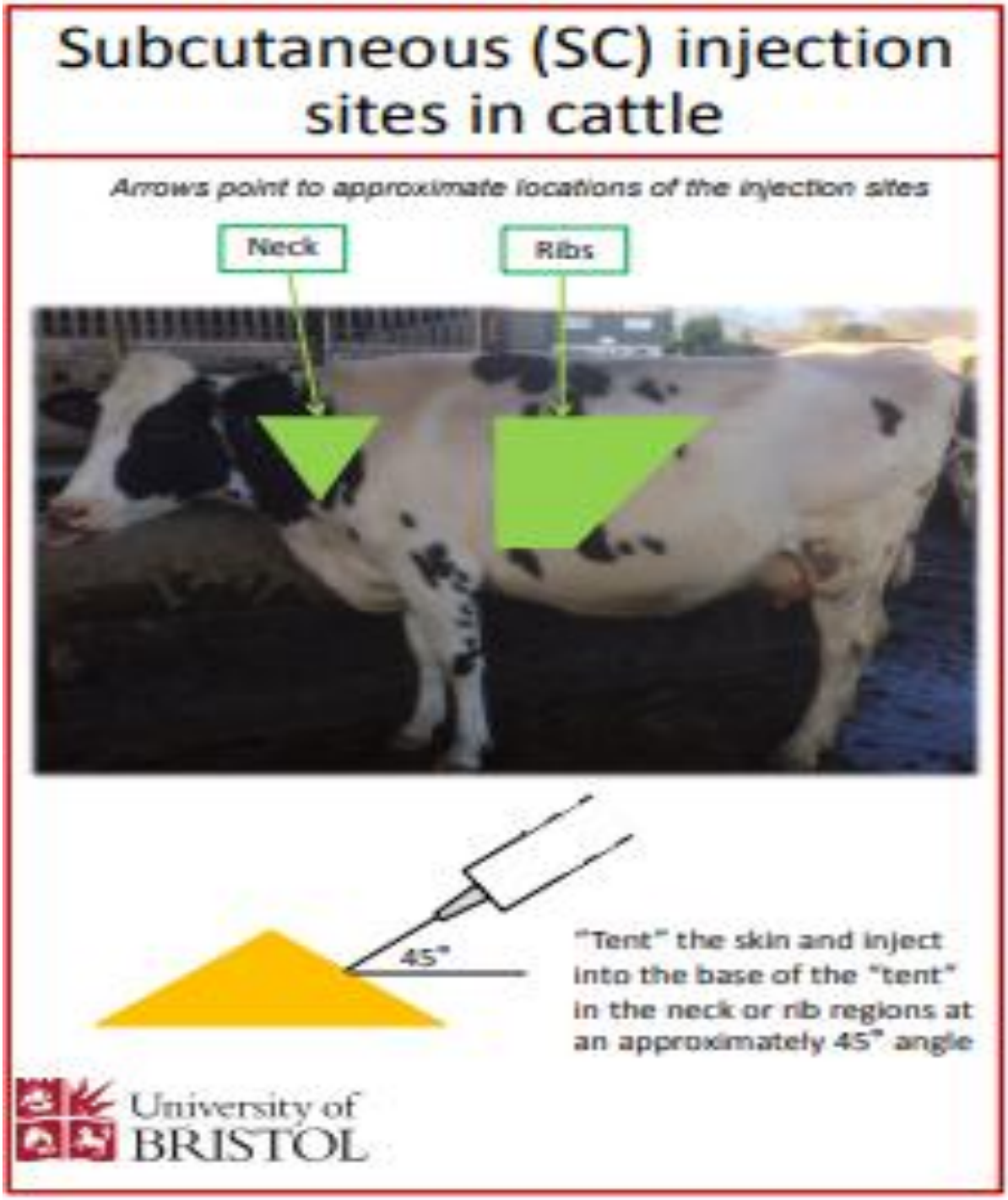


Figure 2.2. Subcutaneous injection sites in cattle

Source: (https://www.bristol.ac.uk/media-library/sites/vetscience/documents/clinical-skills/Locating%20Cattle%20and%20Sheep%20Injection%20Sites.pdf access on 03.09.2022)

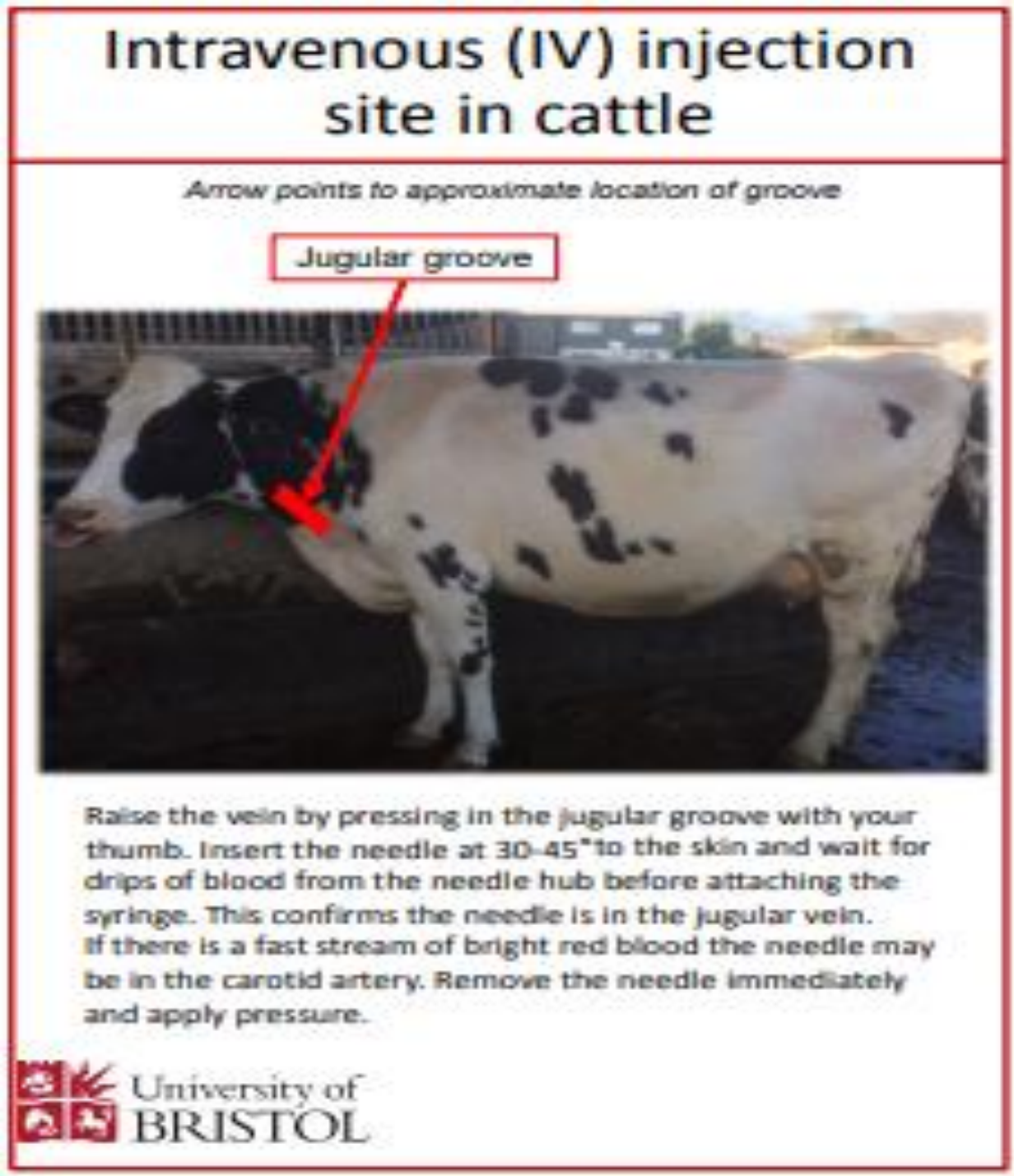


Figure 2.3. Subcutaneous injection sites in cattle

Source: (https://www.bristol.ac.uk/media-library/sites/vetscience/documents/clinical-skills/Locating%20Cattle%20and%20Sheep%20Injection%20Sites.pdf access on 03.09.2022)

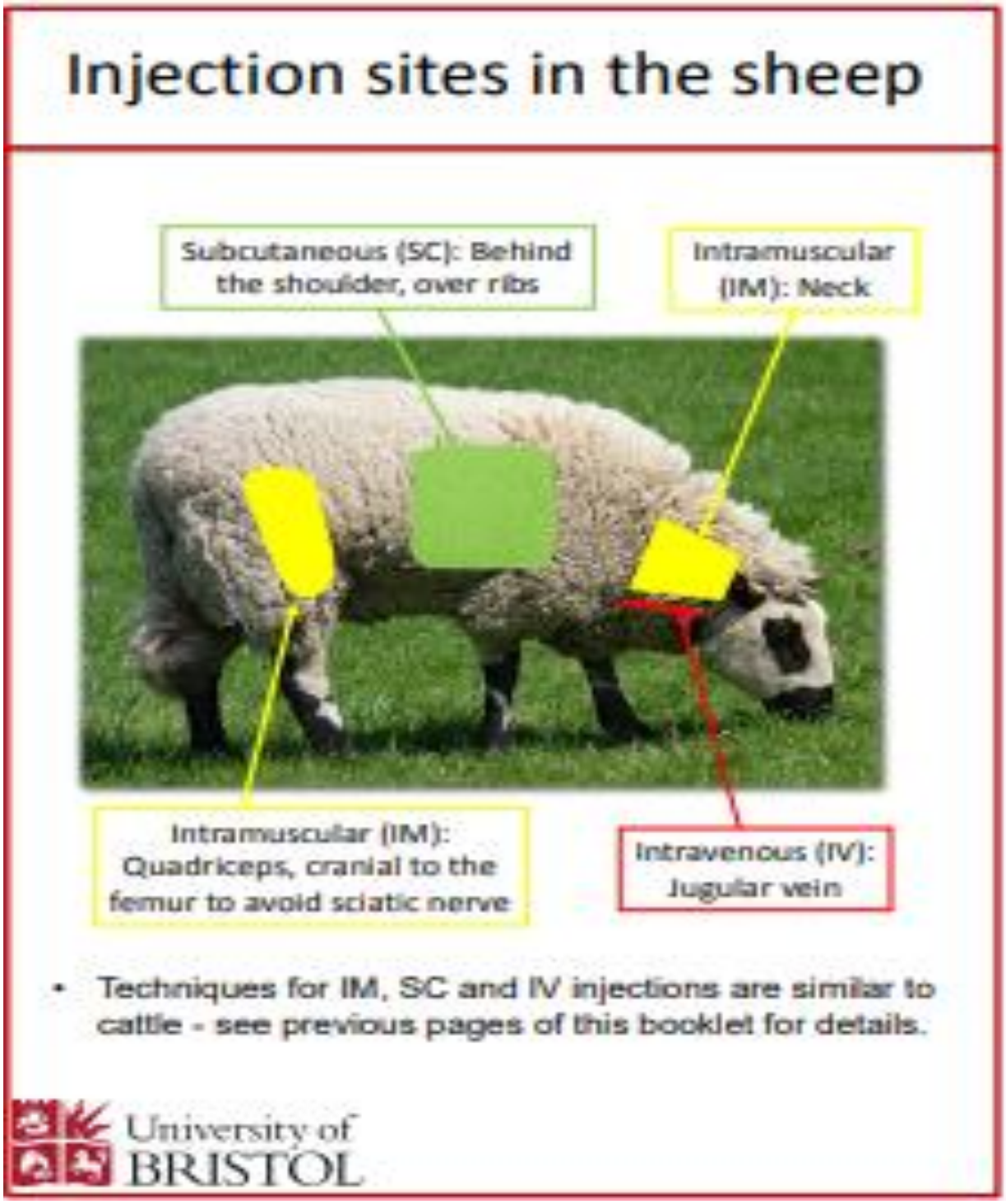


Figure 2.4.Subcutaneous injection sites in Sheep

Source: (skills/Locating%20Cattle%20ad%20Sheep%20Injection%20Sites.pdf access on 03.09.2022)

2.3. Precaution and instructions on veterinary drugs and chemicals

Introduction: An effective animal medicine regulatory programme includes a systematic, evidence-based means of documenting the safety and effectiveness of products before they are produced, marketed or used in a particular country or region. The programme must also include adequate monitoring and controls over the use of these substances. It is clear that such programmes provide veterinarians, farmers and other animal medicine users with greater assurance that veterinary drugs and biological will be safe and effective in preventing and mitigating disease. It is important that these regulatory controls include programmes to ensure that human food obtained from treated animals is safe and that all potential toxicological and microbiological hazards that may be associated with the use of veterinary medicines have been adequately evaluated. There is a great need worldwide for veterinary medicines that provide needed therapies for vast numbers of animals and animal species and, in the case of food-producing animals, for medicinal products that enhance the productivity and efficiency of food production and ensure food safety when they are used in accordance with their approval specifications. The public health mission of regulatory agencies succeeds when they are able to put into the hands of the user an approved, safe and effective, well-manufactured and appropriately labeled medicine, and when there are adequate controls in place to assure proper compliance. Drug precaution is

- Take Medicine as Prescribed- with Input from Your Health Care Provider.
- Store your Medicines Properly and Check the Expiration Date. ...
- Be Aware of Potential Medication Interactions and Side Effects. ...
- Keep a Medication List
- Follow instructions. Read all medicine labels. ...
- Use the right amount. Don't take a larger dose of a medicine thinking it will help you more.
- Take medicine on time.
- Turn on a light.
- Report problems.
- Tell your doctor about alcohol, tobacco, and drug use.
- Check before stopping.
- Don't share

2.4. Residual and side effects of drugs

2.4.1. Residual drugs

A “residue” is any compound in edible products that results from the use of a drug in an animal that produces food. This includes the drug itself, its metabolites, and other substances formed in or on the food because of the drug's use. Residue is defined by CVM (Center for Veterinary Medicine) as any compound or metabolite of a compound that is present in edible tissues from food animals because of the use of a compound in or on animals. The major causes of drug residue accumulation in food-producing animals include improper observation of withdrawal periods, failure to maintain treatment records, overdose, or using prohibited drugs for economic animal treatment.

2.4.2. Side effects of drugs

Some of the common side effects of drugs are:

- Gastrointestinal
  - ✓ dry mouth
  - ✓ metallic taste
  - ✓ oesophageal reflux
  - ✓ nausea and vomiting
  - ✓ diarrhea
  - ✓ constipation
- Nervous system
  - ✓ depression
  - ✓ mania
  - ✓ confusion
  - ✓ collapse
- Dermatological
  - ✓ purities (inflammation)
  - ✓ pruritus (itchy)
  - ✓ urticaria (hives)
  - ✓ photosensitivity
- Blood disorders
  - ✓ anemia
  - ✓ thrombocytopenia
- Examples of Adverse reactions and side effects of Penicillin
  - ✓ Penicillins are safe and non-toxic
  - ✓ Most adverse effect is related with hypersensitivity
  - ✓ All penicillins are cross sensitizing and cross reacting

- ✓ Any preparation containing penicillin, including food or cosmetics can induce sensitization
- ✓ Broad spectrum penicillins disturb the normal flora; predispose the patient for opportunistic infection such as candidiasis
- ✓ Misuse favours the development of resistance

Self-check 2	Written test

Name……ID…… Date…….

Directions: Answer all the questions listed below.

Test I: Much the best answer from A to B (4 point)

A	B
_____ **1.** Metallic taste	A. drug side effects on nervous system
_____ **2.** jugular vein	B. side effects of drugs on blood disorders
_____ **3.** intera venous	C. drugs enter to circulatory system
_____ **4.** drug execration	D. What the drug dose to the patient
_____ **5.** Pharmacokinetics	E. What the patient dose to the drug
_____ **6.** Pharmacodynamics	F. drug execration
_____ **7.** drug absorption	G routes of drug administration
_____ **8.** anemia	H sites of drug injection
_____ **9.** depression	I side effects of drugs

Test II: Short Answer Questions

1. Define pharmacodynamics? (3)
2. Define Pharmacokinetics**?** (3)
3. List sites of drug injection in different species of animals? (3)

Notice: Scoring rates of above **22** is satisfactory and less than that is not satisfactory

LG #16	LO #3- Identify basic categories of therapeutics drugs

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Identifying therapeutic drugs used in the treatment of animal disease
  - ✓ Anti-helminthes
  - ✓ Anti-protozoan
  - ✓ Anti-bacterial
  - ✓ Anti-fungal
  - ✓ Acaroids and miscellaneous chemical agents
- Vitamins and mineral supplements

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Identify therapeutic drugs used in the treatment of various disease causing agents
- Identify hormones, vitamins, mineral supplements and other chemicals used for animal disease/ problem treatment available in the market

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the information Sheets
4. Accomplish the Self-checks

Information Sheet 3

3.1. Identifying therapeutic drugs used in the treatment of animal disease

3.1.1. Anti-parasites

Therapeutics is treatments used to alleviate or prevent a particular disease. Examples of therapeutics include drug therapy, medical devices, nutrition therapy and stem-cell therapies. Antiparasitics are a class of medications which are indicated for the treatment of parasitic diseases caused by

- Nematodes
- Cestodes
- Trematodes
- Protozoa infections
- Arthropodal infestations

For effective treatment of parasitic diseases the following general principles are important:

- Understanding the feature of parasite life cycle
  - ✓ Availability intermediate host(s)
  - ✓ Factors affecting the life cycle
- Education of client
  - ✓ Possible contaminants
  - ✓ Presence of other animals (cross contamination)
  - ✓ Dose, frequency, time of treatment
- Safety and effectiveness of the anti-parasitic agent
  - ✓ Safe for the host and professionals /clients/
  - ✓ Safe for the environment /biodegradable/
  - ✓ Effective to all stages of the parasite (larvae, adult, hibernated)
  - ✓ Cheap and easy to apply
- Caution use in old, young, debilitated, or pregnant animals
- Antiparasitics agents can be grouped depending on the parasite where they act as
  - ✓ Anthelminthic
  - ✓ Antiprotozoal,
  - ✓ Acaricides and insecticides

A. Anthelminthic

- Anthelminthic or anthelminthic are drugs that used for the treatment of helminths (nemathelminths (nematode) and platyhelminths (Trematodes and Cestodes) infestations
- ANTI = against, HELMINTH = worm
- They expel these parasitic worms from the body, by either stunning or killing them so they may be called vermifuges (stunning) or vermicides (killing)
- There are several classes of anthelminthic namely
  - ✓ Benzimidazoles
    - Albendazole
    - Mebendazole
    - Fenbendazole
    - Triclabendazole
    - Oxibendazole
    - Febantel
    - Thiabendazole
  - ✓ Imidazothiazole
    - Tetramisole
    - Levamisole
  - ✓ Tetrahydropyrimidines (pyrantel, oxantel)
    - Pyrantel
    - Morantel
    - Oxantel
  - ✓ Antibiotics
    - Antibiotic–anthelminthic
    - Ivermectin ---→Avermictin -→Streptomyces avermitilis
  - ✓ Organosphates A number of organophosphates have been used as anthelmintics; however, , their use is declining due to their
    - Relative toxicity
    - Limited efficacy against immature stages
    - Narrow margin of safety
    - Contamination of the environment through fecal excretion
    - Dichlorvos is used as an anthelmintic in horses, pigs, dogs, and cats
    - Trichlorfon in horses and dogs

- Coumaphos, crufomate, haloxon, and naftalofos in ruminants
- Organophosphates are effective against the major gastrointestinal nematodes

✓ Others

- Miscellaneous anthelminthic
  - Piperazine
  - Praziquantel
  - Niclosamide
  - Oxyclozanide
  - Rafoxanide

B. Anti-protozoan

- Antiprotozoal agents are drugs that are used to treat infections caused by protozoan parasites:
- Protozoa are eukaryotic, unicellular organism
- Important drug targets are
  - ✓ Enzymes
  - ✓ Membrane transporters
  - ✓ Microtubules
  - ✓ Synaptic transmission
  - ✓ Unknown targets
- Protozoan parasites
  - ✓ Coccidia
  - ✓ Babesia
  - ✓ Trypanosome
  - ✓ Toxoplasma
  - ✓ Trichomonia
  - ✓ Leishmania
  - ✓ Some are Water and/or Food, some are insect born
- There are a large collection of antiprotozoal drugs with variety of chemical structure and mechanisms of actions

I. Drugs for Coccidiosis

- Coccidiosis is severe disease and important from an economic point of view in poultry industry
- Anticoccidial drugs are coccidiostatic or coccidiocidal based on their action on the parasite
- They can act on extracellular stages (sporozoite, merozoite) to prevent penetration of cells or on the intracellular stages to prevent developments
- They are grouped as:

- ✓ hydroxyquinolones and naphthoquinones
  - Buquinolate
  - Decoquinate
  - Nequinate
  - Buparvaquone
  - Parvaquone
  - Atovaquone
- ✓ Clopidol
- ✓ Robenidine
- ✓ Amprolium
- ✓ Nitrobenzamides
- ✓ Nicarbazin
- ✓ sulphonamides

II. Drugs for trypanosomiasis

- Antitrypanosomal drugs are often divided as
  a. Group I compounds
     i. Act immediately after injection
     ii. Example diminazene
  b. Group II compounds
     i. produce their trypanocidal effect in vivo only after a latent period of 24 hrs
     ii. Examples: Homidium, quinapyramine and suramin
- Antitrypanosomal drugs are also divided as
  c. curative drugs
     i. Example: Diminazene aceturate , Quinapyramine sulfate
  d. preventive drugs
     i. Have long acting effect
     ii. Example: Quinapyramine dimethylsulfate,
  e. Both
     i. isometamidium chloride, Suramin, Homidium bromide

III. Drugs for External Parasites /Ectoparasiticide

- What are the damages induced by external parasites?
  - ✓ Suck blood
  - ✓ Mechanical damage /wound/
  - ✓ Worry and irritation
  - ✓ Transmit diseases
- Drugs are grouped as Acaroids and insecticide

- Acaricides are pesticides that kill members of the Acari group, which includes ticks (ixodicides) and mites (miticides)
- Insecticides are pesticides that kill insects
- Problems related with the use of acaricides and insecticides safety (may not be safe for the host, environment, professional), resistance (ticks, tsetse and others)
- Method of application of drugs
  - ✓ Spray (manual, knap sac, automatic (motorized)) on the animal or environment
  - ✓ Dipping (dipping tank (concreted), plastic dipping tank)
  - ✓ Shampoo
  - ✓ Spot on or pour on
  - ✓ Collars or tags (put around the neck or attached to ears)
  - ✓ Injection
- They can be grouped according to their chemical structure and modes of action as:
  - ✓ Organophosphates and carbamates
  - ✓ Chlorinated hydrocarbons
  - ✓ Botanical derivatives (Rotenone, pyrethrins and pyrethroids)
  - ✓ Formamides (Amitraz)
  - ✓ others like avermectins

3.1.2. Anti-bacterial

- Antibacterial drugs can be classified into five groups according to their mechanism of action
  - ✓ Inhibitors of cell wall synthesis
  - ✓ Inhibitors of protein synthesis
  - ✓ Inhibitors of folic acid metabolism
  - ✓ Inhibitors of nucleic acid synthesis (DNA gyrase, RNA polymerase)
  - ✓ Antibacterial that impair cell membrane functions
- Antimicrobial drugs and principles of treatment

Introduction Antimicrobials are chemicals biosynthetically or semi-synthetically produced either to destroy or suppress growth or metabolism of micro-organisms with little or no harm on the host/animal. They can be classified based on their origin as:

- Antibiotics - which are products of micro-organisms-Example- penicillin
- Non- antibiotics – these are not products of micro-organisms¬ Example – sulphonamides

- They can also be classified on the basis of effect on the bacterial cell as:
  - ✓ Bacteriostatic – inhibit bacterial multiplication¬ Example – TTC, sulphonamides, CAF.
  - ✓ Bactericidal – kill bacterial cells¬ Example – penicillins, aminoglycosides, polymixins, and cephalosporin.
- Mechanisms of action of antimicrobials
  - ✓ Selective toxicity Antimicrobials are selectively harmful to microorganisms without causing significant harm on the animal. However, this selective toxicity depends on the concentration of the drug in the tissues. Because it is excessively administered, it may cause severe tissue damage or death of the animal. Specific antimicrobials selectively act on bacterial cells through acting on specific receptors, metabolism or enzymes, which are vital for the life of the microorganism without affecting the metabolism of animal cells.
  - ✓ Specific mechanisms of action of antimicrobials are:
    - Inhibition of cell wall synthesis Examples –Bacitracin, penicillin
    - Impairment of cell membrane function Examples – Polymixins, amphotericin
    - Inhibition of protein synthesis Examples – Erythromycin, CAF, TTC
    - Inhibition of nucleic acid synthesis Examples –Sulphonamides, trimethoprim

3.1.3. Anti-fungal

An antifungal (antimycotics) drugs

- are medications used to treat fungal infections
  - ✓ Dermatophytosis (ring worm)
  - ✓ Aspergillosis
  - ✓ Candidiasis
  - ✓ Epizootic lymphangitis
  - ✓ Sporotrichosis
  - ✓ Serious systemic infections such as cryptococcal meningitis
- It is difficult to treat fungal infections b/c:
  - ✓ The incidence of fungal diseases and the therapeutic results are highly associated with the strength of immunity of the patient and removal of the predisposing factor(s)
  - ✓ Fungal organisms grow slowly and fungal infections often occur in tissues that are poorly penetrated by antimicrobial agents (e.g., devitalized or avascular tissues)
  - ✓ There are less number of antifungal than antibacterial agents

- ✓ Antifungal are more toxic than antibacterial agents (mostly used topically due to their toxicity)
- ✓ Both fungi and animals are eukaryotes, thus fungal and animal's cells are much closer at molecular level than bacterial cells
- ✓ Most fungi are resistant to conventional antimicrobial agents

- Therapy of fungal infections usually requires
  - ✓ Prolonged treatment
  - ✓ Removal of predisposing factors
  - ✓ Strengthening the immunity of the host
  - ✓ Use of combined therapy to enhance antifungal efficacy, reduce resistance and toxicity
- Antifungal agents are generally classified based on: -

I. Chemical structure

- PolyOne antibiotics:
  - ✓ Amphotericin B
  - ✓ nystatin
- Azoles:
  - ✓ Imidazoles: ketoconazole, miconazole
  - ✓ Triazoles: itraconazole, fluconazole
- Others
  - ✓ Griseofulvin
  - ✓ 5-fluorocytosine

II. Site of action or use

A. Local/topical

B. Systemic

III. Effect on fungus

A. Fungicidal

B. Fungistatic

- Most antifungal drugs are static but some are still cidal
- depending on the organism and the concentration of the drug

3.1.4. Miscellaneous chemical agents

Characteristics of ideal antiseptic: -

- Having broad spectrum of action
- Non-irritant or nontoxic to animal and human tissue
- High penetrability (to pus, necrotic tissue)
- Noninterference with normal healing process
- Non-corrosive and stable

3.1.5. Types Antiseptics and disinfectants

I. Physical agents

- Heat
  - ✓ Dry heat (hot air oven)
  - ✓ Moist heat (steam under pressure) or autoclave
  - ✓ Boiling water
  - ✓ Flame
- Light
  - ✓ UV light
- Mechanical /microbe free filters/

II. Chemical agents

- Alcohols
- Iodine
- Quaternary ammonium compounds
- Aldehydes
- Peroxygen Compounds
- Phenol and phenol derivatives (phenolics)
- Hexachlorophene

3.2. Vitamins and mineral supplements

Multivitamin, Vitamin B-complex, vitamin A, is very important for the animals. Calcium borogluconate, Dicalcium phosphate, Chalk, Disodium phosphate, Dehydrated disodium, phosphate Magnesium sulphate, Magnesium oxide, Iodized salt, Cobalt sulphate, preparation, Zinc sulphate, Zinc oxide, Manganese sulphate, Manganese oxide are minerals required for animals. Animals' bodies need vitamins for growth and maintenance. You are probably familiar with most of the vitamins

human and animal bodies need: Vitamin A. B vitamins (biotin, folate, niacin, pantothenic acid, riboflavin, thiamine, vitamin B-6, and vitamin B-12). Macro minerals required by beef cattle include calcium (Ca), magnesium (Mg), phosphorus (P), potassium (K), sodium (Na), chlorine (Cl), and sulfur (S). The micro minerals required are chromium (Cr), cobalt (Co), copper (Cu), iodine (I), iron (Fe), manganese (Mn), selenium (Se), and zinc (Zn).

What are feed supplements for animals? Feed supplements are phosphate, calcium and trace mineral mixtures that can be given to grazing animals during the dry or rainy season. They supplement grazing when it is deficient in minerals and trace minerals. Minerals essential for animal life include common salt (sodium chloride), calcium, phosphorus, sulfur, potassium, magnesium, manganese, iron, copper, cobalt, iodine, zinc, molybdenum, and selenium. The last six of these can be toxic to animals if excessive amounts are eaten. Minerals play a key role in the maintenance of osmotic pressure, and thus regulate the exchange of water and solutes within the animal body. Minerals serve as structural constituents of soft tissues. Minerals are essential for the transmission of nerve impulses and muscle contraction.

Self-check 3	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below.

Test I: Much the best answer from A to B (4 point)

A	B
_____**1.** Antifungal drugs	A. Inhibit bacterial multiplication
_____**2.** Antibacterial drugs	B. Aldehydes
_____**3.** Drugs for ectoparasite	C. UV light
_____**4.** Drugs for trypes	D. Albendazole
_____**5.** Drugs for Coccidiosis	E. Amprolium
_____**6.** Drugs for heliments	F. Diminazene
_____**7.** Physical disinfectant	G Carbamates
_____**8.** Chemical disinfectant	H Penicillin
_____**9.** Bacteriostatic	I Amphotericin B

Test II: Short Answer Questions

1. Define Antiparasitics drugs? (3)
2. Define antibiotics**?** (3)
3. List all types of drug used for different diseases in different species of animals? (3)

Notice: Scoring rates of above **22** is satisfactory and less than that is not satisfactory

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