WORLD ORGANISATION FOR ANIMAL HEALTH

AFRICAN UNION INTERAFRICAN BUREAU FOR ANIMAL RESOURCES

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# MANUAL *for* ANIMAL HEALTH STAFF

## Animal Health Pedagogical Toolkit

- Community-based Animal Health Workers
- Veterinary paraprofessionals
- Veterinarians

UEMOA

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# ANIMAL HEALTH EDUCATIONAL TOOLKIT

*This Educational Kit is extracted from the* **Animal Health Educational Toolkit** *which includes*:

**The Manual for Animal Health Staff** which constitutes a support for continuous training and a reference guide for the field. It contains five sections organized around the main areas of animal health. Each section provides a clear and illustrated explanation of the important concepts to be aware of for the daily exercise of community-based animal health workers, veterinary paraprofessionals and private and/or public veterinarians. The role of each of these actors, the recognition of priority animal diseases and the basic animal health techniques are fully explained in this handbook.

**The Priority Animal Diseases Sheets** for the recognition of 30 animal diseases. Included in the Manual for Animal Health Staff, they are also available as independent double-sided sheets. Each of them provide a clear, practical and illustrated summary to optimize the recognition of the clinical signs of priority animal diseases in the Sahel and the actions to be taken by animal health staff in response to them.

**The Educational Kit** below, composed of 8 practical sheets on educational methods and techniques. These sheets are intended for trainers who will deploy the PRAPS Animal Health Educational Toolkit in the field during training and awareness-raising sessions for animal health staff.

**The User Guide** which explains the content and the objectives of the PRAPS Animal Health Educational Toolkit. It also describes the intended audiences, teaching and learning situations in which trainers will be able to deploy it.

# MANUAL *for* ANIMAL HEALTH STAFF

## Animal Health Educational Toolkit

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*The designations, roles and definitions for animal health staff and institutions in this manual are standard designations as defined by the World Organization for Animal Health (OIE) They may vary according to geographical areas and countries*

*Throughout this manual, the numbers in brackets refer the corresponding annotated illustrations*

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# Preface

In Africa, livestock farming remains a major socio-economic activity. It not only plays an essential role in job creation, income distribution in rural areas and poverty reduction, but is also an important instrument for improving countries; food security and sovereignty. In arid and semi-arid areas, livestock farming is mainly based on pastoralism, itself based on the mobility of people and animals, which is both a risk management strategy and a means of optimizing the use of temporarily available forage resources according to the seasons. However, despite their economic importance, nomadic or semi-nomadic pastoralists, who are the only ones able to enhance the value of vast pastoral areas where no other activity can be envisaged, are still very often socially disregarded, institutionally marginalized and therefore politically neglected.

Supporting the development of basic veterinary technical manuals is one of the tasks entrusted to the regional coordination of the animal health component of the Sahel Regional Project Supporting Pastoralism (PRAPS), which emerged from the conference of Heads of State and Government of Burkina Faso, Chad, Mali, Mauritania, Niger and Senegal. PRAPS is co-funded by governments and the World Bank to support national and regional efforts to build more sustainable and effective veterinary services. The regional coordination of the PRAPS animal health component is entrusted to the OIE under a partnership agreement with CILSS (Permanent Interstates Committee for Drought Control in Sahel).

Although over the past thirty years many similar approaches have been implemented either through continental projects (Pan-African Rinderpest Control Program, PARC, Pan-African Program for the Epizootics Control, PACE, among others) or by international development organizations such as OIE, FAO and the African Union Interafrican Bureau for Animal Resources (AU-IBAR), the PRAPS countries unanimously called for the development of a more detailed manual for Community-based Animal Health Workers and livestock farmers, as well as field workers and veterinarians. It is therefore within this framework that the present manual, intended for the entire chain of veterinary services, was developed thanks to a service provided by CIRAD, based on an AU-IBAR PACE Manual initially developed in 2006 for Community-based Animal Health Workers only. This English version was made possible thanks to the support of the OIE Project to Strengthen Veterinary Services in Developing Countries (SVSDC), funded by the European Union (www.rr-africa.oie.int/svs.html).

Designed to be as accessible as possible to all animal health partners, it is intended as a reminder of the most commonly encountered animal diseases, basic animal health techniques, drugs that can be used, prevention and alert measures to be taken in the event of an outbreak, etc. The iconography shows situations similar to those of pastoralist communities encountered in African countries and tropical territories.

Animal health staff, Community-based Animal Health Workers (CAHWs), veterinary paraprofessionals (veterinary paraprofessionals) and ve-

play a role in veterinary treatment, vaccination, drug distribution and animal disease reporting. They are an integral part of veterinary services in the broad sense as defined by the OIE. Their roles and missions should be clearly defined in each country and supported by appropriate legislation. This includes clarifying their interactions in order to promote better livestock health and to work towards the overall preservation of animal health at national level. The farmers are in close contact with the CAHWs from their community. Many CAHWs can work with a veterinary paraprofessional (VPP, also referred to as paravet) who acts as an intermediary with the veterinarian, if the latter is located far from the village. Each veterinary paraprofessional would work closely with a veterinarian under his/her supervision. The veterinarian would train his team's officers (veterinary paraprofessional) on a very regular basis, manage the drug supply and inform the regional health authority as soon as a notifiable disease is suspected.

The specific role of each stakeholder in the veterinary field and their interactions are described in the first part of this manual. The specific role of each in the management of most diseases encountered in the field is specified in the disease section. Guidance on basic animal health procedures is described in the section on the differential approach. The manual is therefore designed to serve as a support for continuous training and as a practical reference tool for the field. It aims to help maintain the knowledge of veterinarians, veterinary paraprofessionals and CAHWs and to provide a better management of animal health of livestock in camps, villages or pastoral areas.

As an educational tool, the use of this manual begins with a cascade of training provided by the veterinarians for the veterinary paraprofessionals and by the veterinary paraprofessionals for the CAHWs. This training has to insist on the use of drugs from an official circuit and the use of the right technical procedures. This is at stake for the credibility and effectiveness of the veterinary profession among livestock farmers and the safety of prescribed drugs. Expertise and sale of quality medicines are essential skills to establish a trustful relationship between livestock farmers and animal health staff. This trust should make it possible to compete with counterfeit products. As the marketing of medicines is the main source of income for the various actors in the sector and must be a profitable activity for everyone, it is imperative that the veterinarian, the veterinary paraprofessional and the CAHW agree on each other's profit margins and to the same retail price for this sector to be sustainable. As the sale of preventive medicines is more profitable than that of curative medicines, all the stakeholders are called upon to mobilize for enhanced surveillance and effective control of epizootics, in close collaboration with national veterinary services.

Cyrus Nersy,
Oumar Alfaroukh Idriss

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# Chapter

# Animal health staff

*Section* 1

# Introduction

# *Some definitions*

**Antibiotic**. Refers to a natural, semi-synthetic or synthetic substance that, at concentrations that can be reached in vivo, has antimicrobial activity (i.e. destroys or inhibits the growth of microorganisms). Anthelmintic drugs and classified substances as disinfectants or antiseptics are excluded from the scope of this definition.

**Competent Authority**. Refers to the veterinary authority or other governmental authority of a member state responsible for implementing measures relating to the preservation of animal health and welfare, managing international veterinary certification activities and applying other standards and recommendations described in the OIE Terrestrial Code and OIE Aquatic Animal Health Code, or supervising their implementation throughout the national territory, and having the necessary competence to do so.

**Veterinary Authority**. Refers to the government authority, including veterinarians and other professionals and para-professionals, responsible and competent to implement measures relating to the preservation of animal health and possibly animal welfare, to manage international veterinary certification activities and to apply other standards and recommendations described in national regulations, or to supervise their implementation throughout the national territory.

**Community-based Animal Health Worker (CAHW)**. Refers to a person, preferably educated, designated by his community, who has followed one or more practical training courses in animal health that do not lead to a diploma and who, in theory, must be authorized by the competent authority to carry out some basic animal health activities on the territory of a country under the supervision of a veterinarian or even a veterinary para-professional. The CAHW belongs exclusively to the private sector.

**Infection**. Refers to the penetration and development, or multiplication, of a pathogen into the body of a human being or animal.

**Laboratory**. Refers to a suitably equipped institution, employing competent technical staff under the supervision of a specialist in veterinary diagnostic methods, who is responsible for the validity of the results. Such laboratories shall be approved and placed under the supervision of the veterinary authority for the performance of the diagnostic tests required, in particular for international trades.

**Notifiable disease**. Refers to a disease included in a list drawn up by the veterinary authority and of which the detection or suspicion must be brought to its immediate attention in accordance with national regulations.

**Veterinary drug**. Refers to any product authorized, either for preventive, curative or diagnostic indications, or to modify some physiological functions, when administered or used in animals.

**Sanitary measure**. Refers to a measure designed to protect human or animal life and health in the territory of a State from risks related to the entry and/or spread of a threat.

**Statutory veterinary body**. Refers to an autonomous control body for veterinarians and veterinary para-professionals.

**Veterinary paraprofessional (veterinary paraprofessional)**. Refers to a person who has completed initial training leading to a diploma of variable level in animal health but who does not hold a PhD, and who is authorized by the com-

petent authority to carry out, on the territory of a country, some animal health tasks assigned to him (depending on the category of para-professional to which he belongs), under the responsibility and supervision of a veterinarian. The tasks that may be assigned to each category of veterinary para-professionals must be defined by the competent authority according to the qualifications and training of the persons concerned and as necessary. The veterinary paraprofessional may belong to both the public and private sectors.

**Risk**. Refers to the probability of occurrence and the likely magnitude of the consequences of an event detrimental to animal or human health, both in biological and economic terms.

**Veterinary services**. Refers to public or private bodies that ensure the implementation, on the territory of a country, of measures relating to the preservation of animal health and possibly animal welfare, as well as other standards and recommendations described in the OIE Terrestrial Code and the OIE Aquatic Animal Health Code. The veterinary services are under the direct supervision and control of the veterinary authority. Private sector organizations, veterinarians, veterinary para-professionals and aquatic animal health professionals are typically approved by the veterinary authority or authorized by it to carry out the public service tasks delegated to them.

**Official control program**. Refers to a program approved, and managed or supervised, by the veterinary authority of a member state to control a vector, pathogen or disease, by applying specific measures throughout the whole territory of that member state or only in a given zone or compartment within its territory.

**Surveillance**. Refers to the systematic and continuous collection, compilation and analysis of animal health information and its dissemination within a time frame compatible with the implementation of the necessary measures.

**Vaccination**. Refers to the successful immunization of susceptible animals, in accordance with the manufacturer's instructions for a vaccine containing appropriate antigens against the disease being controlled.

**Veterinarian**. Refers to a person who has completed advanced training in animal health leading to a PhD in veterinary medicine, registered or accredited by the competent authority of a country to practice animal medicine or veterinary science. The veterinarian may not only belong to the public sector but also to the private sector. This manual is intended for both categories.

**Mandated veterinarian**. Refers to a private sector veterinarian holding a health mandate issued by the veterinary authority that allows him/her to carry out some sovereign tasks specifically defined in the mandate.

**Official veterinarian**. Refers to a veterinarian authorized by the veterinary authority of his/her country to carry out some official tasks entrusted to him/her in relation to animal or public health, the inspection of goods and, where appropriate, to manage international certification activities.

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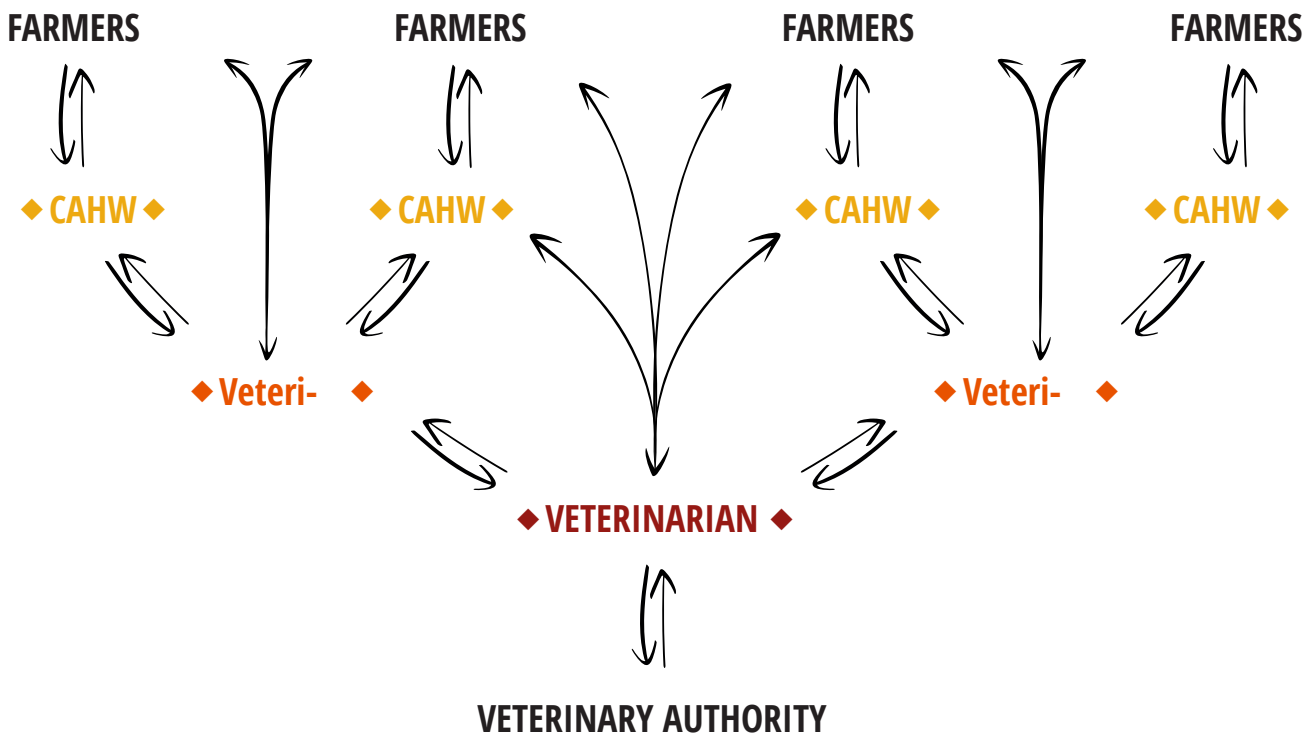
*Relationships between the various animal health partners*



*Section* 2

# Position of the Community-based Animal Health Worker (CAHW)

# *CAHWs' roles and activities*

- The CAHW are the first link in the epidemiological surveillance network for livestock farmers. They are an essential field sentinel;
- They listen to farmers and collect rumors about animal health. They keep a veterinary register (*1, 2, 3*);
- They carry out clinical examinations as often as possible and carries out pre-diagnosis (*4*);
- They notify the villagers and the veterinary authority on which they depend on about all serious diseases and outbreaks they suspect (*5*);
- They can provide support in animal husbandry and/or breeding techniques to farmers;
- CAHWs provide advice to farmers on basic treatments. They may carry them out under the supervision of the veterinary authority to which they are answerable (*6, 7, 8*);
- They mainly vaccinate poultry and may possibly vaccinate other animals under the supervision of the veterinary paraprofessional and veterinarian. They must then complete vaccination forms which they give to the veterinary paraprofessional and/or veterinarian (private and/or public) once a month (*9*);
- They manages their stock of medicines and the income from this activity (*10*);
- They purchase the medicinal products authorized by the competent authority at reasonable prices only from the veterinary paraprofessional and/or veterinarian (private and/or public) on whom they depend on, in order to use quality medicinal products (*11*);
- They act as a link between farmers and the veterinary authority by facilitating the two-way flow of health information (*12, 13*);
- They regularly remind farmers that they must notify them in the event of a suspected serious disease or outbreak.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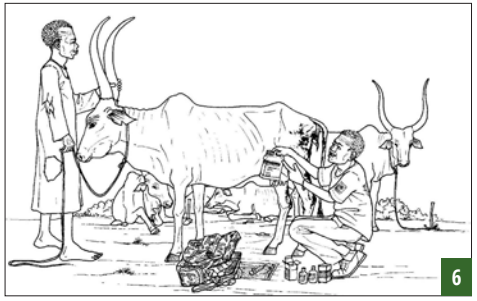
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## *CAHW's place in the community*

- The candidate for the CAHW position is chosen by all members of the village or camp, with the approval of the veterinary authority (*14*);
- After completing training provided or recognized by the veterinary authority, he or she shall receive a certificate confirming his or her status as a CAHW;
- They ensure the health of animals in the entire community (*15*);
- They give advice to the village farmers and explains to them the actions they carry out during theirs interventions (*16*);
- They are paid by all farmers, including those of their family, for the medicines and care they provide to animals, whether in cash or in kind (*17, 18*);
- They contribute to community awareness of animal diseases and vaccination campaigns set by the veterinary authority (*19*).

## *Introduction of the CAHW upon arrival in the village*

- Upon arrival in a village or camp, the CAHW introduces himself or herself and reminds the following points:
  - He/she was trained to recognize the main priority animal diseases (*20*);
  - He/she has a duty to alert and to act as a field sentinel;
  - He/she knows the basic medicines and how to use them against some diseases (*21*);
  - He/she can treat and vaccinate animals under the supervision of the veterinary paraprofessional and the responsibility of the veterinarian (*22*);
  - He/she must be paid for his/her actions (*23*).
- He/she informs farmers and villagers about:
  - The risk of leaving an animal untreated and/or without vaccination (*24*);
  - The importance of parasitism and the preventive and curative measures to be implemented;
  - Zoonotic risks and their importance to human health (including tuberculosis, echinococcosis, brucellosis and rabies).
- He/she visits the herds and carries out the clinical examination of all sick animals (*25*).


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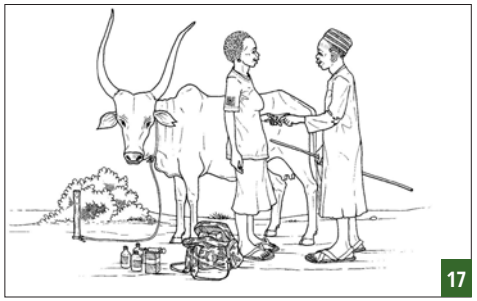
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## *CAHWs' relationship with the veterinary paraprofessional*

- CAHWs work under the direct supervision of the veterinary paraprofessional. The latter contributes to their continuous training (*26*);
- They play a part in the information reviews and awareness-raised campaigns organized by the veterinary paraprofessional (*27*);
- They act as vaccinators during vaccination campaigns (especially on poultry) that the veterinary paraprofessional sets up under the supervision of the veterinarian (private and/or public) (*28*);
- They regularly report to the veterinary paraprofessional on their activities, especially through the systematic maintenance of a veterinary register (*29*);
- They report all serious diseases and outbreaks they suspect (*30*);
- They buy the medicines they need at fair prices from the pharmacy that the veterinary paraprofessional manages under the supervision of the veterinarian (private and/or public, in accordance with national legislation) (*31*).

## *CAHWs' relationship with the veterinarian*

- CAHWs work under the responsibility of the private and/or public veterinarian. The latter provides their initial training and may issue them with their certificates. They also provide part of their continuous training (*32, 33*);
- They can help the veterinarian (private and/or public) when he/she carries out basic health care and sampling (*34, 35, 36, 37*);
- They act as vaccinators during vaccination campaigns that the veterinarian (private and/or public) organizes for the State with the support of the veterinary paraprofessional (*38*);
- They shall report to the veterinarian all serious diseases and outbreaks they suspect, either directly or through the veterinary paraprofessional (*39*);
- They buy from the veterinarian, at reasonable prices, the medicines listed on the list of products authorized by the veterinary authority (*40*).


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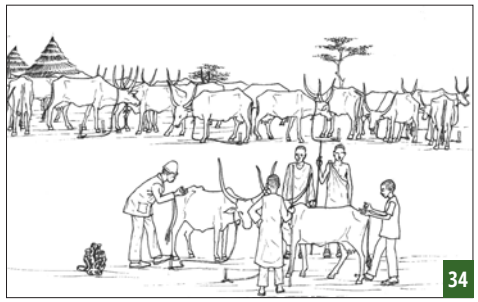
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*Section* 3

# Position of the veterinary paraprofessional

## *Veterinary paraprofessionals' roles and activities*

- Veterinary paraprofessional acts as a link between the CAHW and the private and/or public veterinarian, especially for the circulation of health information (*41*);
- They supervise the CAHW, verify their pre-diagnosis, validate their actions and contribute to their training under the authority of the veterinarian (private and/or public) (*42*);
- They manage the stock of medicines in the pharmacy in their sector under the supervision of the veterinarian (private and/or public) (*43, 44*);
- They centralize all field information as part of epidemiological surveillance monitoring (*45, 46*);
- They implement the health (in the event of an outbreak) and prophylactic (vaccination) measures decided by the veterinarian (private and/or public) and oversees their proper application (*47*);
- They identify and delimit on a map the infected areas in the event of an outbreak at the request of the veterinarian.

## *Veterinary paraprofessional's place in the community*

- The veterinary paraprofessional has followed a training course leading to a diploma in animal health (*48*);
- He/she must have good relationship-building skills in order to interact as effectively as possible with the farmers in his/her area (*49, 50*);
- He/she must have an authorization to practice given by the country's veterinary authority (*51*).


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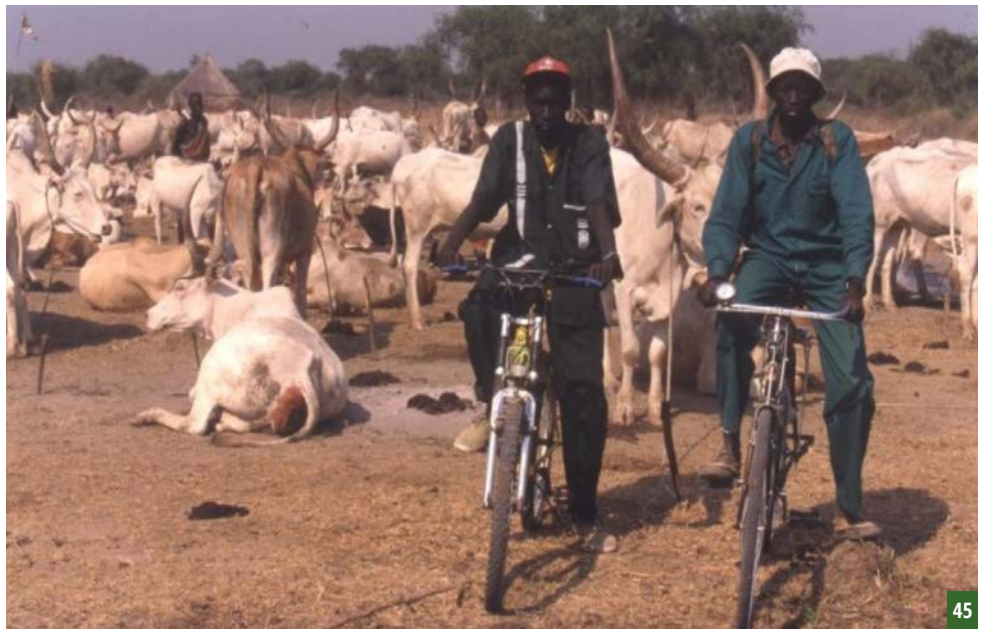
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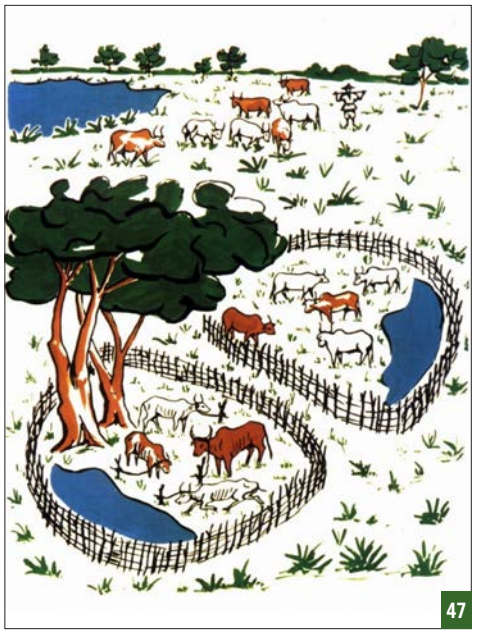
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## *Veterinary paraprofessionals' relationship with the CAHW*

- The veterinary paraprofessional oversees the work of the CAHWs. They watch out for their veterinary register, validate their procedures and confirm their pre-diagnosis. They also contribute to their continuous training under the authority of the veterinarian (private and/or public) (*52, 53*);
- They check the health information given by the CAHWs before forwarding it to the veterinarian (*54*);
- They regularly organize information reviews and animal disease awareness-raised campaigns for the CAHWs and farmers in their area (*55*);
- They set up vaccination campaigns under the authority of the veterinarian (private and/or public), possibly integrating the CAHWs in their area as vaccinators (*56*);
- They sell to the CAHWs the basic animal health medicines listed on the list of products authorized by the veterinary authority and necessary for their activities at fair prices (*57*).

## *Veterinary paraprofessionals' relationship with the veterinarian*

- The veterinary paraprofessional works under the authority of the veterinarian (private and/or public). The latter provides them with continuous training (*58*);
- They forward to the veterinarian (private and/or public) the health information of their area and the alert in case of suspicion of serious disease and/or outbreak (*59*);
- They spread the information given by the veterinarian (private and/or public) to the CAHWs and farmers in their area (*60*);
- They assist the veterinarian (private and/or public) in the event of an epidemiological investigation (questionnaires) and in the taking of samples (*61*);
- They assist them in the set-up of vaccination campaigns (*62*);
- They participate in the application of animal health measures by decision of the veterinarian (private and/or public) (*63*);
- They assist them in the management of the pharmacy and set up their prescriptions.


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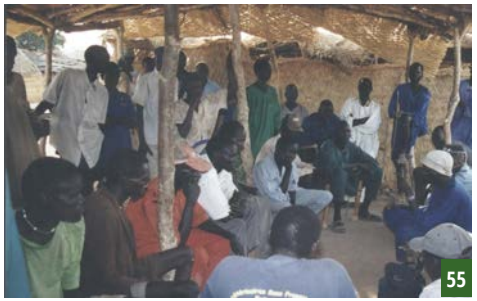
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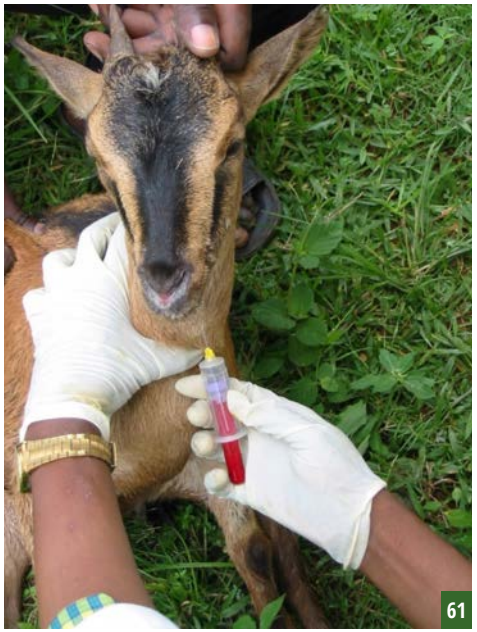
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*Section* 4

# Position of the private and/or public veterinarian

# *Veterinarian's roles and activities*

- The veterinarian (private and/or public) has completed advanced training in animal health with a PhD in veterinary medicine, and/or has been accredited by the competent authority of a country to practice animal medicine or veterinary science;
- He/she is responsible for animal health management in his/her area (*64*);
- He/she centralizes health information from his/her area for transmission to the veterinary authority, especially by collecting it from veterinary paraprofessionals and CAHWs (*65*);
- He/she alerts the veterinary authority in the event of strong suspicion and confirms contagious diseases listed by the OIE by sending samples to the reference laboratory (*66, 67, 68*);
- He/she ensures the continuous training of the veterinary paraprofessional and the CAHW and confirms their pre-diagnosis (*69*);
- He/she performs or prescribes veterinary procedures related to the pathologies encountered (*70*);
- He/she organizes vaccination campaigns and possibly health police measures in his/her area;
- He/she manages the pharmacy in his/her area (according to national legislation) with the support of the veterinary paraprofessional (*71*).

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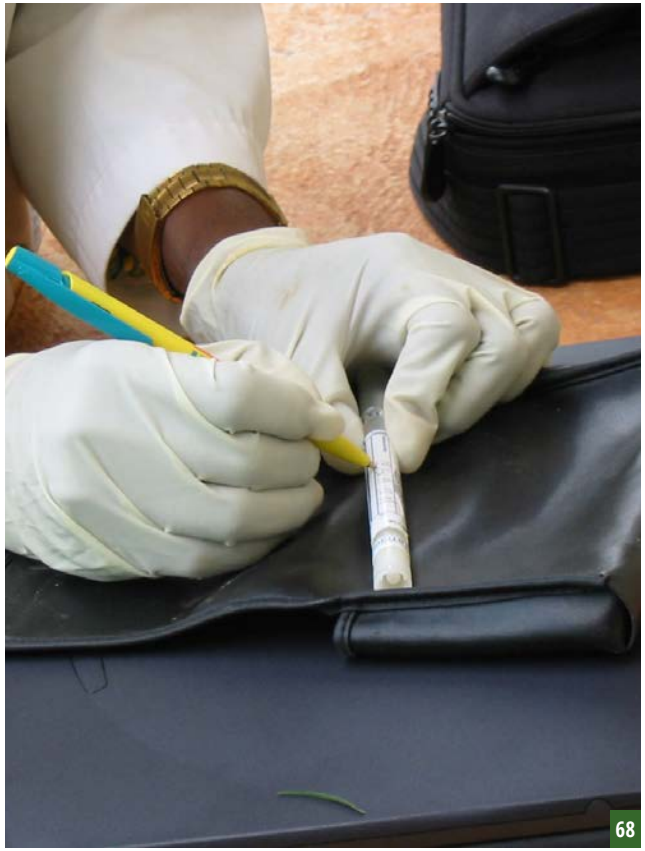
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## *Veterinarian's relations with veterinary paraprofessionals and CAHWs*

- The veterinarian (private and/or public) supervises and trains the veterinary paraprofessionals and CAHWs on an ongoing basis. He/she regularly set up workshops on priority diseases and/or other specific themes (*72*);
- He/she asks them for regular updates on the health information of the area he/she covers under a health mandate (*73*);
- He/she confirms their pre-diagnosis, validates their actions and the health care they provide to animals (*74, 75*);
- He/she involves the veterinary paraprofessionals in his/her area in the implementation of vaccination campaigns and possibly the CAHWs as vaccinators (*76, 77*);
- He/she involves them in animal disease awareness-raised campaigns aimed at communities in his/her area (*78, 79, 80*);
- He/she sells them at reasonable prices, the veterinary medicines products authorized by the veterinary authority he/she prescribes if necessary.

## *Relations between the veterinarian and the veterinary authority*

- The veterinarian (private and/or public) shall send a regular review of the health status of the livestock in his/her area to the veterinary authority. To do this, he/she collects information from veterinary paraprofessionals and CAHWs, as well as from his/her field visits (villages, markets, slaughterhouses, etc.) (*81, 82, 83*);
- He/she alerts the veterinary authority in case of strong suspicion of a priority and/or notifiable disease;
- He/she carries out epidemiological investigations (investigations and samples) at its request (*84*);
- He/she enforces animal health measures with the support of the veterinary paraprofessional;
- He/she implements medical and health prophylaxis programs (*85, 86*);
- He/she identifies and maps the areas affected by the diseases.


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CHAPTER

# Basic animal health care

*Section* 1

# Basic animal health care techniques

# *Measuring body temperature*

## Temperature measurement - In 6 steps

1. Find someone to hold the animal (*87*);
2. Shake the thermometer (alcohol or thermoelectric);
3. Insert it deeply into the rectum;
4. Wait at least one minute;
5. Remove it and read the result;
6. Clean and store the thermometer away from heat and sunlight.


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## Normal Temperatures - By Species

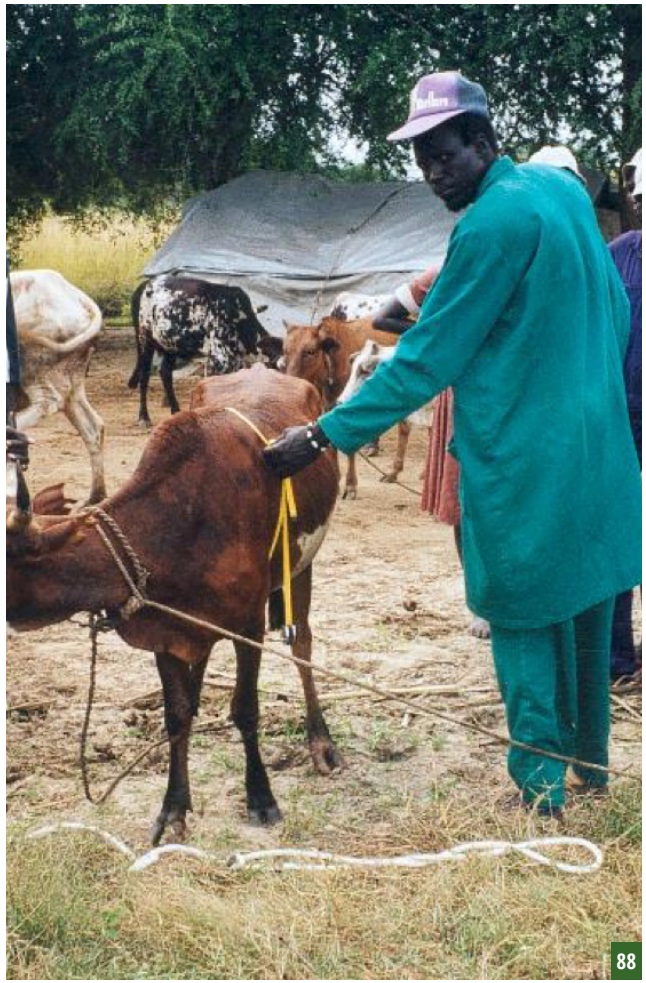
| Species | Normal temperature |
|---|---|
| CATTLE | From 37,5°C to 39,5°C |
| CAMELIDS | From 35°C to 41°C |
| HORSES | 37,5°C to 39°C |
| GOATS | 38,5°C to 40,5°C |
| SHEEP | 38,5°C to 40°C |
| SWINE | 38°C to 40,5°C |
| POULTRY | 40,5°C to 43°C |

Be careful, in young animals, the temperature is usually 1 degree Celsius (1°C) higher than in adults

# *Measuring weight*

## Weighing - 2 methods

1. The weight tape for cattle (*88, 89*);
2. The spring scale for sheep and goats (*90*).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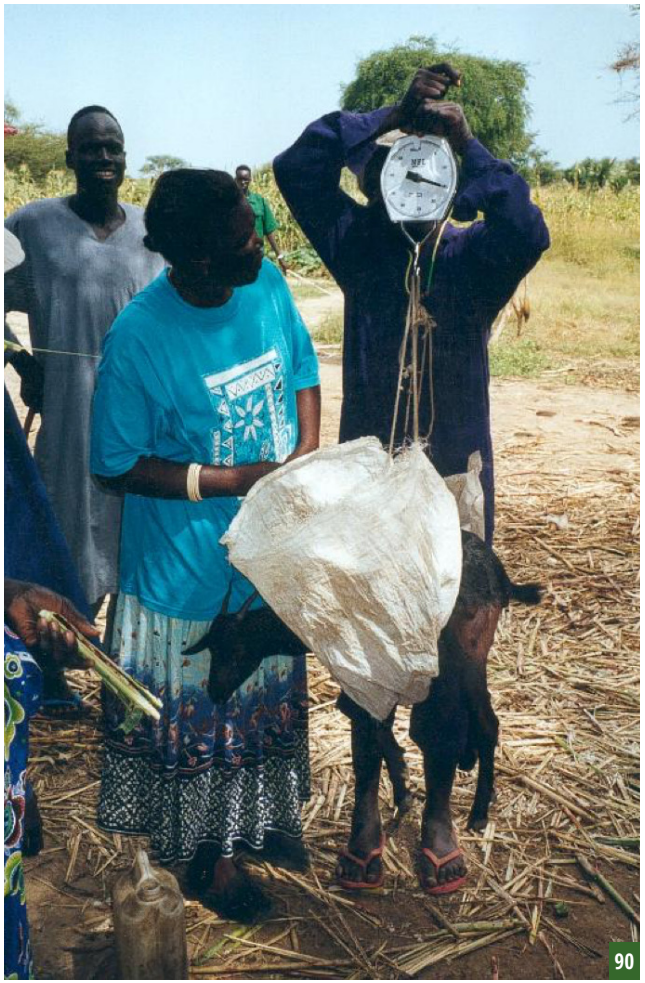
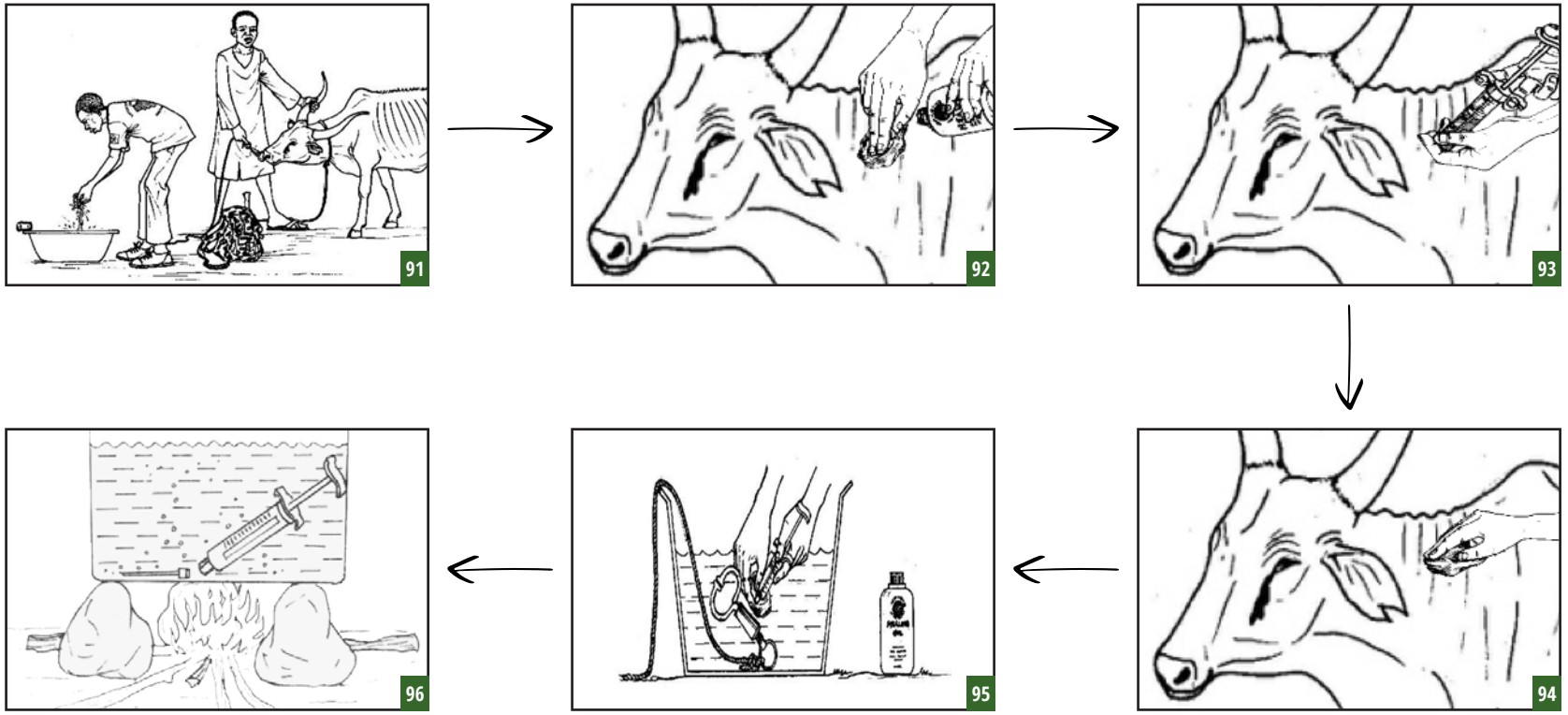

90

# *Disinfecting before injection*

## Clean the injection site - In 5 steps

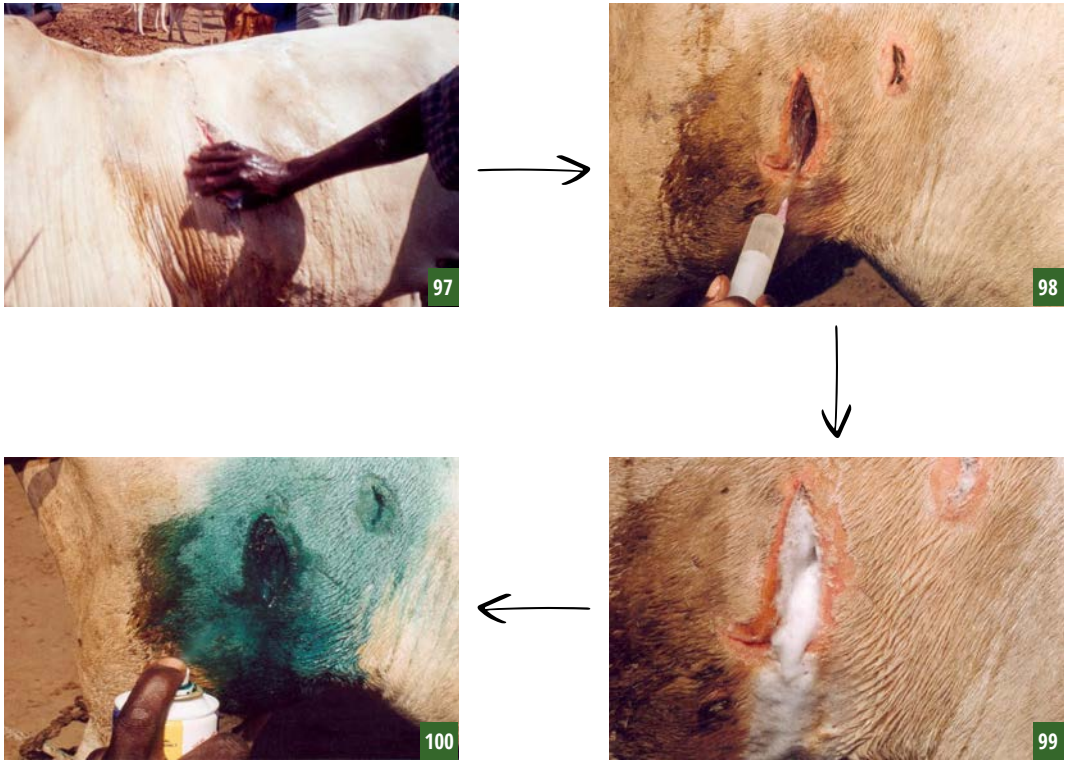
1. Wash hands with soap and water (*91*);
2. Clean the injection site with an iodine solution (e. g. povidone iodine) or quaternary ammonium (e. g. healing oil). Intramuscular injections are performed at the neck (*92*);
3. Stick the needle into the disinfected area (*93*);
4. Clean the area again with an iodine solution (*94*);
5. Clean the devices (*95*), sanitize them (*96*) and wash your hands again.



# *Cleaning wounds*

## Cleaning and treatment of deep wounds - In 4 steps

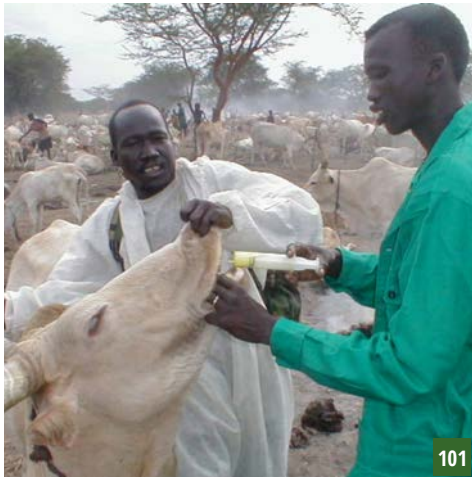
1. Remove all dead and dirty tissues with soap and water (*97*);
2. Cover the wound with hydrogen peroxide or iodine solution (*98*);
3. Allow hydrogen peroxide or iodine solution to escape from the wound (*99*);
4. Apply an antibiotic spray (*100*).



# *Administering medication*

## Oral administration:

- Example 1: Liquid Albendazole (*101, 102*);
- Example 2: Albendazole bolus (*103, 104*).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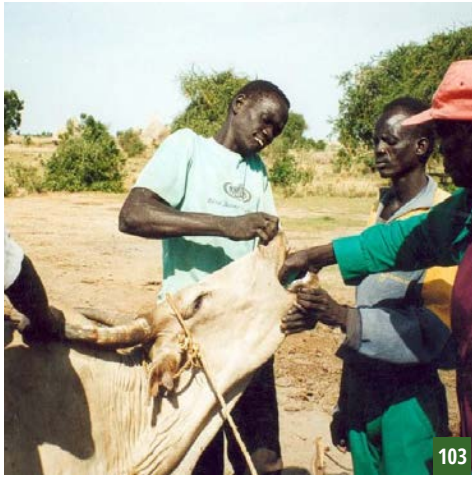

103


104

## Subcutaneous injection (under the skin):

- Example: Vaccination (*105*).

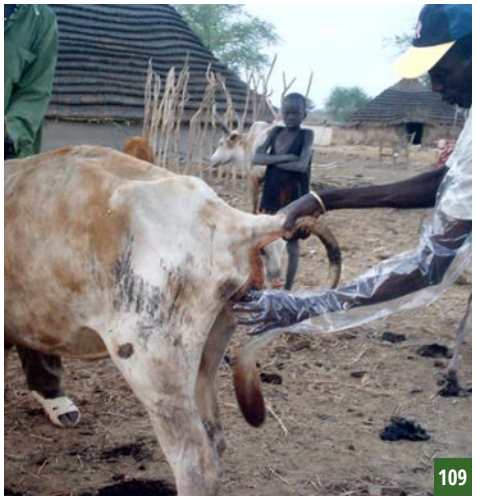

105

**Antibiotic spraying** *(106)* **:**

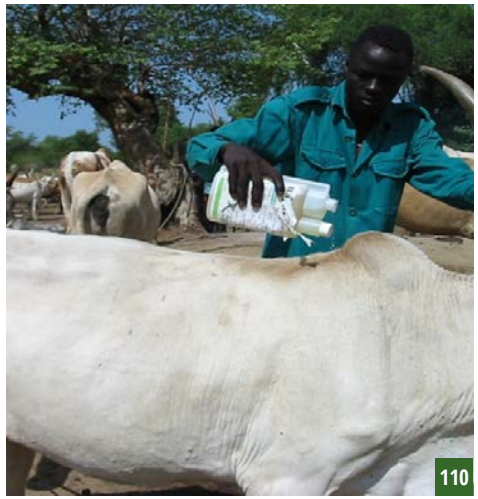

**Insecticide powder application** *(107)* **:**


**Acaricide spraying** *(108)* **:**

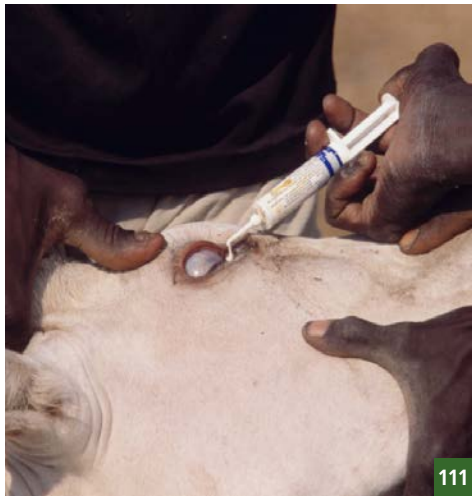

**Placement of a uterine pessary** *(109)* **:**




**External application** *(110)* **:**




**Eye ointment application** *(111)* **:**




**For your safety and that of the animals, it is imperative to wear gloves!**

**In some circumstances, wearing a mask and glasses is also strongly recommended!**

**All equipment must be stored in a safe place, out of the reach of children!**

*Section* 2

# Introduction to diagnosis

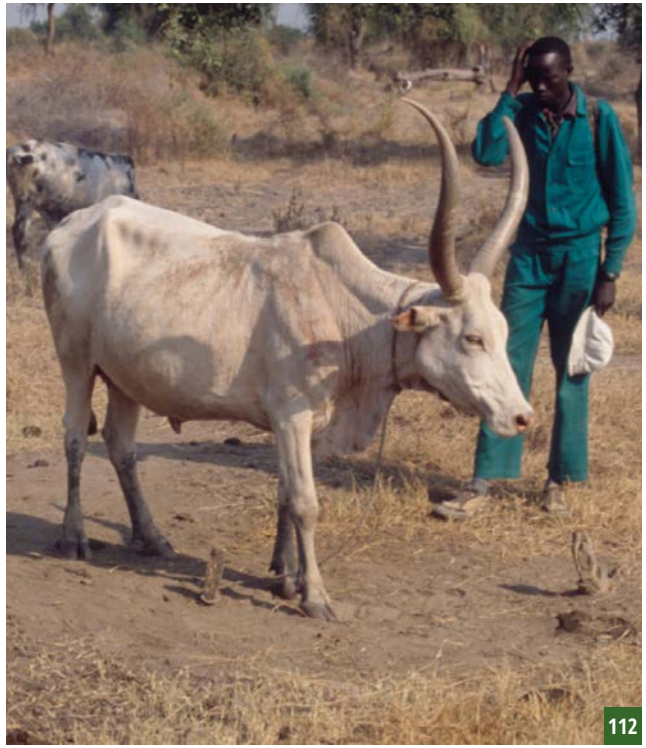
# *Diagnosing a disease*

The diagnosis of a disease is based on three types of examinations that follow one another over time:

1. Clinical examination of the living animal (*112*);
2. Autopsy of the corpse or the sacrificed animal (*113*);
3. Laboratory tests based on samples taken from the living animal or during the autopsy (*114*).

The accuracy of the diagnosis depends on these three equally important tests. Some diseases can be diagnosed by clinical examination alone, but most require confirmation by autopsy or laboratory tests.

*Each of these three examinations is discussed more precisely on pages 63 to 85*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113

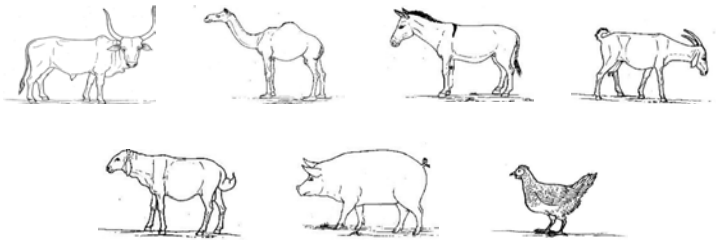

114

# *Differences between healthy and sick animals*

## Healthy animal

- Cheerful, calm, vigilant;
- Robust;
- Normal temperature;
- Smooth and supple skin;
- Shiny coat;
- Appetite, regular cud-chewing;
- Semi-liquid, semi-solid feces;
- Clean natural orifices;
- Regular walking, without lameness;
- Wet and pink mucous membranes;
- Wet and bright nostrils;
- Regular and silent breathing;
- Fluid urine, more or less dark yellow;

- In poultry: smooth plumage, straight head, safe gait, two-colored and semi-liquid feces.



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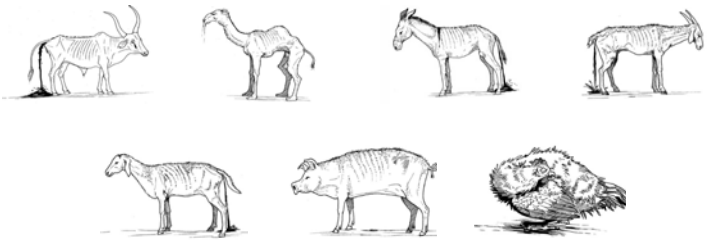
## Sick animal

- Sad, nervous or restless;
- Thin;
- Abnormal temperature;
- Rough and bare skin in some areas;
- Pitted, brittle and dull hair;
- Lack of appetite or pica (eats dirt or feces);
- Liquid or solid feces;
- Natural orifices soiled and dirty;
- Unsteady gait, lameness;
- Dark red or pale, purplish or dehydrated mucous membranes;
- Dry and cracked nostrils;
- Irregular and noisy breathing;
- Dark urine streaked with blood;

- In poultry: spiky feathers, drooping wings, nasal/oral discharge on the beak, conjunctivitis (dirty eyes), head lying on the back, sagging on the tarsus.



*Section* 3

# Clinical examination

# *Objectives*

## Examination of the sick animal - Why?

- To identify the disease;
- To decide on the best treatment and propose preventive measures for the rest of the herd not yet affected (*115, 116*);
- To be able to report to the reference veterinarian, so he/she can confirm the suspicion.

## Examination of the animal after treatment - Why?

- To check the effectiveness of the treatment (*117*);
- To show the farmers the importance of treating theirs animals properly and how we do care about the latter (*118*).


115


116


117


118

# *Three-step method*

*Step 1*

**HERD HISTORY**

**Ask the farmer:**

- Where did the herd come from?
- How long has he/she been at this place?
- Size and composition of the herd?
- Recent introduction of animals into the herd?
- How many animals have died in the herd from this disease, since when and at what rate?
- How many sick animals in the herd for this disease, since when and at what rate?
- How many apparently healthy animals?

*Step 2*

**HISTORY OF THE ANIMAL AND THE SICK ANIMALS**

**Ask the farmer:**

- Age, sex, category (calf, heifer)?
- Date of arrival in the herd and place of origin?
- Previous diseases for this animal?
- If female: number of pregnancies (of the sick animal) and number of viable calves?
- Any close contact with other animals suspected of diseases?
- Duration of the disease (date of first symptoms)?
- Aggravation or not?

*Step 3*

**EXAMINATION OF CLINICAL SIGNS**

**Visual examination:**

- Overweight;
- Feeding and cud-chewing;
- Energy;
- Head carriage;
- Nervous disorders;
- Coat quality;
- Presence of flies and ticks;
- Photosensitivity;
- Breathing;
- Oral/nasal discharges;
- Lameness;
- Diarrhea.

*This have to be followed by a clinical examination discussed on pages 66 to 69*

# *Clinical examination*

## Mucous membranes (mouth and eyes):

- Color (*119*);
- Moisture condition;
- Nature of discharges (*120*).


119


120

## Degree of hydration (skin fold):

- Pull (*121*);
- Release (*122*);
- The skinfold must disappear immediately. If it persists for a few seconds, it means that the animal is dehydrated.


121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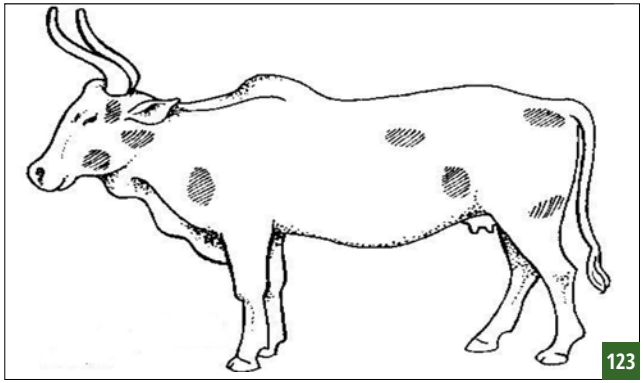
## Lymphatic nodes:

- Location of palpable lymph nodes under the skin (*123*);
- Feel and assess the size: if the lymph node is large and easy to grasp by hand, it is a sign of disease (*124*).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124

## Digestive system:

- Condition of the mouth (*125*);
- Stomach movements and noises (*126*);
- Appetency;
- Feces condition.

## Respiratory system:

- Nasal movements and discharges;
- Thoracic movements and noises (*127*);
- Cough (*128*).

## Members:

- Joints (*129*);
- Feet (*130*);
- Deformities, lameness or injuries.


125


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129


130

### Nervous system:

- Coordination of movements (*131*);
- Sight (*132*);
- Aggressiveness or lethargy.


131


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### Skin:

- Hair loss;
- Skin color;
- Presence of injuries (*133*);
- Presence of ectoparasites;
- Irritations, swelling (*134*).


133


134

### Udder:

- Size and balance of mammary glands (*135*);
- Presence of hard areas;
- Teat condition (*136*).


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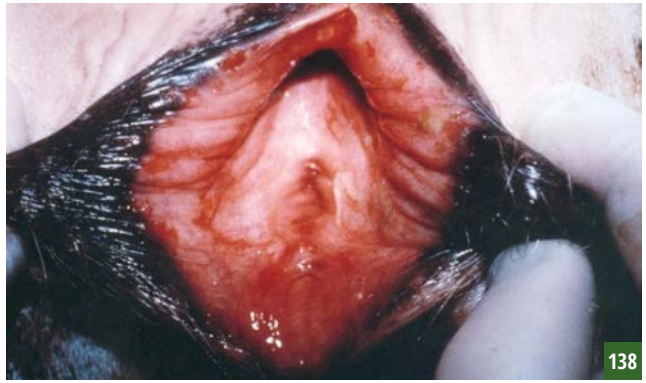
## Vulva:

- Moistness (*137*);
- Color (*138*);
- Presence of injuries or discharges.


137


138

## Temperature:

- Using the thermometer (*139*);
- Insert it deep into the rectum for at least 1 minute (*140*).


139


140

*A summary table of the methodology to be used to carry out the clinical examination is available on pages 70 and 71*

*The animal may need to be restrained for examination using restraint techniques available in appendix 7 (page 267)*

# *Summary table*

| Examination | Observations | Normal | Alarming |
|---|---|---|---|
| MUCOUS MEMBRANES | Moistness, color | Pink, bright | Pale, white, yellow or dark red, dry, injured |
| STATE OF HYDRATION | Pull and release the skin: skinfold | The skinfold disappears quickly | The skinfold remains for a few seconds |
| LYMPH NODES | Feel under the skin: size | Small and not visible under the skin | Large and visible under the skin |
| DIGESTIVE SYSTEM | Look at the mouth, tongue, feel the neck, listen to the stomach, check the stool | Clean mouth, neck without deformation, regular noises of digestion | Food debris in the mouth, mass in the esophagus, no digestion noise, bloating |
| RESPIRATORY SYSTEM | Look at the nostrils, feel the neck, listen to the chest | Nostrils without discharge, no cough, wind noises | Yellow, white or dark red discharge from the nostrils, cough with or without palpation of the neck, no noise or water noises |
| MEMBERS | Look at the gait and shape of the 4 members | Rights, without deformation | Lameness, swelling at all levels: joints, muscle masses, bone parts |

| Examination | Observations | Normal | Alarming |
|---|---|---|---|
| NERVOUS SYSTEM | Check the view, the behavior | Reacts to hand movement, calm | No reaction to moving an object or hand in front of the eyes, aggressiveness or depression |
| SKIN | Hair condition, color and appearance of the skin | Smooth, shiny coat, dry and clean skin | Straight, brittle, dull, oozing or scabbed hair, red spots on the skin |
| UDDER | Teat condition, palpation of the mammary glands | Clean and painless teats, soft and painless udder, balanced udder size | Teats with scabs or papules, painful, udder with hard areas |
| VULVA | Moistness, color | Pink, bright, clear | Pale, white, yellow or dark red, dry, injured, yellow or dark red smelly discharges |
| TEMPERATURE | Using the thermometer, reaction to light | Normal values for the species, the animal is not afraid of light (not systematic) | Below and above normal values for the species, the animal sometimes fears light |

*Section* 4

# Autopsy

## *Definition and objectives*

The autopsy (or necropsy) follow the clinical examination performed on the same animal before its death, or on other animals showing the same symptoms.

The autopsy has 2 essential purposes:

- Examine the animal's internal organs looking for possible lesions to guide the diagnosis;
- Take samples for laboratory tests.

*An illustration of the equipment required to perform the autopsy examination is available on page 75 (141)*

*Complete autopsy methodologies for small ruminants and poultry are available in appendices 5 and 6 (pages 249 and 257)*

## *Conditions of realization*

- When working on a corpse, the autopsy must be performed as soon as possible after death;
- A late autopsy will provide little information and will not allow for quality sampling;
- To be valid, an autopsy must be complete (*142* to *150*, a few steps of an autopsy on a small ruminant);
- The examination should not be limited to only those parts that are supposed to be sick, as it often happens that the examination of other (supposedly healthy) organs is full of surprises.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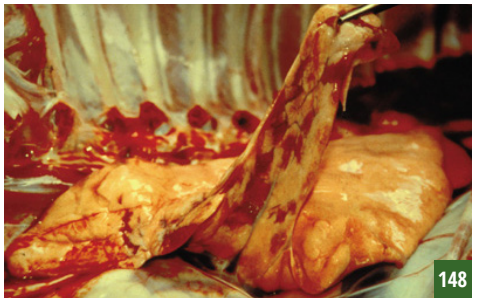
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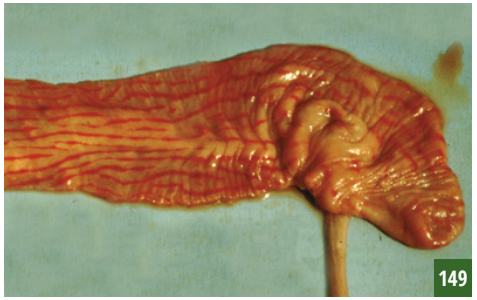
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150

*Section* 5

# Laboratory tests: Samples

# *Samples from living animals*

**Whole blood or serum** (*151*) **:**


**Eye swabbing** (*152*) **:**


**Nasal swabbing** (*153*) **:**


**Oral swabbing** (*154*) **:**


**Ganglionic puncture** (*155*) **:**


**Blood layer on filter paper** (*156*) **:**


**For your safety and that of the animals, it is imperative to wear gloves!**

**In some circumstances, wearing a mask and glasses is also strongly recommended!**

**All equipment must be stored in a safe place, out of the reach of children!**

# *Storage and transport procedures*

- All samples must be accompanied by a complete history data;
- The samples must be individually numbered (157, 158);
- They must be transported as soon as possible after sampling. The useful and necessary equipment (cooler, packaging, data sheet, etc.) must be available (159);
- Transport to the laboratory must be carried out under appropriate temperature conditions (room temperature, positive or negative cold) in relation to the suspicion raised and the samples taken.


157

158


159

# *Diagnostic confirmation*

The collection methods and the types of samples to be taken are linked to the suspicion raised by the animal health worker. The veterinarian (public and/or private) will usually take the samples and organize their storage for transport to the national laboratory. Depending on the suspected disease(s), samples may be sent to a reference laboratory.

The following table describes, for each disease, the collection procedures, types of analyses, types of samples and their transport conditions.

*A list of national and international diagnostic and reference laboratories and a detailed reminder of the regulatory framework for sample transport procedures are available in appendices 8 and 9 (pages 275 and 279)*

| Disease | Animal | Types of analyses | Types of samples | Transport conditions |
|---|---|---|---|---|
| ANAPLASMOSIS | Living animal | Bacteriology (Blood smear on slide with staining, molecular biology) | Blood with anticoagulant (Vacutainer 5ml) | Refrigerated (+4 °C) |
| | | Serology | Serum | |
| BABESIOSIS | Living animal | Bacteriology (Blood smear on slide with staining, molecular biology) | Blood with anticoagulant (Vacutainer 5ml) | Refrigerated (+4 °C) |
| | | Serology | Serum | |
| BRUCELLOSIS | Living animal | Bacteriology (Blood culture isolation) | Uterine, vaginal, or abortion fluids, lymph nodes, male and female reproductive organs | Room temperature |
| | | Serology | Serum / Milk | Refrigerated (+4 °C) |

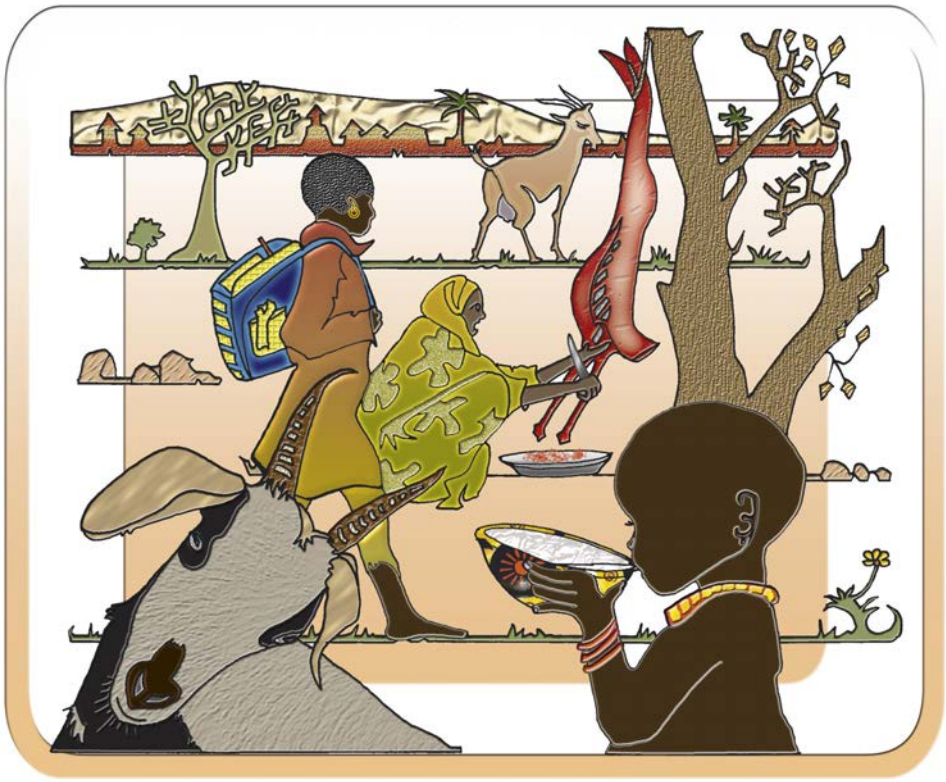
| Disease | Animal | Types of analyses | Types of samples | Transport conditions |
|---|---|---|---|---|
| ANTHRAX | Living or dead animal | Bacteriology (Direct examination colored Gram, culture) | Blood with anticoagulant (Vacutainer 5ml) Edema puncture, spleen | Room temperature |
| | | Serology | Serum | |
| BLACKLEG | Living or dead animal | Bacteriology by microscopy | Muscle sampling (at least 10*10*10 cm) | Room temperature |
| SHEEP POX | Living animal | Virology (Molecular biology, electron microscopy) | Skin papules biopsy Blood with anticoagulant (Vacutainer 5ml) | Refrigerated (+4°C) and dry (virus detection) or fixed with gluta-raldehyde (electron microscopy) |
| | After autopsy | Serology | Serum | Refrigerated (+4 °C) |
| COWDRIOSIS | Living animal | Bacteriology (Blood smear on slide with staining, molecular biology) | In the febrile phase, blood collected with anticoagulant (Vacutainer 5ml) | Refrigerated (+4 °C) if transported to the laboratory < 12 hours If delay > 12 hours, freeze at -20°C |
| | | Serology | Serum | |
| | After autopsy | Bacteriology (Blood smears, culture, molecular biology) | Brain biopsy | |
| DERMATOPHILOSIS | Living animal | Bacteriology (Blood smear on slide with staining, molecular biology) | Fresh scabs, skin with lesion | Refrigerated (+4 °C) |
| | | Serology | Serum | |
| LUMPY SKIN DISEASE | Living animal | Virology (Molecular biology, electron microscopy) | Skin nodules biopsy Lymphatic node fluid Blood with anticoagulant (Vacutainer 5ml) | Refrigerated (+4°C) and dry (virus detection) or fixed with gluta-raldehyde (electron microscopy) |
| | | Serology | Serum | |
| ECHINOCOCCOSIS | Living animal | Microscopic/Coprology | Fresh stools | Refrigerated (+4°C) or at room temperature |
| | After autopsy | Microscopic/Lesions | Liver, lung | |

| Disease | Animal | Types of analyses | Types of samples | Transport conditions |
|---|---|---|---|---|
| FASCIOLOSIS | Living animal | Microscopic/Coprology | Fresh stools | Refrigerated (+4°C) in a stool culture pot or at room temperature on an examination glove |
| | After autopsy | Microscopic/Coprology | Bile ducts | Room temperature |
| FOOT-AND-MOUTH DISEASE | Living animal sick for less than 10 days | Virology (Molecular Biology) | Epithelium and lymph in vesicles + 1 cm2/1g epithelium from vesicles (tongue, mucous membranes, interdigital spaces) and/or oropharyngeal samples | Refrigerated (+4°C) in a sterile sample cup as soon as possible, dry transport or in PBS solution Oropharyngeal samples: Refrigerated (+4°C) if transported to the laboratory < 12h / If delay > 12h, freeze at -80°C |
| | Living animal sick for more than 10 days | Serology | Serum | |
| BLUETONGUE | Living animal | Virology (Isolation, culture, molecular biology) | Blood with anticoagulant (Vacutainer 5ml) | Refrigerated (+4°C) if transported to the laboratory < 48h / If delay > 48h, freeze at -80°C |
| | After autopsy | Virology | Spleen | |
| RIFT VALLEY FEVER | Febrile living animal | Virology (Isolation and molecular biology) | Plasma or serum with anticoagulant (Vacutainer 5ml) | Refrigerated (+4°C) if transported to the laboratory < 48h / If delay > 48h, freeze at -80°C |
| | | Serological (IgM, IgG) | Serum | |
| | After autopsy | Virology (Isolation and molecular biology) | Liver, spleen, brain (+5 g), runt | |
| Q FEVER | Living animal | Bacteriology | Uterine, vaginal, placental, abortion fluids, abortion tissues, milk, colostrum | Refrigerated (+4°C) if transported to the laboratory < 24h / If delay > 24h, freeze at -20°C |
| | | Serology | Serum | Refrigerated (+4°C) |
| | After autopsy | Bacteriology | Uterine, vaginal, placental, abortion fluids, abortion tissues, milk, colostrum | Refrigerated (+4°C) if transported to the laboratory < 24h / If delay > 24h, freeze at -20°C |

| Disease | Animal | Types of analyses | Types of samples | Transport conditions |
|---|---|---|---|---|
| WEST NILE FEVER | Living animal | Serology | Serum | Refrigerated (+4°C) if transported to the laboratory < 24h / If delay > 24h, freeze at -80°C |
| | After autopsy | Virology (Isolation and molecular biology) | Horses: Brain, spinal cord Birds: Kidney, heart, brain, liver, intestine | |
| SCABIES | Living animal | Microscopic/Binocular magnifier | Skin scrapings | At room temperature On slide, dry |
| AVIAN INFLUENZA | Living animal or after autopsy | Virology (Culture and molecular biology) | Cloacal and tracheal swabs, feces + Fragments of intestine, brain, trachea, lung, liver and spleen after autopsy | Refrigerated (+4°C) as soon as possible, in PBS solution with added antibiotics (Penicillin (2000 units/ml), streptomycin (2 mg/ml), gentamycin (50 µg/ml) and mycostatin (1000 units/ml)) If delay > 48h, freeze at -80°C |
| | Living animal | Serology | Serum | Refrigerated (+4 °C) |
| NEWCASTLE DISEASE | Living animal or after autopsy | Virology (Culture and molecular biology) | Cloacal and tracheal swabs, feces + Fragments of intestine, brain, trachea, lung, liver and spleen after autopsy | Refrigerated (+4°C) as soon as possible, in PBS solution with added antibiotics (Same dosages as for avian influenza) If delay > 48h, freeze at -80°C |
| | Living animal | Serology | Serum | Refrigerated (+4 °C) |
| PASTEURELLOSIS | Living animal | Bacteriology | Blood with anticoagulant (Vacutainer 5ml) | Refrigerated (+4 °C) |
| | After autopsy | Bacteriology | Blood with anticoagulant, long bone, lung fragments | |

| Disease | Animal | Types of analyses | Types of samples | Transport conditions |
|---|---|---|---|---|
| CONTAGIOUS BOVINE PLEUROPNEUMONIA | Living animal | Bacteriology | Pleural fluid (5 ml) Bronchial-cell/ nasal swabs | Refrigerated (+4 °C) if transported to the laboratory < 24 hours<br>If delay > 24 hours, freeze at - 20°C |
| | | Serology | Serum | |
| | After autopsy | Bacteriology | Pleural fluid (5 ml) Whole regional nodes<br>Fragments of lungs | |
| SHEEP AND GOAT PLAGUE | Living animal | Virology (Isolation and molecular biology) | Blood with anticoagulant (Vacutainer 5ml)<br>Swabs from eye, oral and nasal conjunctiva | Refrigerated (+4 °C) if transported to the laboratory < 24 hours<br>If delay > 24 hours, freeze at -80°C |
| | | Serology | Serum | |
| | After autopsy | Virology (Isolation and molecular biology) | Lymph nodes, lung, intestine, spleen | |
| AFRICAN SWINE FEVER | Living animal | Virology (Molecular Biology) | Blood with anticoagulant (Vacutainer 5ml)<br>Spleen, tonsils, ileocecal lymph nodes, kidneys | Refrigerated (+4 °C) |
| | After autopsy | Serology | Serum | |
| CONTAGIOUS CAPRINE PLEUROPNEUMONIA | Living animal | Bacteriology | Pleural fluid (5 ml) Bronchial-cell/ nasal swabs | Refrigerated (+4 °C) if transported to the laboratory < 24 hours<br>If delay > 24 hours, freeze at -20°C |
| | Living animal | Serology | Serum | |
| | After autopsy | Bacteriology | Pleural fluid (5 ml) Whole regional nodes<br>Fragments of lungs | |

| Disease | Animal | Types of analyses | Types of samples | Transport conditions |
|---|---|---|---|---|
| RABIES | Living animal | Immunology | Serum | Refrigerated (+4 °C) |
| | After autopsy | Virology (Direct fluorescence test, immunohistochemistry, molecular biology) | Brain biopsy | |
| THEILERIOSIS | Living animal | Parasitology (Blood smear or lymph node on slide with staining, molecular biology) | Lymphatic node Blood with anticoagulant (Vacutainer 5ml) | Refrigerated (+4 °C) |
| | | Serology | Serum | |
| TRYPANOSOMIASIS | Living animal | Parasitological (Direct examination on slide, culture) | Blood with anticoagulant (Vacutainer 5ml) Nodal puncture | Room temperature |
| | | Serology | Serum | Refrigerated (+4 °C) |
| BOVINE TUBERCULOSIS | Living animal | Immunology related to interferon/ Bacteriology (Isolation, pathogen detection by molecular biology techniques) | Blood with anticoagulant (Vacutainer 5ml) | Refrigerated (+4 °C) |
| | | IDR test with reading 72 hours later | Tuberculin injection | |
| | After autopsy | Immunology related to interferon production | Blood with anticoagulant (Vacutainer 5ml), lung fragment, lymph node, spleen | |
| INTESTINAL WORMS | Living animal | Microscopic/Coprology | Fresh stools | Refrigerated (+4°C) in a stool culture pot or at room temperature on an examination glove |
| | After autopsy | Microscopic/Coprology | Fresh stools | |



Géraldine Laveissiere © cirad-astre, 2018

CHAPTER

# Introduction to animal diseases

*Section* 1

# Pathogens and transmission

# *Pathogens*

Pathogens are small living organisms that survive and multiply in the organs of an animal (the host) or on its skin. They cause disease in this host, either directly or indirectly via a vector. In this manual, we will distinguish between parasites and microbes.

## Parasites - Internal and external

Parasites are living organisms that live and develop at the expense of other organisms, the hosts.

They are often responsible for a decrease in the general state of health and a decrease in production (milk, meat), ultimately leading to a disease that can lead to death.

They can also transmit many diseases to their host. Host resistance to other diseases is rapidly reduced by parasitism.

There are several types, depending on whether they are internal (endoparasites), external (ectoparasites) and visible to the naked eye or not.

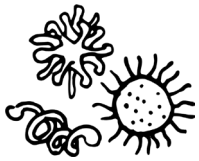
*A table detailing the characteristics of internal and external parasites, visible or not to the naked eye, is available on page 91*

## Microbes - Some examples

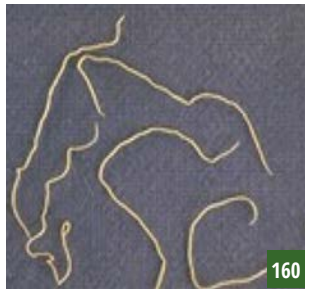
Microbes are living organisms invisible without a special laboratory equipment.

They develop inside the animal's body. They are responsible for a large number of contagious diseases, including the following examples, which will be developed later in this manual:

- Anthrax;
- Blackleg;
- Pasteurellosis;
- Foot-and-mouth disease;
- Contagious bovine pleuropneumonia;
- Sheep and goat plague;
- African swine fever;
- Newcastle disease;
- Avian influenza.



| *Parasites* | **Internal** | **External** |
|---|---|---|
| VISIBLE TO THE NAKED EYE | Parasitic worms are visible, either directly in the feces (*160*) or by opening the liver or stomach (*161*) | Most adult parasites are visible to the naked eye. Some live between the animal's fur, others in the sinuses (*162*). Others live under the skin, such as insect larvae (*163*), or upon the skin, such as ticks (*164*) and flies (*165*) |
| INVISIBLE TO THE NAKED EYE | Eggs can be detected under the microscope from the feces of infested animals (*166, 167, 168*). Parasites can be detected under the microscope from the blood of infected animals, as in trypanosomiasis (*169*) | Some are big enough to be collected (*170*) and observable under a microscope, as the mites responsible for scabies (*171*) |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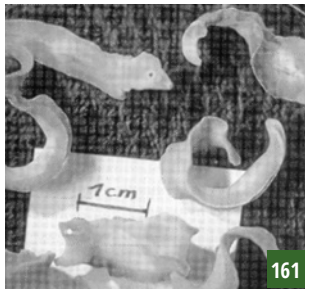

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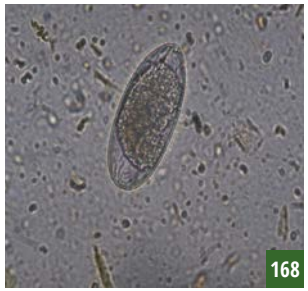
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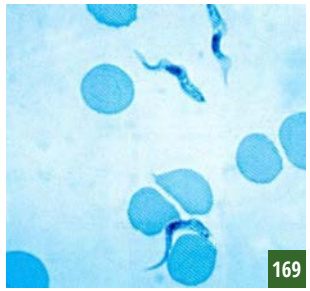
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171

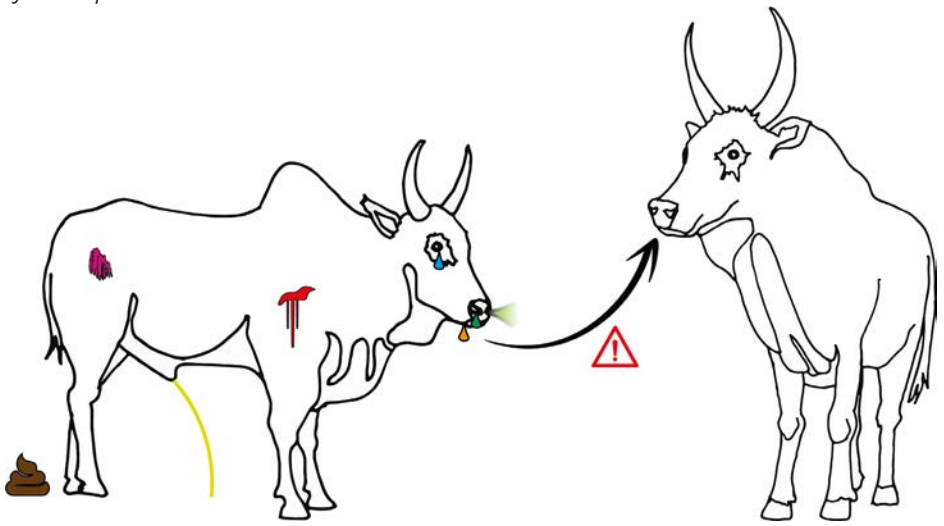
# *Transmission of a disease*

| *Transmission* | **By absorption** (172) | **By contact** (173) | **By means of a common vehicle (Mechanically)** (174) | **By means of a biologic vector (Vector-borne)** (175) |
|---|---|---|---|---|
| PORTALS OF ENTRY | ◆ Digestive tract (mouth)<br>◆ Respiratory tract (mouth, nostrils) | ◆ Skin (healthy or damaged)<br>◆ Mucous membranes | ◆ Digestive tract (mouth)<br>◆ Respiratory tract (mouth, nostrils)<br>◆ Skin (healthy or damaged)<br>◆ Genitals<br>◆ Mucous membranes | ◆ Skin (healthy or damaged) |
| PRODUCTS CONCERNED | ◆ Any discharge (ocular, nasal, oral)<br>◆ Blood<br>◆ Genital fluids<br>◆ Genital membranes<br>◆ Breathing drops<br>◆ Urine drops<br>◆ Feces<br>◆ Abortion products<br>◆ Slaughter residues<br>◆ Fragments or debris of skin | ◆ Any discharge (ocular, nasal, oral)<br>◆ Blood<br>◆ Genital fluids<br>◆ Genital membranes<br>◆ Breathing drops<br>◆ Urine drops<br>◆ Feces<br>◆ Abortion products<br>◆ Slaughter residues<br>◆ Fragments or debris of skin | ◆ Veterinary devices and equipment<br>◆ Clothing, hats and shoes<br>◆ Ropes, containers and knives<br>◆ Harnesses<br>◆ Foodstuffs<br>◆ Soil, grass, fodder<br>◆ Water | ◆ Mosquitoes<br>◆ Biting flies<br>◆ Midges<br>◆ Ticks<br>◆ Horseflies |

## *Good to know*

A vector refers to an insect or any living vector that transports an infectious agent between a susceptible individual and the food they eat or their immediate environment. This infectious agent may or may not go through a development cycle within the vector.

*By absorption*



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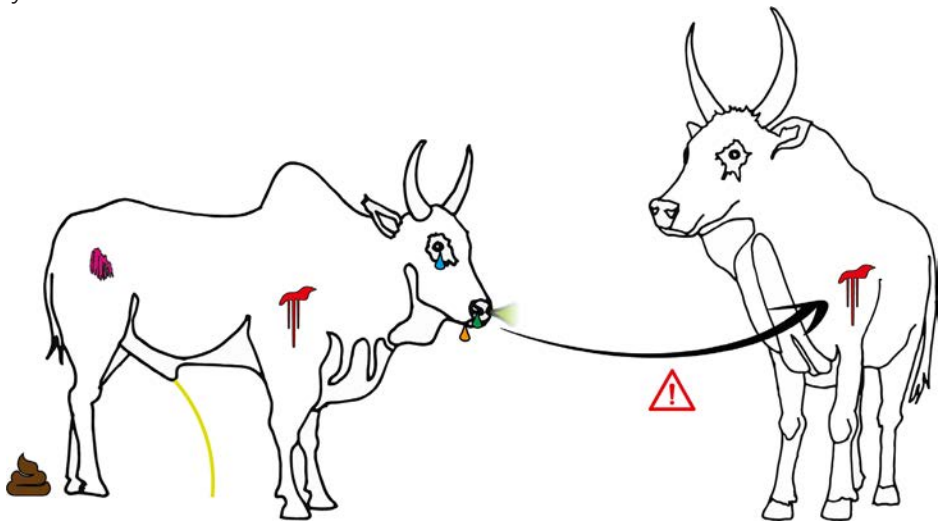
*By contact*



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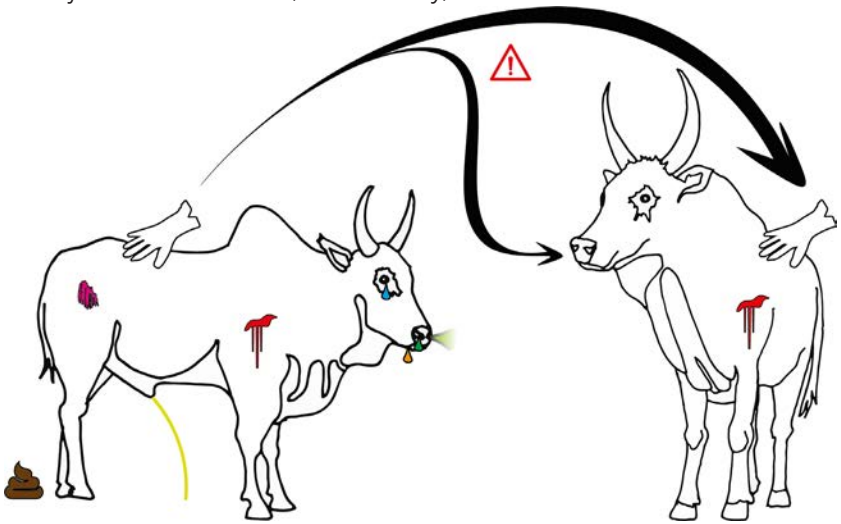
*By means of a common vehicle (Mechanically)*



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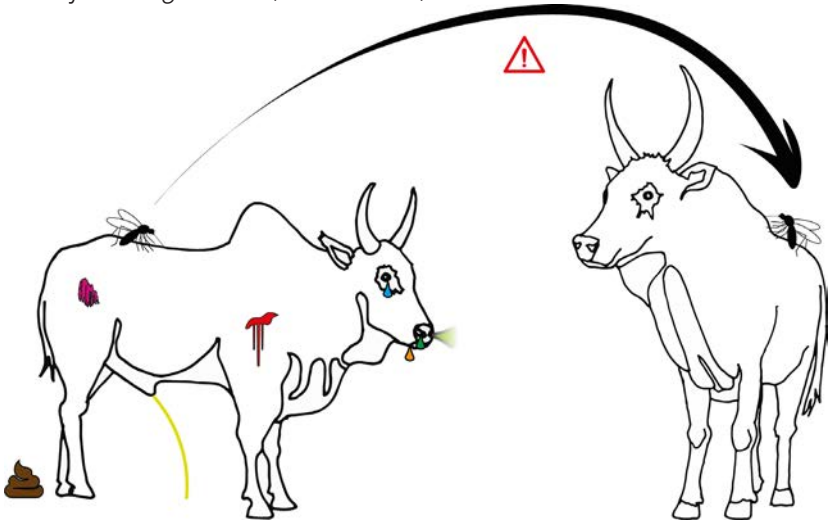
*By means of a biologic vector (Vector-borne)*



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*Section* 2

# Basic notions about prevention, treatment and control

# *Prevention*

Prevention is about impeding pathogens, which are responsible for diseases, from entering the animal's body. This can be done by using vaccination (*176*) or by isolating healthy animals from sick ones and new ones introduced into the herd (*177*). It is also about removing disease-causing agents after they have entered the animal's body (regular screening, *178*) and before they have acted (antibiotic treatment before transport, *179*).

Vaccination and preventive treatments with drugs are considered to be preventive medical measures. Other measures to prevent the transmission of pathogens, such as isolation, quarantine, movement control and disinfection, are preventive health measures. All these preventive measures (= prophylaxis) contribute to the protection of herds against pathogens.

**As far as possible, it is better to prevent than to cure!**


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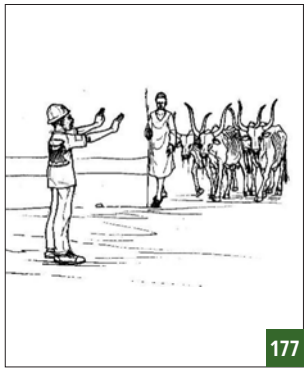
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## *Good to know*

In terms of prevention, the CAHW and the veterinary paraprofessional must:

- Alert their veterinary authority (private and/or public veterinarian in the area) as soon as they identify a disease or several suspicious clinical signs;
- Participate in prophylactic operations (preventive treatments or vaccination campaigns) under the supervision of the veterinarian;
- Raise the awareness of farmers about the dangers of diseases and the importance of implementing treatments as soon as symptoms show up, under the supervision of the veterinarian.

# *Treatment*

This means removing pathogens with medication after they have entered the animal's body and started making it sick.

Veterinary drugs are effective only if:

- They are purchased in the pharmacy of private and/or public veterinarians (if authorized by national legislation) in the area;
- They have been stored in appropriate conditions;
- The expiration date is not passed;
- They are good quality drugs (not counterfeits);
- They are used with the right active ingredient and in the right concentration;
- They are administered at the right dosage and for the right amount of time.


180


181

## *Good to know*

In some special circumstances, by decision of the veterinary authority and under its responsibility, the veterinary paraprofessional may administer products outside its authorized list, such as:

- Injectable antibiotics (*180*);
- Fasciolicides;
- Trypanocides (*181*).

The CAHW is limited to the use of:

- Oral anthelmintics;
- Ectoparasiticides;
- Antibiotics in spray form;
- Ointments;
- Gynecologic pessaries;
- Disinfectants.

# *Control*

## Avoid the occurence of a disease

- Practice good personal hygiene;
- Always boil the milk before drinking it;
- Keep animals clean and hygienic if farming conditions allow it (*182*);
- Clean the dung in the pens (*183*);
- Maintain a healthy distance between animals on the picket line (*184*);
- Systematically keep new animals isolated for several weeks (quarantine) before introducing them into the herd (*185*);
- Do not bring several herds together at pastures and water points (*186*);
- Ensure that the animals are regularly vaccinated against known diseases and treated against worms (*187, 188*);
- When re-using syringes, make sure that they have been sanitized with boiling water;
- Build solid and clean slaughter areas and fence them off to prevent dogs from entering them (*189*);
- Limit the spread of carcass residues by stray dogs (*190*).

## Avoid the spread of a disease

- Alert the veterinary authority;
- Inform farmers;
- Burn and/or bury dead or slaughtered animals (*191, 192*);
- Put every new animal in quarantine and isolate sick animals from the herd (*193*);
- Absolutely prohibit the gathering of animals from different herds especially at water points (*194*);
- Prohibit all movement in the infected area(s) (*195*);
- Slaughter long infected or infertile animals (*196*);
- Slaughter females that have had several abortions;
- Play a part in ring vaccination or emergency vaccination campaigns;
- If necessary, treat with drugs from the authorized list (*197*).


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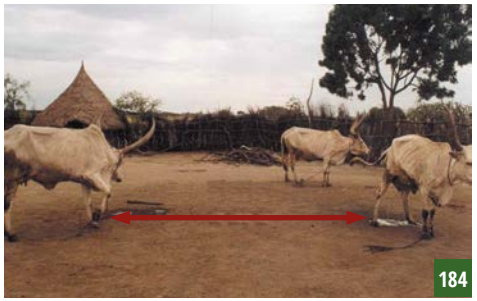
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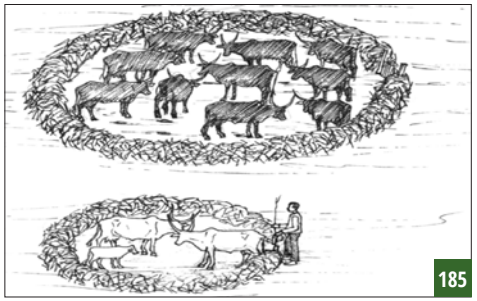
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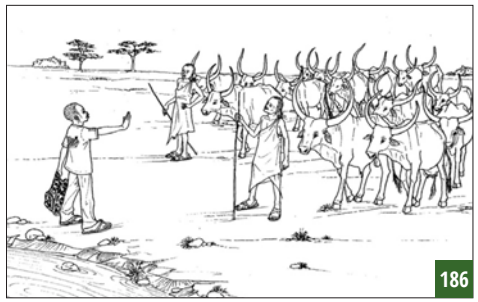
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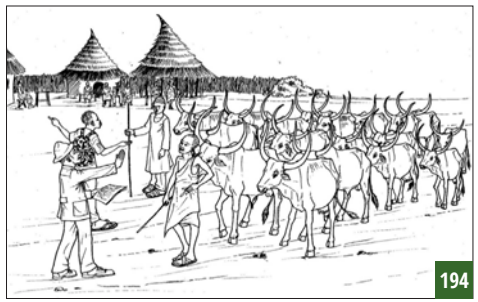
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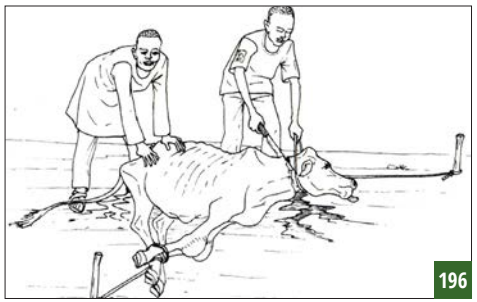
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*Section* 3

# Measures to be taken and general recommendations

*The general measures and recommendations described in this section should be applied for all diseases covered in this manual*

*Specific actions and recommendations for each disease are detailed in the Chapter 4: Priority Animal Diseases (pages 107 to 171)*

## *For the CAHW*

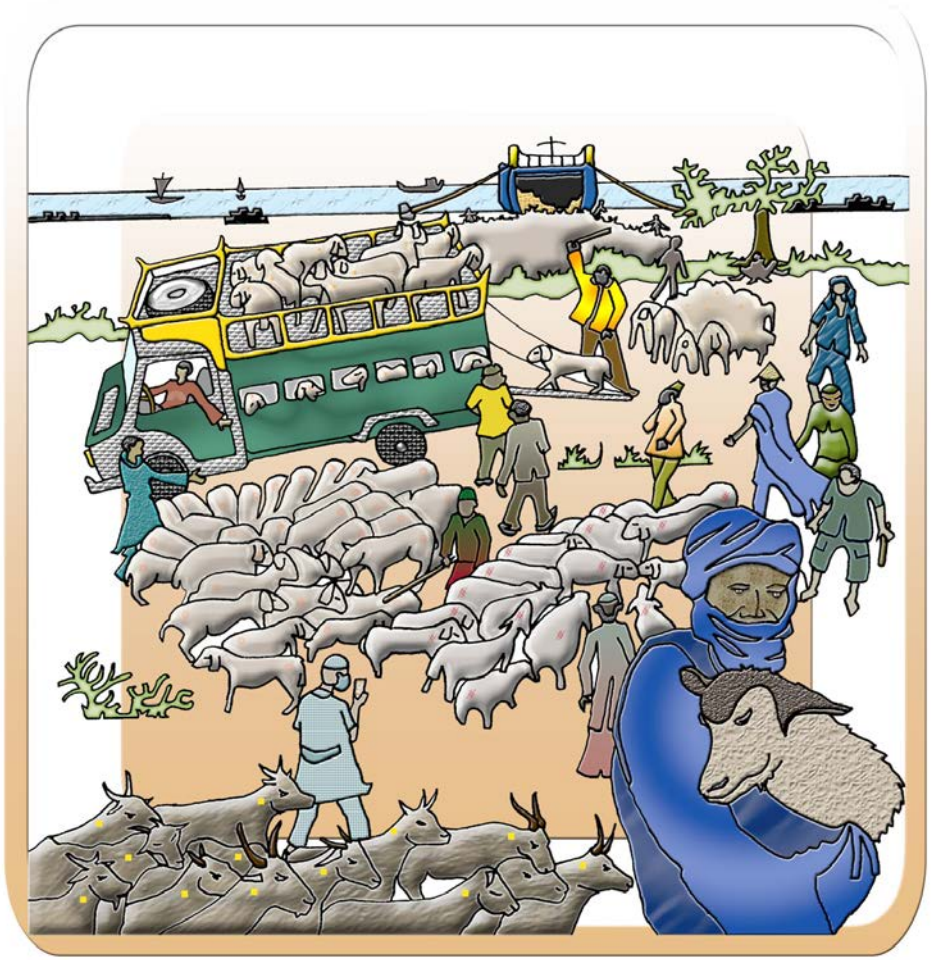
- Alert the veterinary authority of the area (veterinary paraprofessional and private and/or public veterinarian) in case of clinical signs on one or several animals;
- Contribute to early diagnosis or strong suspicion based on observed clinical signs;
- Examine with the farmer the other animals in the herd for similar clinical signs and count the number of sick animals to prepare the veterinarian's work;
- Regularly take the temperature of all animals;
- Strictly isolate infected animals from the rest of the herd for at least 15 days. Avoid contact between the different herds in the area;
- Change clothes and disinfect them when leaving each farm, village or camp. Enforce this instruction to all persons who have been close to sick animals;
- Help raise awareness of the disease among surrounding farmers and remind them of the biosecurity rules to be respected;
- Quarantine new animals arriving in the herd for at least 15 days;
- Support the veterinary paraprofessional and the private and/or public veterinarian in the implementation of animal health measures (contaminated area under containment, slaughter, vaccination, etc.);
- Set up meetings with the camp or village to explain the reasons for the animal health measures being implemented;
- Assist the veterinary paraprofessional and the veterinarian in preparing their epidemiological investigation by collecting all relevant health information and writing it in their veterinary register.

## *For the veterinary paraprofessional*

- Alert the veterinary authority in the area (private and/or public veterinarian) in case of suspicion;
- Confirm the diagnosis if possible, by examining sick animals and taking samples;
- Check the quarantine of the herd and prohibit any movement of animals within the perimeter;
- Notify the surrounding CAHWs of the diagnosis, remind them of the characteristics of the disease and the biosecurity rules to be followed;
- Host awareness-raising meetings for CAHWs and farmers;
- Check the CAHWs and farmers to ensure that the application of the animal health measures laid down by the veterinarian have been understood;
- Check that veterinary prescriptions are properly followed and that the medicines have been purchased in the official circuit;
- Make a regular review of the health situation;
- Assist the veterinarian in conducting an epidemiological investigation.

## *For the private and/or public veterinarian*

- Immediately alert the health authority of the region or country;
- Perform autopsies of dead animals;
- Confirm the diagnosis of the disease with laboratory tests, after taking the recommended samples;
- Check the containment of herds and the isolation of sick animals;
- Remind the veterinary paraprofessional(s) of the animal health measures to be implemented immediately and check their proper application;
- Remind the CAHWs and the veterinary paraprofessional(s) of the biosecurity rules to be implemented and the characteristics of the disease;
- Set up vaccination campaigns in the area if the country's health authority decides so;
- Prescribe drugs and veterinary procedures related to the disease;
- Identify and map the areas affected by the disease;
- Carry out an epidemiological investigation.



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# Chapter

# Priority animal diseases

*Section* 1

# Non-zoonotic notifiable diseases

*The diseases described in this section are non-zoonotic infectious diseases:*
*→ They can't be transmitted to humans*

*They are notifiable diseases:*
*→ They are subject to special regulations (due to their impact on veterinary, socio-economic and public health) providing for immediate appropriate State intervention in the event of any suspicion of any of them, in order to prevent their spread and ensure their eradication*

# *Anaplasmosis*

*Non-zoonotic notifiable diseases*

## Species concerned

- Cattle
- Sheep
- Goats

## Pathogenicity

- General information: Anaplasmosis is a non-contagious bacterial infectious disease
- Bacteria: Members of the family Anaplasmataceae, *Anaplasma marginale* and *Anaplasma centrale* bacteria are both responsible for anaplasmosis
- Incubation period: 25 to 50 days

## Clinical signs

- Anorexia, depression (*200*)
- Joint pain (*201, 202*)
- High fever
- Drop in milk production

## Transmission

- Indirect: Vector-borne, ticks of the genus *Rhipicephalus (Boophilus)* and *Amblyomma (e.g. R. Boophilus microplus, 198; Amblyomma variegatum, 199)*


198


199

## Samples

- Living animal: Blood with anticoagulant (Vacutainer 5ml), or serum

## Treatment

- Preventive treatment is acaricide
- Curative treatment can be based on IMIDOCARBE


200


201


202

## *Specific recommendations and measures to be taken in the event of anaplasmosis*

For the CAHW:

- Inspect all animals with the farmer looking for arthritis and anorexia;
- Destroy insect nests, clear the bushes.

For the veterinary paraprofessional:

- Oversee the implementation of the vector control program set up by the veterinarian;
- Find out the *R. Boophilus* and *Amblyomma* tick areas locations.

For the private and/or public veterinarian:

- Set up a vector control program (external disinfestation, destruction of insect nests, brush clearing, etc.);
- Map the *R. Boophilus* and *Amblyomma* tick areas.

# *Babesiosis*

*Non-zoonotic notifiable diseases*

## Species concerned

- Cattle

## Pathogenicity

- General information: Babesiosis is a non-contagious disease of cattle caused by the protozoan parasites *Babesia bovis* and *Babesia Bigemina*
- Parasites: Members of the family Babesiidae, *Babesia bovis* and *Babesia Bigemina* invade the erythrocytes of their host
- Incubation period: 5 to 10 days

## Clinical signs

- Hemoglobinuria, hematuria (*205, 206*)
- Pipe-stem diarrhea *(207)*
- Lethargy
- High fever
- Nervous disorders, pedaling
- Jaundice (*208*)
- Abortions

## Transmission

- Indirect: Vector-borne, ticks of the genus R. Boophilus and Ixodes (*e.g.: R. Boophilus microplus, 203; Ixodes scapularis, 204)*


203


204

## Samples

- Living animal: Blood with anticoagulant (Vacutainer 5ml), or serum

## Treatment

- Preventive treatment is acaricide
- Curative treatment can be based on IMIDOCARBE


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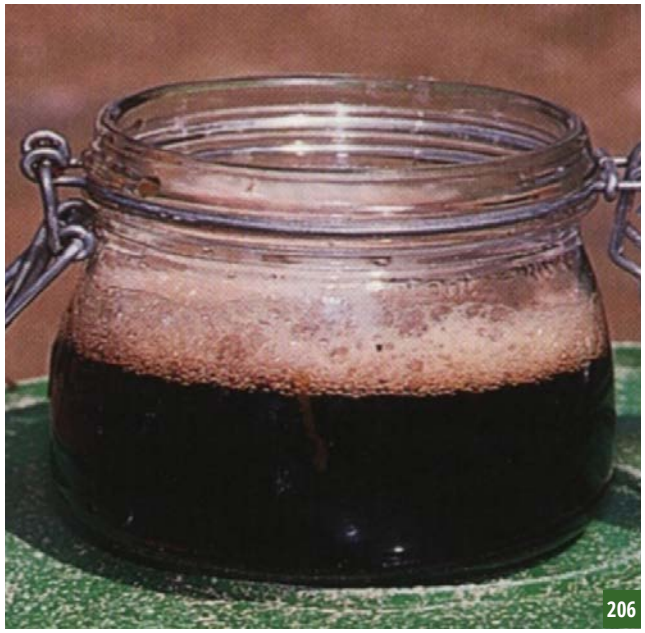
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208

## *Specific recommendations and measures to be taken in the event of babesiosis*

For the CAHW:

- Inspect all animals with the farmer looking for hematuria and pipe-steam diarrhea;
- Destroy insect nests, clear the bushes.

For the veterinary paraprofessional:

- Oversee the implementation of the vector control program set up by the veterinarian;
- Find out the *R. Boophilus* and *Ixodes* tick areas locations.

For the private and/or public veterinarian:

- Set up a vector control program (external disinfestation, destruction of insect nests, brush clearing, etc.);
- Map *R. Boophilus* and *Ixodes* tick areas.

# *Sheep pox and goat pox*



## Species concerned

- Sheep
- Goats

## Pathogenicity

- General information: Sheep pox and goat pox are highly contagious viral diseases of sheep and goats
- Virus: Member of the family Poxviridae and the genus *Capripoxivirus,* it is highly resistant in the outdoor environment
- Incubation period: 5 to 15 days

## Clinical signs

- Macules then papules from 0.5 to 1.5 cm in diameter, evolving into nodules that dry (scabs) and leave scars. They are usually located on lips, tongue, eyes, ears, udders and teats (*209, 210, 211, 212*)
- Enlargement of the lymph nodes, especially the prescapular lymph node
- Nasal, ocular and oral discharge
- High fever
- Dyspnea
- Lethargy
- Abortions

## Transmission

- Direct: By contact with a sick animal and/or absorption of any contaminated animal secretion and/or production
- Indirect: Mechanically (litter, food, clothing, equipment...)

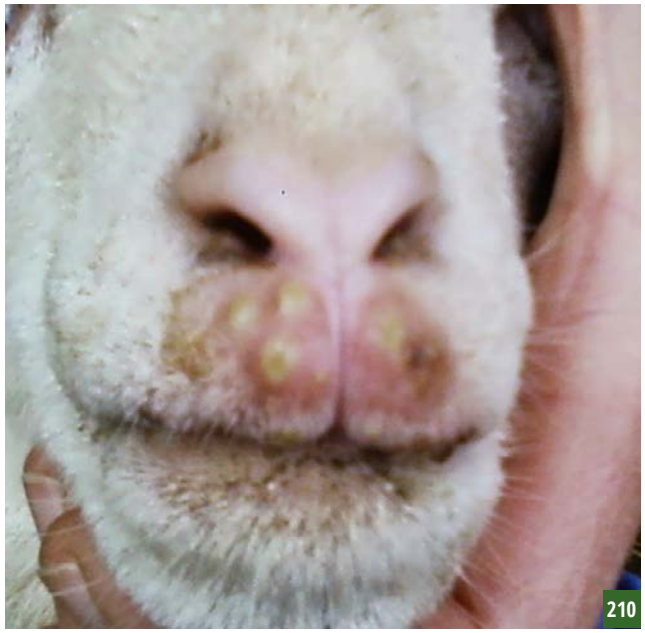
## Samples

- Living animal: Biopsy of skin papules, blood with anticoagulant (Vacutainer 5ml), or serum
- After autopsy: Serum

## Treatment

- Disinfect wounds
- Curative treatment can be based on TETRACYCLINE


209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## *Specific recommendations and measures to be taken in the event of sheep pox and goat pox*

For the CAHW:

- Inspect all animals with the farmer looking for papules and nodules on lips, eyes, ears and teats;
- Disinfect any wounds.

For the veterinary paraprofessional:

- Oversee the good practice of disinfection and treatment chosen by the veterinarian;
- Set up quarantine for sick animals (for at least 45 days);
- Oversee the implementation of the vaccination program set up by the veterinarian.

For the private and/or public veterinarian:

- Assess the treatment to be implemented;
- Set up an annual vaccination program targeting all animals in a specific epidemiological and geographical area.

# *Cowdriosis*



## Species concerned

- Cattle
- Sheep
- Goats
- Camelids

## Pathogenicity

- General information: Cowdriosis is a non-contagious bacterial infectious disease
- Bacterium: Member of the Rickettsiaceae family, *Ehrlichia ruminantium* is transmitted by a tick
- Incubation period: 10 to 20 days

## Clinical signs

- Sudden and high hyperthermia
- Dyspnea
- Nervous disorders: turning, pedaling, convulsions, teeth grinding, pushing on the wall (*215*), hindquarters paralysis (*216*), opisthotonos (*217*)
- High fever
- Lethargy
- Abortions (especially in camelids)
- Diarrhea (especially in cattle)
- Sudden death in hyperacute form

### After autopsy

- Hydropericardium and hydrothorax (*218, 219*)

## Transmission

- Indirect: Vector-borne, ticks of the genus Amblyomma (e.g. Amblyom*ma variegatum, 213, 214*)


## Samples

- Living animal: Blood with anticoagulant (Vacutainer 5ml), or serum
- After autopsy : Brain biopsy

## Treatment

- Preventive treatment is acaricide
- Curative treatment can be based on TETRACYCLINE


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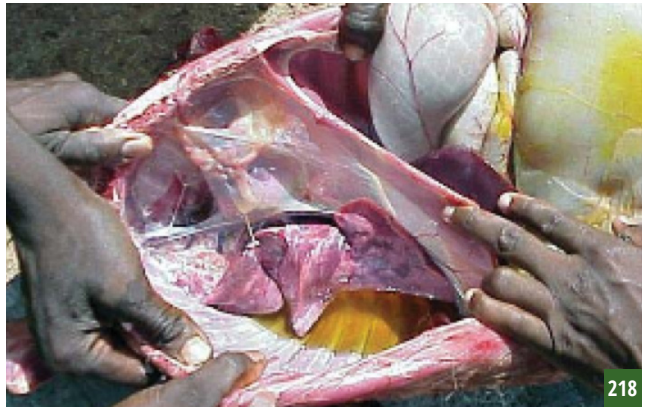
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219

## *Specific recommendations and measures to be taken in the event of cowdriosis*

For the CAHW:

- Inspect all animals with the farmer looking for nervous disorders, dyspnea, sudden hyperthermia and high fevers;
- Destroy insect nests, clear the bushes.

For the veterinary paraprofessional:

- Oversee the implementation of the vector control program set up by the veterinarian;
- Find out the *Amblyomma* tick areas locations.

For the private and/or public veterinarian:

- Set up a vector control program (external disinfestation, destruction of insect nests, brush clearing, etc.);
- Map *Amblyomma* tick areas.

# *Lumpy skin disease*



## Species concerned

- Cattle

## Pathogenicity

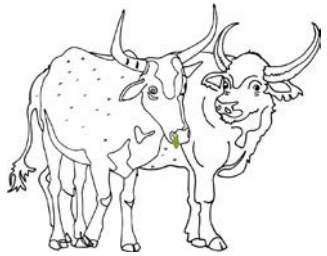
- General information: Lumpy skin disease is a highly contagious viral disease of cattle
- Virus: Member of the genus *Capripoxivirus*, of the family Poxviridae, it is highly resistant in the outdoor environment
- Incubation period: 10 to 30 days

## Clinical signs

- Cutaneous nodules from 0.5 to 5 cm in diameter that necrotize and superinfect (*220, 221, 222, 222, 223, 224*)
- Purulent ocular and nasal discharge
- Hypersalivation
- Persistent fever
- Anorexia, depression
- Edemas of members
- Swollen lymph nodes
- Drop in milk production

## Transmission

- Direct: By contact with a sick animal and/or absorption of any contaminated animal secretion and/or production
- Indirect: Vector-borne (biting fly, mosquito, tick...)



## Samples

- Living animal: Biopsy of skin nodules, lymph node fluid, blood with anticoagulant (Vacutainer 5ml), or serum

## Treatment

- There is no specific treatment except symptomatic


220


221


222


223


224

## *Specific recommendations and measures to be taken in the event of contagious lumpy skin disease*

For the CAHW:

- Inspect with the farmer all animals looking for skin nodules;
- Destroy insect nests, clear the bushes.

For the veterinary paraprofessional:

- Oversee the implementation of the vector control program set up by the veterinarian.

For the private and/or public veterinarian:

- Set up a vector control program (external disinfestation, destruction of insect nests, brush clearing, etc.);
- Set up a ring vaccination strategy, if necessary, around the outbreaks.

# *Foot-and-mouth disease*



## Species concerned

- Cattle
- Sheep
- Goats
- Swine
- Camelids

## Pathogenicity

- General information: Foot-and-mouth disease is a serious and highly contagious viral disease
- Virus: Member of the genus *Aphthovirus*, of the family Picornaviridae, it is resistant in the outdoor environment
- Incubation period: 2 to 7 days

## Clinical signs

- Hypersalivation and bad breath (*225*)
- Extensive lesions in the mouth, especially on the tongue and the soft palate (*226*)
- Lameness
- Fever
- Loss of appetite, anorexia, lethargy
- Lesions between the cloven hooves, above the cloven hooves and at the udder level (*227, 228*)
- Vesicles on teats (sudden drop in milk production) (*229*)
- Long and bristly hair (sometimes) (*230*)
- Abortions
- Infertility
- In calves: polypnea and death

## Transmission

- Direct: By contact with a sick animal and/or absorption of any contaminated animal secretion and/or production
- Indirect: Mechanically (litter, food, clothing, equipment...)

## Samples

- Living animal sick for less than 10 days: Epithelium and lymph in the vesicles + 1 cm2/1g of epithelium from vesicles (tongue, mucous membranes, interdigital spaces) and/or oropharyngeal samples
- Living animal sick for more than 10 days: Serum

## Treatment

- Support treatment on young animals if necessary
- There is no specific treatment except symptomatic
- Dead animals must be buried deep and destroyed with quicklime


225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## *Specific recommendations and measures to be taken in the event of foot-and-mouth disease*

For the CAHW:

- Inspect with the farmer all animals looking for vesicles throughout the body, especially the oral cavity, feet and udders. Identify the presence of fever, hypersalivations and lameness;
- Bury dead animals 2 meters deep with quicklime.

For the veterinary paraprofessional:

- Confine the herd and set up a security perimeter;
- Oversee the slaughtering and destruction of corpses.

For the private and/or public veterinarian:

- Set up vaccination campaigns if the virulent strain is characterized, in accordance with the country's health authority.

# *Bluetongue*

*Non-zoonotic notifiable diseases*

## Species concerned

- Cattle
- Sheep
- Goats
- Camelids

## Pathogenicity

- General information: Bluetongue is a non-contagious viral disease
- Virus: Member of the genus *Orbivirus*, of the family Reoviridae, it is not resistant in the outdoor environment
- Incubation period: 5 to 12 days

## Clinical signs

- Hemorrhages and ulcerations of tissues in the oronasal sphere (*231*)
- Hypersalivation (*232*), nasal discharge (*233*) and swelling of the lips
- Lameness
- Fever
- Loss of appetite, anorexia
- Diarrhea, vomiting
- Blue tongue (rare) (*234*)
- Pneumonia
- Possible abortions

## Transmission

- Indirect: Vector-borne (small biting insects of the genus *Culicoides*)

## Samples

- Living animal: Blood with anticoagulant (Vacutainer 5ml)
- After autopsy: Serum, spleen

## Treatment

- There is no specific treatment except symptomatic


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## *Specific recommendations and measures to be taken in the event of bluetongue*

For the CAHW:

- Inspect all animals with the farmer looking for oral ulcerations, hypersalivations and lameness;
- Destroy insect nests, clear the bushes.

For the veterinary paraprofessional:

- Oversee the implementation of the vector control program set up by the veterinarian;
- Oversee the implementation of the vaccination program.

For the private and/or public veterinarian:

- Set up a vector control program (external disinfestation, destruction of insect nests, brush clearing, etc.);
- Set up a vaccination program, if the virulent strain is known, in agreement with the country's health authority.

# *Newcastle disease*



## Species concerned

- All bird species

## Pathogenicity

- General information: Newcastle disease is highly contagious viral bird disease
- Virus: Member of the genus *Rubulavirus*, of the family Paramyxoviridae, it is relatively stable in the outdoor environment, especially in cold weather
- Incubation period: From 2 to 15 days

## Clinical signs

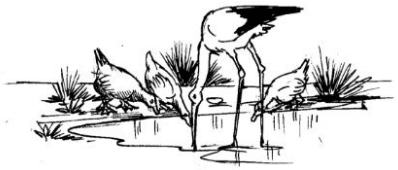
- General symptoms: depression, loss of appetite, prostration (*235*)
- Digestive symptoms: greenish diarrhea
- Respiratory symptoms: dyspnea, nasal discharge, rales
- Nervous symptoms: tremors, paralysis, spasms (*236*)
- Cutaneous symptoms: swollen comb and wattles, red spots on the skin
- Relatively sudden drop in egg-laying, egg anomaly (*237*)
- Sudden death (often very high mortality)

### After autopsy

- Very red ovarian cluster (*238*)
- Mucous membrane of the proventriculus very red (*239*)
- Cecal tonsils very red (*240*)

## Transmission

- Direct: By absorption of any contaminated animal secretion and/or production (mainly fecal and respiratory)
- Indirect: Mechanically (litter, food, clothing, equipment...)



## Samples

- Living or dead animal: Cloacal and tracheal swabs, feces, intestinal fragments, brain, trachea, lungs, liver and spleen, or serum

## Treatment

- There is no specific treatment except symptomatic
- Dead animals must be burned or buried deep and destroyed with quicklime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## *Specific recommendations and measures to be taken in the event of Newcastle disease*

For the CAHW:

- Inspect with the farmer all animals for clinical signs, not to be confused with avian influenza;
- Promote the use of footbaths, check their renewal and compliance with hygiene rules;
- Burn or bury dead animals 2 meters deep with quicklime.

For the veterinary paraprofessional:

- Prohibit any movement of poultry, by-products and equipment;
- Advise emptying the buildings for at least 15 days between each raising batch of poultry.

For the private and/or public veterinarian:

- Set up a semi-annual vaccination program targeting all animals in a specific epidemiological and geographical area.

# *Contagious bovine pleuropneumonia*



## Species concerned

- Cattle

## Pathogenicity

- General information: Contagious bovine pleuropneumonia is a highly contagious bacterial infectious disease
- Bacterium: Member of the Mycoplasmataceae family, *Mycoplasma mycoides* is not resistant in the outdoor environment
- Incubation period: 20 to 120 days

## Clinical signs

- Coughing
- Difficulty in breathing immobilizing the whole body, dilated nostrils, bad breath
- Horizontal head (*241*)
- Nasal discharge
- Weight loss, grunting
- Drop in milk production
- Inflated jugular vein
- Dull sounds at percussion
- Elbows facing outwards
- Walking with a round back
- Frequent joint hypertrophy in calves

### After autopsy

- Adherence to ribs (*242, 243*)
- Omelet appearance surrounding the lungs (*244*)
- Adherence of the heart to the lungs (*245*)
- Mosaic appearance of the lungs (*246*)

## Transmission

- Direct: By absorption of nasal secretions or droplets breathed out into the air by the sick animal

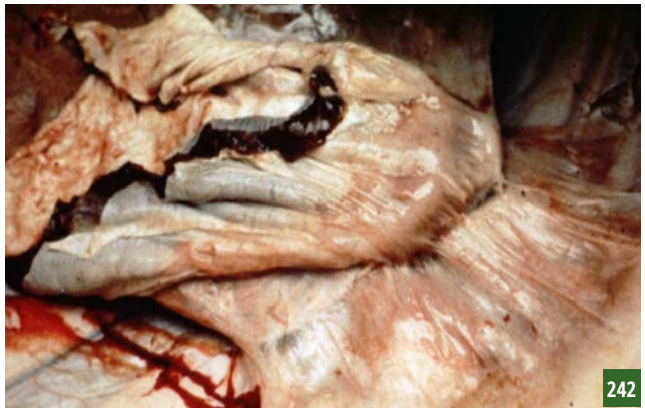
## Samples

- Living animal: Pleural fluid (5 ml), bronchoalveolar/nasal swabs, or serum
- After autopsy : Pleural fluid (5 ml), whole regional lymph nodes, lung fragments

## Treatment

- Depending on the case, it is recommended to favor slaughter over antibiotic care. The latter can indeed lead to apparently healthy animals who still breath out infected secretions


241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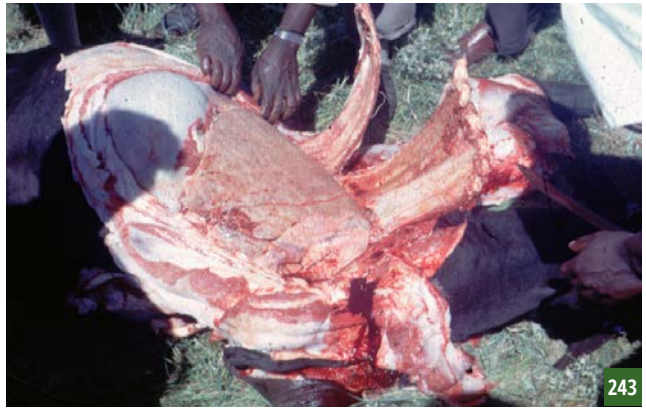
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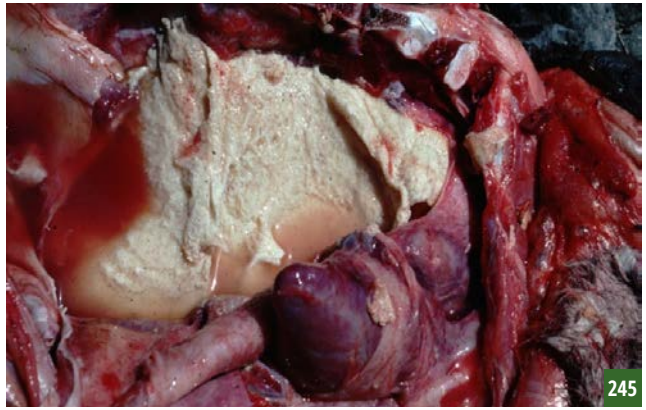
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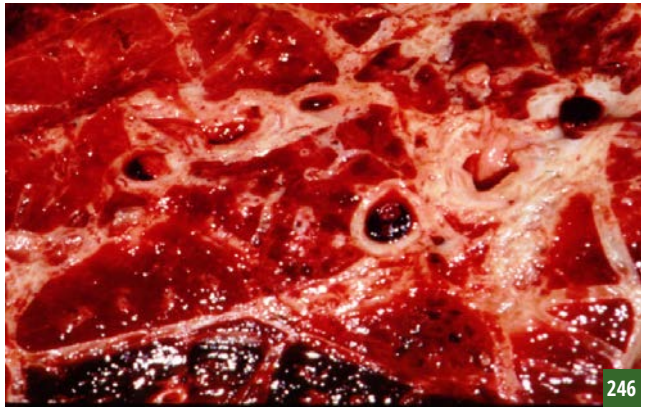
246

## *Specific recommendations and measures to be taken in the event of contagious bovine pleuropneumonia*

For the CAHW:

- Inspect all animals with the farmer looking for nasal discharge, difficulty in breathing and coughing;
- Help farmers to sort and isolate sick animals by a first clinical examination. Then, make the animals run for 5 minutes and re-Inspect them.

For the veterinary paraprofessional:

- Attend slaughter and keep a record of any suspicious lesions observed in the rib cage.

For the private and/or public veterinarian:

- Recommend the slaughter of animals with persistent coughing;
- Set up an annual vaccination program targeting all animals in a specific epidemiological and geographical area.

# *Sheep and goat plague*

*Non-zoonotic notifiable diseases*

## Species concerned

- Sheep
- Goats

## Pathogenicity

- General information: Sheep and goat plague, also known as "Peste des petits ruminants" is a highly contagious viral disease of sheep and goats
- Virus: Member of the genus *Morbilivirus*, of the family Paramyxoviridae, the virus does not survive for a long time outside the body of a host animal.
- Incubation period: 3 to 6 days

## Clinical signs

- Sudden onset of high fever
- Severe depression
- Eye (*247*), nasal (*248*) and oral discharge, first clear and then purulent
- Severe diarrhea sometimes mixed with blood (*249*)
- Breathing difficulties with cough
- Sores in the mouth (*250*), the animal no longer eats
- Cracked and dry nostrils
- Abortions
- Sudden death (in 5-10 days)

### After autopsy

- Pulmonary hemorrhages (*251*)
- Red striated colon (*252*)

## Transmission

- Direct: By contact with a sick animal and/or absorption of any contaminated animal secretion and/or production
- Indirect: Mechanically (litter, food, clothing, equipment...)

## Samples

- Living animal: Blood with anticoagulant (Vacutainer 5ml), eye, buccal and/or nasal swabs, or serum
- After autopsy : Samples from lymph nodes, lung, intestine, spleen

## Treatment

- There is no specific treatment except symptomatic
- Dead animals and abortion residues must be buried deep and destroyed with quicklime


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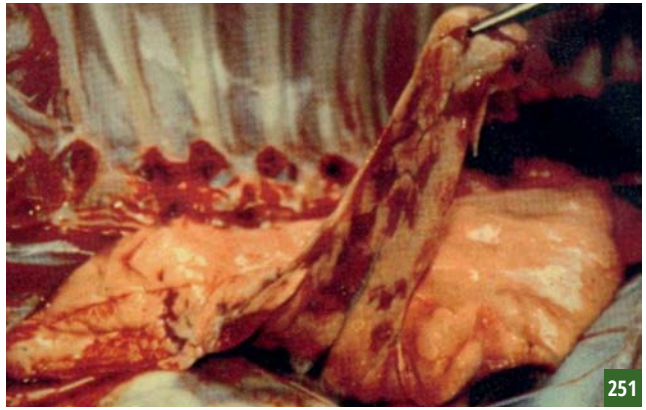
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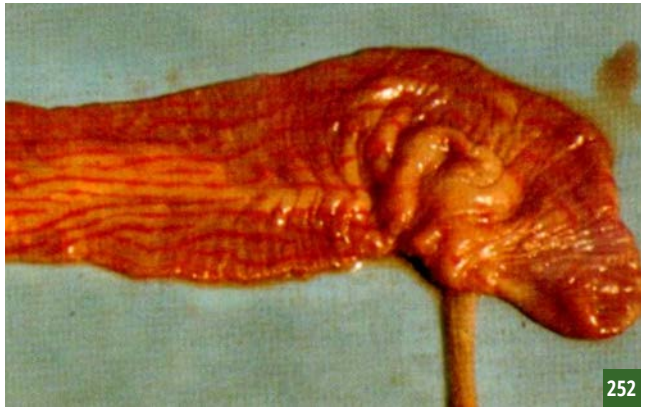
252

## *Specific recommendations and measures to be taken in the event of sheep and goat plague*

For the CAHW:

- Inspect all animals with the farmer looking for eye, nasal and oral discharge, depression and severe diarrhea;
- Inspect all animals twice a day for 7 days;
- Bury dead animals and abortion residues 2 meters deep with quicklime.

For the veterinary paraprofessional:

- Confine the herd and set up a security perimeter;
- Oversee the slaughter and the destruction of dead animals and abortion residues.

For the private and/or public veterinarian:

- Recommend the slaughter of sick animals;
- Set up a vaccination program in agreement with the country's health authority.

# *African swine fever*

*Non-zoonotic notifiable diseases*

## Species concerned

- Swine

## Pathogenicity

- General information: African swine fever is a highly contagious hemorrhagic disease
- Virus: Member of the genus *Asfivirus*, of the family Asfarviridae, it remains infectious for several months in carcasses
- Incubation period: 5 to 15 days

## Clinical signs

- Generalized bleeding
- Vomiting and diarrhea with blood
- Physical depression (*255*)
- Cyanosis and redness on the abdomen and under the ears (*256*)
- High fever for 3-4 days
- Clustering and hyperthermia (*257*)
- Generalized jaundice
- Cough, respiratory distress
- Conjunctivitis
- Loss of appetite
- Unsteady walking
- Very high contagion (100%)
- Very high mortality rate

### After autopsy

- Hemorrhagic carcass (*258*)
- Large dark spleen (*259*)
- Enlarged and bloated lymph nodes
- Edematous lungs
- Red spots on the kidneys

## Transmission

- Direct: By contact with a sick animal (*253*) or by absorption of contaminated waste
- Indirect: Vector-borne (biting fly, tick *Ornithodoros moubutu - 254*) and/or Mechanically (litter, food, clothing, equipment...)


253


254

## Samples

- Living animal: Blood with anticoagulant (vacutainer 5ml), spleen, tonsils, ileocecal lymph nodes, kidneys
- After autopsy: Serum

## Treatment

- There is no treatment or vaccine
- Dead animals must be buried deep and destroyed with quicklime (*260 to 263*)


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260


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## *Specific recommendations and measures to be taken in the event of African swine fever*

For the CAHW:

- Inspect all animals with the farmer looking for bleeding, high contagiousness and sudden death;
- Remove parasites from quarantined pigs and bury dead animals 2 meters deep with quicklime;
- Enforce disinfection of vehicles, shoes, clothing and equipment with 1% caustic soda.

For the veterinary paraprofessional:

- Confine the herd and set up a security perimeter;
- Enforce quarantine for all farms within a 20 km radius around the outbreak;
- Oversee the disinfestation of all quarantined pigs;
- Oversee the disinfection, slaughter and destruction of corpses.

For the private and/or public veterinarian:

- Order the following sanitary measures, for 40 days:
  - Slaughtering of all pigs in the contaminated area;
  - Containment of herds and control of all inputs;
  - Quarantine of farms within a 20 km radius;
  - Prohibition of all human and animal movements;
  - Disinfection of facilities and disinfestation of animals.

# *Contagious caprine pleuropneumonia*



## Species concerned

- Goats

## Pathogenicity

- General information: Caprine contagious pleuropneumonia is a highly contagious bacterial infectious disease of goats
- Bacterium: Member of the Mycoplasmataceae family, *Mycoplasma capricolum* is not resistant in the outdoor environment. Other strains of the same family may be implicated in this disease
- Incubation period: 10 to 30 days

## Clinical signs

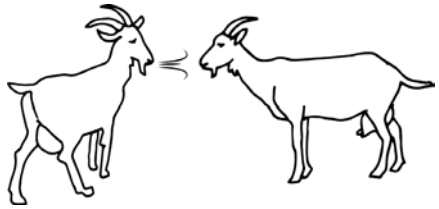
- Violent coughing
- Mucopurulent nasal discharge (*264*)
- Accelerated and painful breathing: orthopedic position (*265*)
- High fever
- Abortions
- In the event of acute infection: very high morbidity and mortality up to 80% (sudden death)

### After autopsy

- Only one lung is affected
- Fibrinous pleuropneumonia (*266, 267*) with massive hepatitis and exudative pleurisy (*268, 269*)

## Transmission

- Direct: By absorption of nasal secretions or droplets breathed out into the air by the sick animal



## Samples

- Living animal: Pleural fluid (5 ml), bronchoalveolar/nasal swabs, or serum
- After autopsy: Pleural fluid (5 ml), whole regional lymph nodes, lung fragments

## Treatment

- Curative treatment can be based on TETRACYCLINE


264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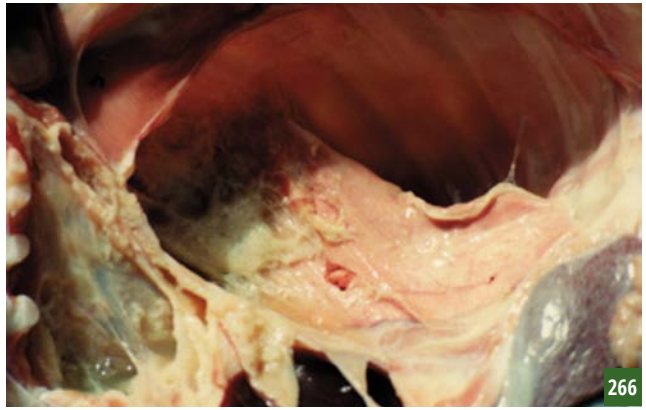
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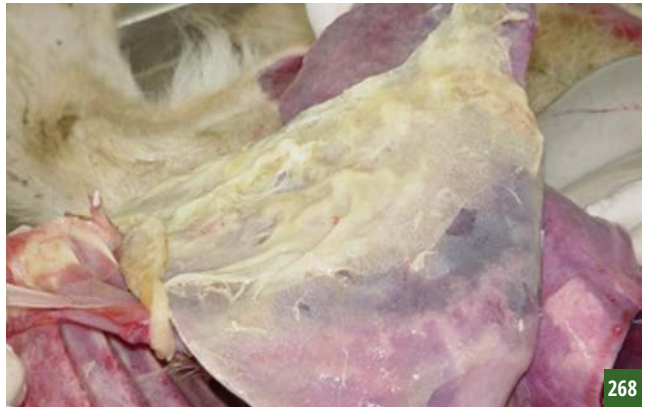
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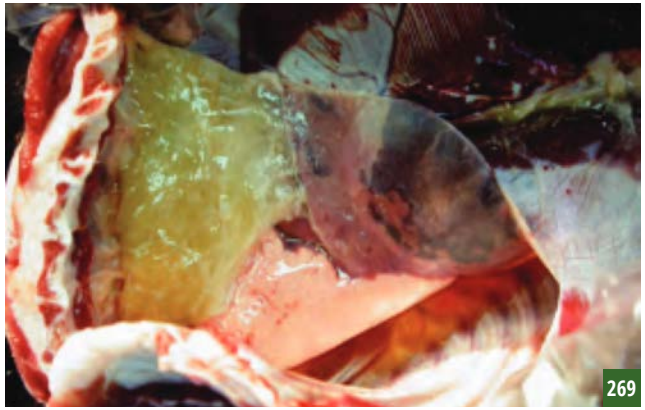
269

## *Specific recommendations and measures to be taken in the event of contagious caprine pleuropneumonia*

For the CAHW:

- Inspect all animals with the farmer looking for nasal discharge, coughing and difficulty in breathing.

For the veterinary paraprofessional:

- Remind farmers of the importance of a quarantine period of at least 30 days for animals joining the herd;
- Keep a record of any suspicious lesions observed in the rib cage of a goat.

For the private and/or public veterinarian:

- Recommend the slaughter of animals with persistent coughing;
- Set up an annual vaccination program targeting all animals in a specific epidemiological and geographical area.

# *Theileriosis*

*Non-zoonotic notifiable diseases*

## Species concerned

- Cattle

## Pathogenicity

- General information: Theileriosis is a non-contagious disease of cattle caused by the protozoan parasite *Theileria parva*
- Parasite: Member of the family Theileriidae, *Theileria parva* invades the erythrocytes of its host
- Incubation period: 10 to 15 days

## Clinical signs

- Epistaxis (nosebleed) (*271*)
- Ganglionic hypertrophy (generalized adenitis) (*272*)
- Watery eyes, glassy eyes (*273*)
- High fever
- Pale mucous membranes
- Dyspnea
- Diarrhea
- Cachexia (*274*)

## Transmission

- Indirect: Vector-borne, ticks of the genus *Rhipicephalus* (ex: *Rhipicephalus Sanguineus*, 270)


270

## Samples

- Living animal: Lymphatic node, blood with anticoagulant (Vacutainer 5ml), or serum

## Treatment

- Preventive treatment is acaricide
- Curative treatment can be based on BUPARVAQUONE


271


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273


274

## *Specific recommendations and measures to be taken in the event of theileriosis*

For the CAHW:

- Inspect all animals with the farmer looking for epistaxis, watery eyes and generalized adenitis;
- Destroy insect nests, clear the bushes.

For the veterinary paraprofessional:

- Oversee the implementation of the vector control program set up by the veterinarian;
- Find out the *Rhipicephalus* tick areas locations.

For the private and/or public veterinarian:

- Set up an vector control program (external disinfestation, destruction of insect nests, brush clearing, etc.);
- Map *Rhipicephalus* tick areas.

*Section* 2

# Zoonotic notifiable diseases

*The diseases described in this section are zoonotic infectious diseases:*
*→ They can be transmitted to humans*

*They are notifiable diseases:*
*→ They are subject to special regulations (due to their impact on veterinary, socio-economic and public health) providing for immediate appropriate State intervention in the event of any suspicion of any of them, in order to prevent their spread and ensure their eradication*

# *Brucellosis*

*Zoonotic notifiable disease*

## Species concerned

- Cattle
- Sheep
- Goats
- Swine
- Horses
- Camelids
- Humans

## Pathogenicity

- General information: Brucellosis is a highly contagious bacterial infectious disease of livestock
- Bacterium: Members of the Brucellaceae family, *Brucella abortus* (cattle) and *Brucella melitensis* (small ruminants) are highly resistant in the outdoor environment
- Incubation period: From 1 to 30 days

## Clinical signs

### In animals

- Abortions (*275, 276*)
- Infertility
- Thickened and retained placenta (*277, 278*)
- Swollen joints (*279*)
- Swollen testicles (*280*)
- Intermittent fever

### In humans

- Intermittent fever
- Back and joint pain
- Weakness and lethargy
- Swollen testicles
- Infertility
- Abortions

## Transmission

- Direct: By contact with a sick animal (especially through the mucous membranes, during mating) and/or absorption of any contaminated animal secretion and/or production (especially genital secretions, milk and abortions)
- Indirect: Mechanically (litter, food, clothing, equipment...)

## Samples

- Living animal: Uterine, vaginal, or abortion fluids, lymph nodes, male and female reproductive organs, milk, or serum

## Treatment

- Curative treatment can be based on TETRACYCLINE
- Depending on the case, it is recommended to favor slaughter over antibiotic care. The latter can indeed lead to apparently healthy animals who still breath out infected secretions
- Dead animals, placentas and runts must be buried deep and destroyed with quicklime


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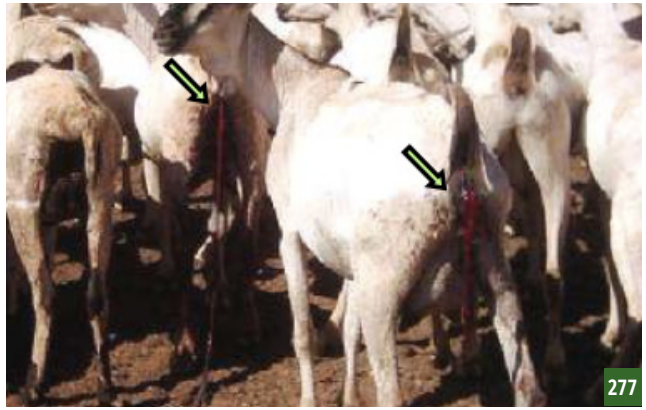
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## *Specific recommendations and measures to be taken in the event of brucellosis*

For the CAHW:

- Inspect all animals with the farmer looking for retained placentas and a high number of abortions;
- Isolate females that will give birth, burn or bury placentas and runts;
- It is essential to boil the milk before consumption.

For the veterinary paraprofessional:

- Count abortions and have females slaughtered if they have had several;
- Participate in screening and vaccination campaigns.

For the private and/or public veterinarian:

- Set up a screening campaign (misleading if prior vaccination);
- Set up a vaccination campaign in endemic areas.

# *Anthrax*

*Zoonotic notifiable disease*

## Species concerned

- Cattle
- Sheep
- Goats
- Swine
- Horses
- Camelids
- Humans

## Pathogenicity

- General information: Anthrax is a deadly and virulent acute infectious disease
- Bacterium: Member of the Bacillaceae family, *Bacillus anthracis* spreads extremely resistant spores in the outdoor environment
- Incubation period: 1 to 5 days

## Clinical signs

### In animals

- Sudden death (almost sudden collapse) (*281*)
- Tarry bleeding through all natural orifices (*282, 283, 284*)
- Tremors, flabby limbs
- Dyspnea
- High fever
- Drop in milk production (aqueous milk, tasteless)
- High morbidity and mortality

#### After autopsy

- Big spleen
- It is recommended not to perform an autopsy

### In humans

- Cutaneous form in 95% of cases: a macule forms at the site of inoculation, then ulcers, accompanied by high fever. Serious complications can occur (*285, 286*)
- Gastrointestinal (by ingestion of contaminated meat) and pulmonary (by inhalation of spores) forms are uncommon and especially deadly

## Transmission

- Direct: By absorption/inhalation of any secretion and/or animal production contaminated by spores (carcasses, blood, wool...)
- Indirect: Mechanically (contaminated soil, litter, food, clothing, equipment...) and/or a vector that has been in contact with spores (insect)

## Samples

- Living or dead animal: Blood with anticoagulant (Vacutainer 5ml), edema puncture, spleen, or serum

## Treatment

- Curative treatment can be based on BENZYLPENICILLIN
- Clinical progression is often so fast that there is no time to treat infected animals
- Dead animals must be buried deep and destroyed with quicklime


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## *Specific recommendations and measures to be taken in the event of anthrax*

For the CAHW:

- Inspect all animals with the farmer looking for sudden deaths with tarry bleeding through all natural orifices;
- Look with the farmer for pastures roamed by sick animals in the previous days;
- Keep dogs away from the contaminated area;
- Recommend never eating or handling the meat and/or any other product of a dead animal;
- Enforce disinfection of vehicles, shoes, clothing and equipment with 1% caustic soda;
- Burn the carcasses on site or bury them at least 2 meters deep before destroying them with quicklime.

For the veterinary paraprofessional:

- Confine the herd, check the quarantine;
- Oversee the disinfection, slaughter and destruction of corpses.

For the private and/or public veterinarian:

- Set up the monitoring and the census of deaths;
- Map the affected and contaminated areas and pastures, condemn them;
- Set up annual vaccination campaigns.

# *Echinococcosis*

*Zoonotic notifiable disease*

## Species concerned

- Cattle
- Sheep
- Goats
- Swine
- Camelids
- Humans

## Pathogenicity

- General information: Echinococcosis, also known as hydatidosis, is a disease caused by an infestation of the body by parasitic worms
- Parasite: Member of the Taeniidae family, *Echinococcus granulosus* is a very small tapeworm that develops cysts mainly in the liver and lungs of its host
- Incubation period: Variable, up to several years

## Clinical signs

### In animals

- Mostly asymptomatic
- Slight lethargy
- Growth retardation
- Drop in milk, meat and wool production
- Decreased births
- The uncommon hydatid cyst rupture can lead to death

#### After autopsy

- Hydatid cysts mainly in the liver and lungs (*287, 288, 289*)

### In humans

- Hydatid cysts lead to serious lesions depending on their size and location
- They can not only develop in the liver (jaundice, liver pain), lungs (Cough, bloody sputum) or bones (fractures, pain), but also in the kidneys, spleen or nervous system

## Transmission

- Direct: By absorption of any infested animal production (mainly meat and feces)
- *Adult worms live and reproduce in the intestine of the final host (canine) and are released into the environment through the feces. The intermediate host accidentally ingests the eggs by eating contaminated food. It then develops hydatid cysts filled with larvae, which will be ingested again by the final host (290)*

## Samples

- Living animal: Fresh stools
- After autopsy: Liver, lung

## Treatment

- There is no specific treatment except symptomatic
- Control measures are essentially based on the prevention and interruption of the parasite's life cycle. This requires preventing dogs' access to carcasses and slaughter remains, potentially treating them with an anthelmintic (PRAZIQUANTEL), complying with hygiene and cleaning/disinfection rules, inspecting offal and spotting any cyst


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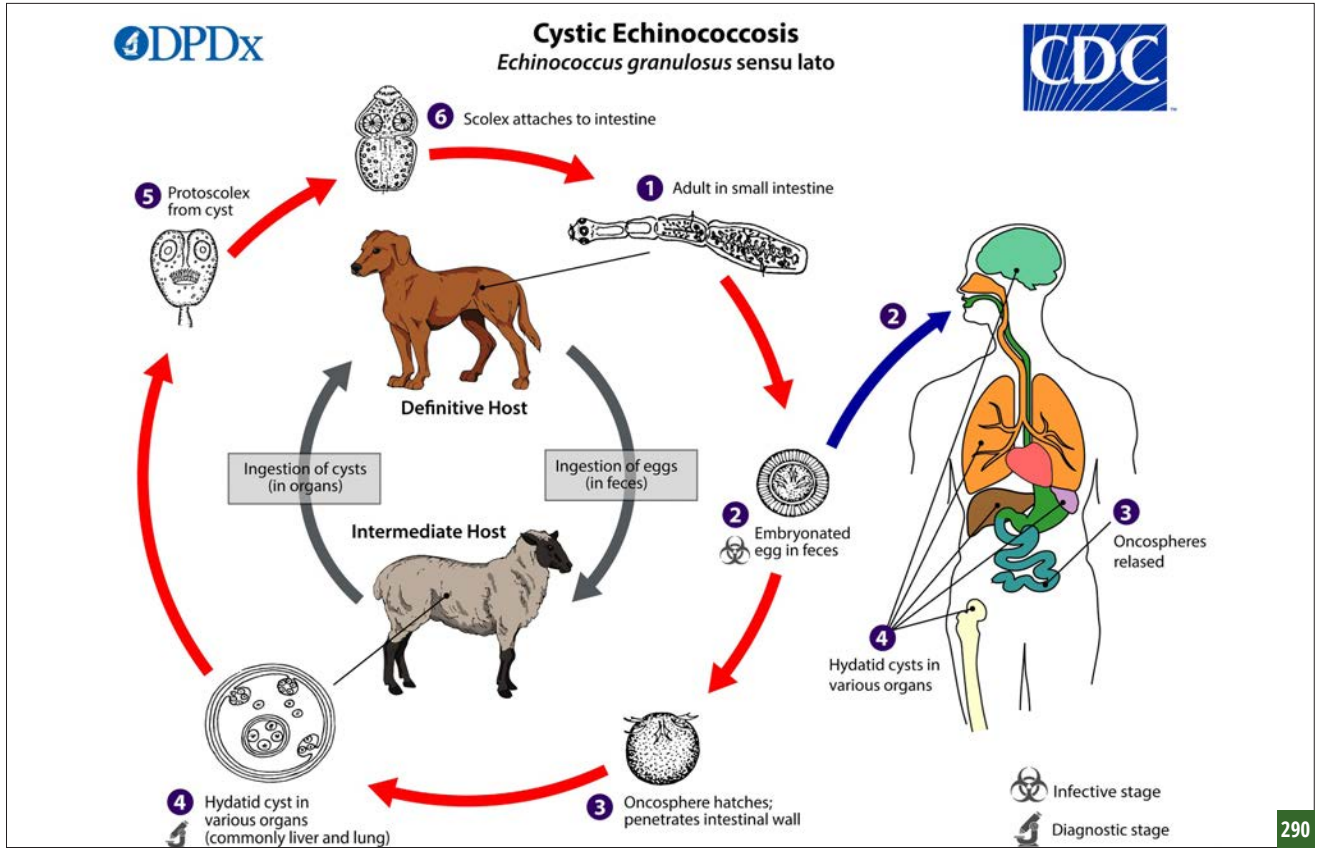

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## *Specific recommendations and measures to be taken in the event of echinococcosis*

For the CAHW:

- Inspect all animals with the farmer looking for lethargy and drop in productions;
- Prevent dogs from accessing carcasses and slaughter remains, keep stray dogs away.

For the veterinary paraprofessional:

- Attend slaughter as regularly as possible to inspect offal and organs for hydatid cysts;
- Ensure the effective destruction of carcasses and offal.

For the private and/or public veterinarian:

- Set up an information campaign aimed at the populations of areas where the parasite is known to be present;
- Notify local doctors in the event of a positive diagnosis.

# *Rift Valley fever*

*Zoonotic notifiable disease*

## Species concerned

- Cattle
- Sheep
- Goats
- Camelids
- Humans

## Pathogenicity

- General information: Rift Valley fever is an acute viral disease characterized by a severe clinical picture with high morbidity and mortality
- Virus: Member of the genus *Phlebovirus*, of the family Phenuiviridae, it is highly resistant in the outdoor environment
- Incubation period: 1 to 6 days

## Clinical signs

### In animals

- Abortions (*291*, *292*)
- High morbidity & mortality (especially among young animals)
- High fever, hyperthermia
- Mucopurulent nasal discharge
- Lethargy, anorexia
- Bloody diarrhea (*293*), vomiting
- Muscle spasms, locomotion disorders
- Jaundice

#### After autopsy

- Necrotizing hepatitis (*294*)

### In humans

- Acute fever
- Muscle pain
- Lethargy, anorexia
- Headaches, nausea, photosensitivity
- Complication: bleeding, nervous signs, loss of sight
- Possible lethal evolution

## Transmission

- Direct: By contact and/or absorption of any contaminated animal secretion and/or production (blood, milk, meat...)
- Indirect: Vector-borne (mosquitoes, main mode of transmission)

## Samples

- Living animal: Plasma or serum on anti-coagulant (Vacutainer 5ml)

After autopsy: Liver, spleen, brain (+5 g), whole runt

## Treatment

- There is no specific treatment except symptomatic
- Dead animals, runts and other abortion products must be buried deep and destroyed with quicklime


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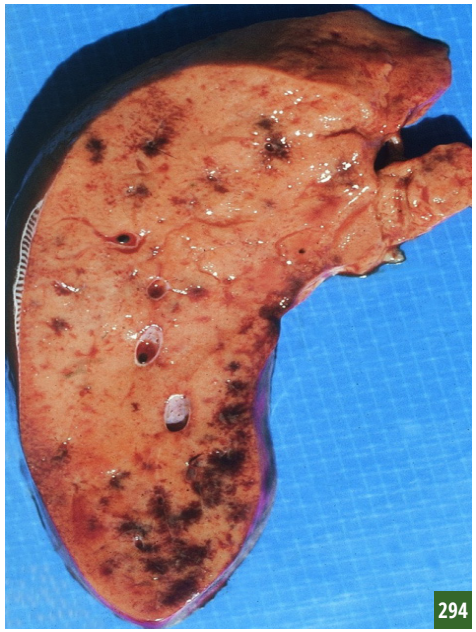

294

## *Specific recommendations and measures to be taken in the event of Rift Valley fever*

For the CAHW:

- Inspect all animals with the farmer looking for a high number of abortions and high mortality among young animals;
- Destroy mosquito nests, recommend the installation of mosquito nets.

For the veterinary paraprofessional:

- Confine the herd, check quarantine, census abortions;
- Oversee the disinfection, slaughter and destruction of corpses and abortions;
- Oversee the implementation of vector control, epidemiological surveillance and vaccination programs.

For the private and/or public veterinarian:

- Set up epidemiological surveillance;
- Set up a vector control program (external disinfestation, destruction of mosquito nests, etc.);
- In the event of an epizootic: delimit the infected area and prohibit any movement. Set up a vaccination program around the area;
- Off epizootic: set up a vaccination program in and around the infected area, restrict movement.

# *Q fever*

*Zoonotic notifiable disease*

## Species concerned

- Cattle
- Sheep
- Goats
- Swine
- Camelids
- Horses
- Birds
- Humans

## Pathogenicity

- General information: Q fever, also known as coxiellosis, is an extremely contagious bacterial infectious disease
- Bacterium: Member of the family Coxiellaceae, *Coxiella burnetii* is highly resistant in the outdoor environment through pseudo-spores
- Incubation period: 9 to 40 days

## Clinical signs

### In animals

- Usually mild or asymptomatic
- Possible abortions at all stages (*295, 296*)
- Gynecological problems (metritis)

### In humans

- Influenza syndrome
- In 50% of cases, high fever, headache, muscle aches, nausea, vomiting, chest pain, gastric discomfort
- Possible complications: pneumonia, liver damage, meningitis, encephalitis...

## Transmission

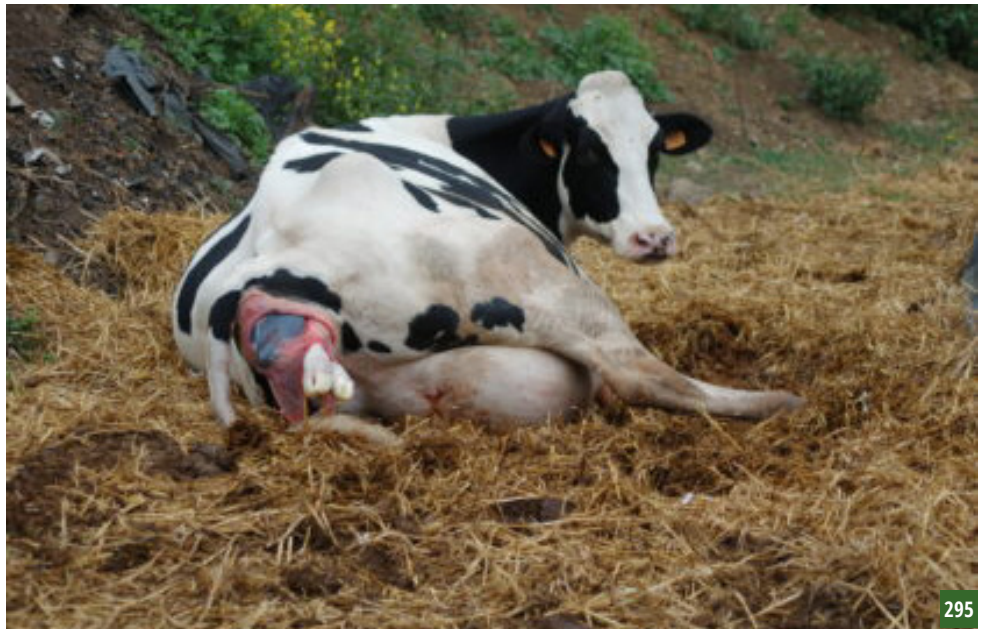
- Direct: By contact and/or absorption of any contaminated animal secretion and/or production (especially amniotic fluid, placenta, abortions, milk, urine, feces...)
- Indirect: Vector-borne (tick) and/or Mechanically (litter, food, clothing, equipment, dust...)

## Samples

- Living animal: Uterine, vaginal, placental excretion fluids, abortion tissues (spleen, liver, stomach, lung), milk, colostrum, or serum
- After autopsy: Uterine, vaginal, placental, placental excretion fluids, abortion tissues (spleen, liver, stomach, lung), milk, colostrum

## Treatment

- There is no specific treatment except symptomatic
- Dead animals, runts and other abortion products must be buried deep and destroyed with quicklime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296

## *Specific recommendations and measures to be taken in the event of Q fever*

For the CAHW:

- Inspect all animals with the farmer looking for abortions and metritis;
- Remind farmers of the cleaning/disinfection rules and the need to boil milk thoroughly;
- Isolate aborted females and those in advanced gestation;
- Burn abortion residues on site or bury them at least 2 meters deep before destroying them with quicklime.

For the veterinary paraprofessional:

- Confine the herd, check quarantine, census abortions;
- Oversee the disinfection, slaughter and destruction of corpses and abortion residues;
- Oversee the implementation of vector control, epidemiological surveillance and vaccination programs.

For the private and/or public veterinarian:

- Set up epidemiological surveillance;
- Set up a vector control program;
- Set up a campaign to slaughter infected animals;
- Set up a vaccination campaign in endemic areas.

# *West Nile fever*

*Zoonotic notifiable disease*

## Species concerned

- Horses
- Birds
- Humans

## Pathogenicity

- General information: West Nile fever is an infectious viral vector-borne disease
- Virus: Member of the genus *Flavivirus*, of the family Flaviviridae, it uses birds as its main reservoir
- Incubation period: 3 to 6 days

## Clinical signs

### In animals

- Weakness (*298*)
- Ataxia, muscle contractions, convulsions, partial paralysis (*299*)
- Loss of appetite, depression
- Leaning on the head (*300*)
- Non-systematic fever
- Teeth grinding
- May develop into encephalomyelitis with high mortality rates
- Usually asymptomatic in birds

### In humans

- Influenza syndrome
- In 1 to 15% of cases, high fever, headache, muscle aches, nausea, skin rash, abdominal pain
- Possible complications: meningitis and/or encephalitis
- Asymptomatic in 80% of cases

## Transmission

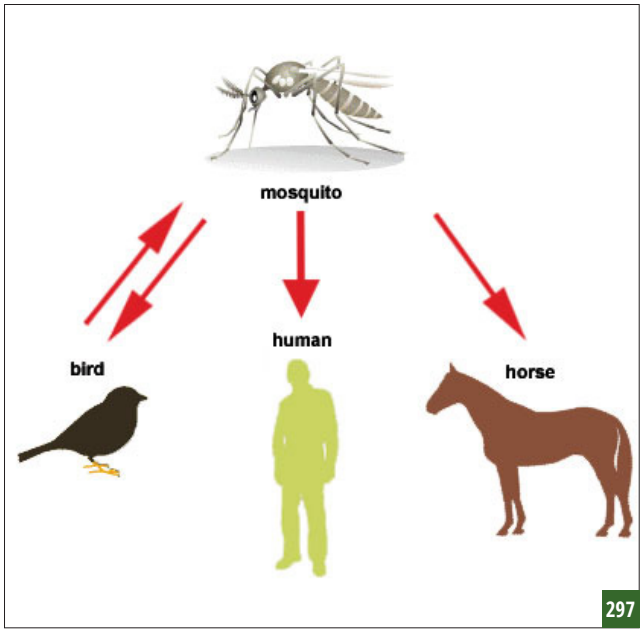
- Indirect: Vector-borne (mosquitoes, mainly of the genus *Culex - 297*)

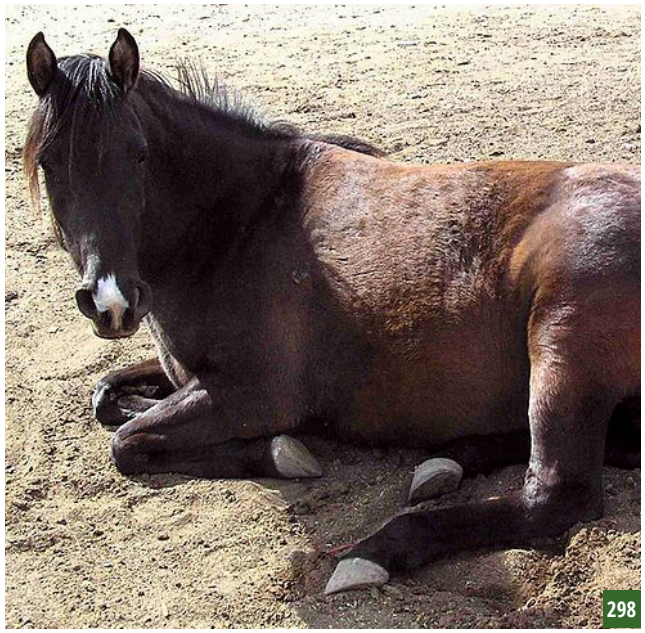
## Samples

- Living animal: Serum
- After autopsy: Brain, spinal cord for horses; Kidney, heart, brain, liver, intestine for birds

## Treatment

- There is no specific treatment except symptomatic






## *Specific recommendations and measures to be taken in the event of West Nile fever*

For the CAHW:

- Inspect all animals with the farmer looking for weakness, depression and ataxia;
- Destroy insect nests, clear the bushes;
- Recommend the installation of mosquito nests.

For the veterinary paraprofessional:

- Oversee the implementation of the vector control program set up by the veterinarian.

For the private and/or public veterinarian:

- Set up a vector control program (external disinfestation, destruction of insect nests, brush clearing, etc.).

# *Avian influenza*

*Zoonotic notifiable disease*

## Species concerned

- All bird species
- Swine
- Humans

## Pathogenicity

- General information: Avian influenza, also known as bird flu or fowl plague, is a highly contagious viral disease
- Virus: Member of the genus *Influenzavirus A*, of the family Orthomyxoviridae, it is highly resistant in the outdoor environment
- Incubation period: 3 to 7 days

## Clinical signs

### In animals

- General symptoms: depression, loss of appetite, prostration (*301*)
- Respiratory symptoms: dyspnea, nasal discharge, cough, sneezes, rales
- Cutaneous symptoms: swollen and congested comb, caruncle and legs, bristly feathers (*302*, *303*)
- Digestive symptoms: diarrhea
- Nervous symptoms: tremors, spasms
- Sudden drop in egg-laying, egg anomaly (*304*)
- Bleeding hocks
- Sudden death (often very high mortality)

#### After autopsy

- Dark red, swollen, bleeding organs and muscles (*305*)
- Bright red trachea with deposits (*306*)
- Dehydrated carcass

### In humans

- High fever
- Headaches
- Diarrhea
- Muscle pain
- Lethargy, anorexia
- Dyspnea, sneezes, cough, nasal and eye discharges
- Quickly progresses into severe respiratory disorders
- Significant risk of death

## Transmission

- Direct: By absorption of any contaminated animal secretion and/or production (mainly fecal and respiratory)
- Indirect: Mechanically (litter, food, clothing, equipment...)

## Samples

- Living or dead animal: Cloacal and tracheal swabs, feces, intestinal fragments, brain, trachea, lung, liver and spleen

## Treatment

- There is no specific treatment except symptomatic
- Dead animals must be burned or buried deep and destroyed with quicklime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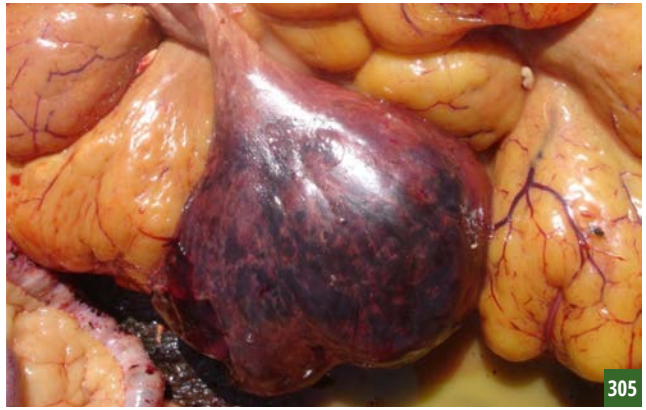
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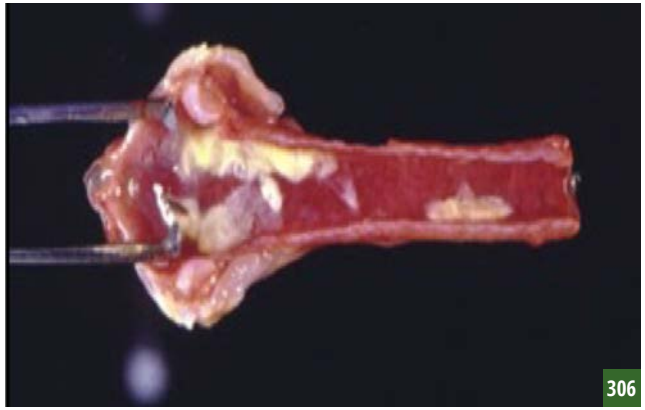
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## *Specific recommendations and measures to be taken in the event of avian influenza*

For the CAHW:

- Inspect all animals with the farmer looking for persistent mortality despite the application of treatment and/or vaccination measures for other diseases;
- Promote the use of footbaths, check their renewal and compliance with hygiene rules;
- Burn or bury dead animals 2 meters deep with quicklime.

For the veterinary paraprofessional:

- Prohibit any movement in the area;
- Advise emptying the buildings for least 15 days between each raising batch of poultry.

For the private and/or public veterinarian:

- Set up information campaigns aimed at the population;
- Possibly set up a vaccination campaign.

# *Rabies*

*Zoonotic notifiable disease*

## Species concerned

- All mammals

## Pathogenicity

- General information: Rabies is a highly contagious viral disease that affects the nervous system of warm-blooded animals
- Virus: Member of the genus *Lyssavirus*, of the Rhabdoviridae family, it is very resistant in the outdoor environment
- Incubation period: 20 to 80 days, sometimes more (several years)

## Clinical signs

### In animals

- Nervous symptoms: behavioral disorders, aggressiveness (*307*), spasms, paralysis (*308, 309*), convulsions, hydrophobia
- Hypersalivation (*310*)
- High fever
- Constipation
- Loss of appetite
- Rough mooing
- Quick death after the symptoms show up
- Two forms: furious form (strong aggressiveness, convulsions, progressive paralysis...) and paralytic form (abnormally docile animal, depressed, progressive paralysis...)

### In humans

- High fever
- Nervous symptoms: behavioral disorders, disorders of higher brain functions, anxiety, confusion, spasms, paralysis, convulsions, hydrophobia
- Quick death after the symptoms show up
- There are two forms of the disease (furious and paralytic)

## Transmission

- Direct: By contact and/or absorption of saliva from a contaminated animal (often by biting, sometimes by eating meat from an animal that has died of the disease)

## Samples

- Living animal: Serum
- After autopsy: Brain biopsy

## Treatment

- There is no specific treatment


307


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## *Specific recommendations and measures to be taken in the event of rabies*

For the CAHW:

- Inspect all animals with the farmer looking for behavioral disorders, hypersalivations and hindquarters paralysis;
- Take part actively in the fight against stray dogs.

For the veterinary paraprofessional:

- Confine and watch the herd for at least 3 months (long incubation period);
- Isolate the diseased animal(s) from other animals and humans.

For the private and/or public veterinarian:

- Map the endemic areas and set up vaccination campaigns;
- Set up a campaign to fight against stray dogs.

# *Trypanosomiasis*

*Zoonotic notifiable disease*

## Species concerned

- Cattle
- Sheep
- Goats
- Horses
- Camelids
- Humans

## Pathogenicity

- General information: Trypanosomiasis is an infectious parasitic disease caused by flagellated protozoans
- Parasites: Members of the Trypanosomatidae family, there are several species depending on the geographical areas and animals they infect (*T. brucei, T. congolense, T. vivax*...)
- Incubation period: 8 to 20 days

## Clinical signs

### In animals

- Lymphadenopathy (*312*)
- Anorexia, depression (*313*)
- Pale mucous membranes (*314*)
- Hyperthermia and high fever (intermittent)
- Watery eyes (*315*)
- Loss of appetite
- Drop in milk production
- Hair loss on the tail (*316*)
- Coordination disorders
- Sleep disorders (lately)

### In humans

- High fever
- Lymphadenopathy
- Muscle and joint pain
- Headaches
- In its second phase, the disease causes neurological disorders (mental confusion, coordination and sleep disorders)
- Lethal without treatment, it is better known as «sleeping sickness»

## Transmission

- Indirect: Vector-borne (tsetse flies - 311), horseflies, stable flies)

## Samples

- Living animal: Blood with anticoagulant (Vacutainer 5ml), lymph node puncture, or serum

## Treatment

- The preventive treatment is trypanocide
- Curative treatment can be based on DIMINAZENE


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## *Specific recommendations and measures to be taken in the event of trypanosomiasis*

For the CAHW:

- Inspect all animals with the farmer looking for lymphadenopathy, anorexia and pale mucous membranes;
- Recognize vectors and advise farmers to avoid their areas of abundance.

For the veterinary paraprofessional:

- Set up fly traps, especially at water points;
- Check the measures taken to avoid areas of vector abundance.

For the private and/or public veterinarian:

- Set up preventive and/or curative treatment campaigns according to the areas.

# *Bovine tuberculosis*

*Zoonotic notifiable disease*

## Species concerned

- Cattle
- Sheep
- Goats
- Swine
- Horses
- Camelids
- Humans

## Pathogenicity

- General information: Bovine tuberculosis is a highly contagious and chronic bacterial infectious disease that does not only affect cattle
- Bacterium: Member of the Mycobacteriaceae family, *Mycobacterium bovis* is not resistant in the outdoor environment
- Incubation period: Variable, several months to several years

## Clinical signs

### In animals

- Intermittent dry coughing (*317*)
- Lymphadenopathy (*318*)
- Anorexia (*319*)
- Intermittent fever
- Diarrhea
- Slowly progressing disease
- Can remain asymptomatic

### After autopsy

- Caseous necrosis of tracheobronchial and mediastinal lymph nodes (*320*)
- Nodules in mesenteric lymph nodes (*321*)
- Lung lesions (*322*)

### In humans

- Fever
- Coughing with sputum (sometimes with blood)
- Headaches
- Pain in the chest and joints
- Loss of appetite, tiredness, anorexia

## Transmission

- Direct: By absorbing nasal secretions or droplets breathed out into the air by the sick animal, and/or by consuming raw milk or undercooked meat

## Samples

- Living animal: Blood with anticoagulant (Vacutainer 5ml)
- After autopsy: Blood with anticoagulant (Vacutainer 5ml), lung fragment, lymph node, spleen

## Treatment

- For all forms of tuberculosis, treatment is first based on antibiotics that must be taken over a long period of time (several months)
- Treatment and/or slaughter should be considered and adapted according to the legislation of the country


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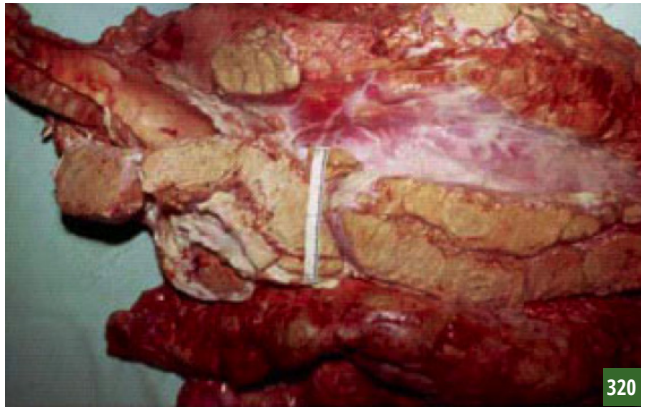
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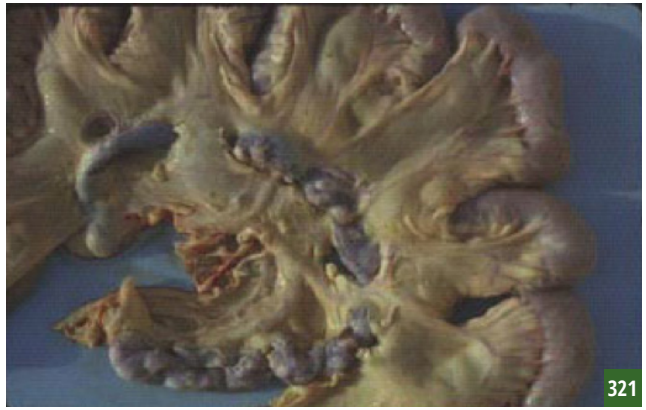
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322

## *Specific recommendations and measures to be taken in the event of tuberculosis*

For the CAHW:

- Inspect all animals with the farmer looking for persistent cough, lymphadenopathy and leanness;
- Remind farmers of the need to boil milk and cook meat properly.

For the veterinary paraprofessional:

- Participate in screening campaigns;
- Inspect carcasses during slaughter.

For the private and/or public veterinarian:

- Set up screening campaigns in suspicious farms;
- Conduct a tuberculin test on any newcomer.

*Section* 3

# Non-notifiable diseases

*The diseases described in this section are not zoonotic infectious diseases:*
*→ They are not transmitted to humans*

*These are non-notifiable diseases:*
*→ They are not subject to any specific regulations*

# *Blackleg*

*Non-notifiable disease*

## Species concerned

- Cattle
- Sheep
- Goats
- Swine
- Horses

## Pathogenicity

- General information: Blackleg is an acute infectious disease of livestock
- Bacterium: Member of the Clostridiaceae family, *Clostridium chauvoei* produces highly resistant spores in the outdoor environment
- Incubation period: De 2 to 5 days

## Clinical signs

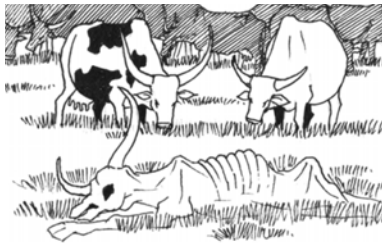
- Sudden death (*323*)
- Sudden lameness
- Swollen shoulder or hip with crepitus on palpation (*324*)
- High fever
- Loss of appetite

### After autopsy

- Swollen muscle, black blood clots (*325*)
- Dark muscle with gas (*326*)
- It is recommended not to perform an autopsy

## Transmission

- Indirect: Mechanically (contaminated soils, litter, food, clothing, equipment...)



## Samples

- Living or dead animal: Muscle sample (at least 10*10*10 cm)

## Treatment

- Curative treatment can be based on BENZYLPENICILLIN
- Clinical progression is often so fast that there is no time to treat infected animals
- Dead animals must be buried deep and destroyed with quicklime


323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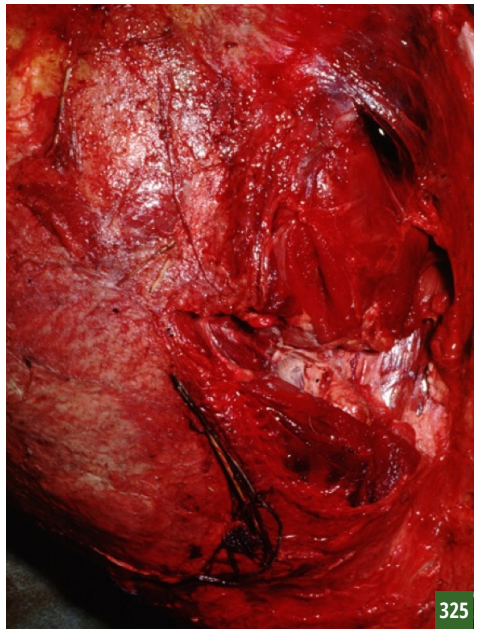
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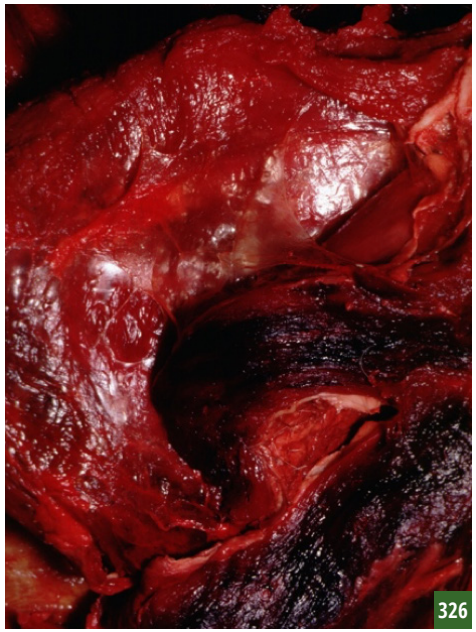

326

## *Specific recommendations and measures to be taken in the event of blackleg*

For the CAHW:

- Inspect all animals with the farmer looking for sudden deaths and crepitus under the skin;
- Look with the farmer for pastures roamed by sick animals in the previous days;
- Burn the carcasses on site or bury them at least 2 meters deep after destroying them with quicklime.

For the veterinary paraprofessional:

- Confine the herd, check the quarantine;
- Oversee the disinfection, slaughter and destruction of corpses.

For the private and/or public veterinarian:

- Set up the monitoring and the census of deaths;
- Map the affected and contaminated areas and pastures, condemn them;
- Set up annual vaccination campaigns.

# *Dermatophilosis*

*Non-notifiable disease*

## Species concerned

- Cattle
- Sheep
- Goats
- Horses
- Camelids

## Pathogenicity

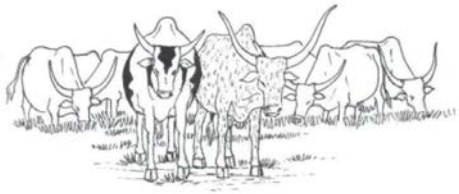
- General information: Dermatophilosis is a bacterial skin disease
- Bacterium: Member of the Dermatophilaceae family, *Dermatophilus congolensis* affects the epidermis of the animals it infects. It is highly resistant in the outdoor environment
- Incubation period: 15 to 30 days

## Clinical signs

- Skin lesions with serous exudate, without itching (*327, 328*)
- Yellowish, thick scabs (*329*)
- Skin detachments (*330*)
- Bristly hair
- Lethargy

## Transmission

- Direct: By contact (friction) with a sick animal
- Indirect: Vector-borne (flies, horseflies, ticks, mites...) and/or Mechanically (contaminated soil, litter, food, clothing, equipment...)



## Samples

- Living animal: Fresh scabs, skin with lesion, or serum

## Treatment

- Preventive treatment is acaricide
- Curative treatment can be based on CHLORHEXIDINE and TETRACYCLINE


327


328


329


330

## *Specific recommendations and measures to be taken in the event of dermatophilosis*

For the CAHW:

- Inspect all animals with the farmer looking for itch-free scabbed skin lesions with bristly hair;
- Isolate suspicious animals;
- Destroy insect nests, clear the bushes.

For the veterinary paraprofessional:

- Oversee the implementation of the vector control program set up by the veterinarian;
- Check the containment of sick animals.

For the private and/or public veterinarian:

- Set up a vector control program (external disinfestation, destruction of insect nests, brush clearing, etc.);
- Remind the necessity for preventive vector control.

# *Fasciolosis*

*Non-notifiable disease*

## Species concerned

- Cattle
- Sheep
- Goats
- Horses
- Camelids

## Pathogenicity

- General information: Fasciolosis is a parasitic worm infection of the liver
- Parasite: Member of the Fasciolidae family, *Fasciola hepatica* (liver fluke) is a large flatworm that feeds on liver tissue
- Incubation period: 6 to 60 days

## Clinical signs

- Pale mucous membranes
- Diarrhea
- Bottle jaw (*331*)
- Loss of appetite, anorexia, lethargy
- Drop in milk production

### After autopsy

- Hard and greyish liver when cut (*332*)
- Thickened bile ducts (*333*)
- Adult flukes (*334*)

## Transmission

- Indirect: Mechanically (pastures and swampy areas contaminated by parasite larvae)

## Samples

- Living animal: Fresh stools
- After autopsy: Bile ducts

## Treatment

- Curative treatment can be based on ALBENDAZOLE or NITROXINIL


331


332


333


334

## *Specific recommendations and measures to be taken in the event of fasciolosis*

For the CAHW:

- Inspect all animals with the farmer looking for pale mucous membranes, loss of appetite and swollen throats;
- Advise farmers to avoid herd gatherings in wetlands and water points.

For the veterinary paraprofessional:

- Train CAHWs in the proper practice of treatments chosen by the veterinarian.

For the private and/or public veterinarian:

- Assess the appropriate treatment to be implemented according to the situation, considering possible resistances.

# *Scabies*

*Non-notifiable disease*

## Species concerned

- Cattle
- Sheep
- Goats
- Swine
- Horses
- Camelids

## Pathogenicity

- General information: Scabies are parasitic skin diseases caused by mites
- Parasites: Many species of mites, members of the order Sarcoptiformes, are responsible for scabies
- Incubation period: 20 to 40 days

## Clinical signs

- Hair loss (*335*)
- Itching (the animal scratches against trees and/or equipment)
- Red, thickened, cracked skin (*336, 337*)
- Lethargy
- Drop in milk production
- Usually starts on the head and neck and extends to the hind legs (*338*)

## Transmission

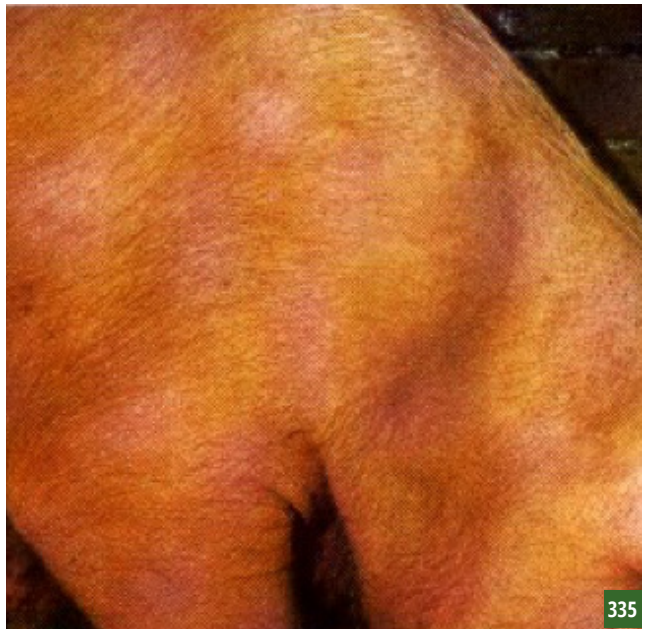
- Direct: By contact (friction) with a sick animal
- Indirect: Mechanically (trees or equipment on which sick animals have rubbed)

## Samples

- Living animal: Skin scrapings

## Treatment

- Preventive treatment is acaricide
- Curative treatment can be based on IVERMECTIN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## *Specific recommendations and measures to be taken in the event of scabies*

For the CAHW:

- Inspect all animals with the farmer looking for hair loss, itching and thickened skin;
- Isolate suspicious animals;
- Destroy insect nests, clear the bushes.

For the veterinary paraprofessional:

- Oversee the implementation of the vector control program set up by the veterinarian;
- Check the containment of sick animals.

For the private and/or public veterinarian:

- Set up a vector control program (external disinfestation, destruction of insect nests, brush clearing, etc.);
- Remind the necessity for preventive vector control.

# *Pasteurellosis*

*Non-notifiable disease*

## Species concerned

- Cattle
- Sheep
- Goats
- Camelids

## Pathogenicity

- General information: Pasteurellosis is a highly contagious bacterial infectious disease
- Bacterium: Member of the family Pasteurellaceae, *Mannheimia haemolytica* (formerly called *Pasteurella haemolytica*) is poorly resistant in the outdoor environment
- Incubation period: 7 to 10 days

## Clinical signs

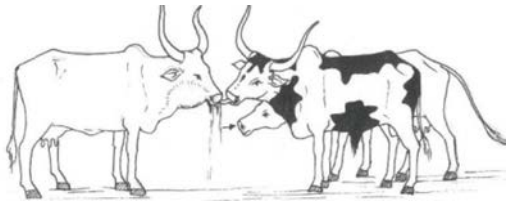
- Mucopurulent nasal discharge (*339*)
- Difficult and noisy breathing
- Sudden death
- High fever
- Sudden drop in milk production
- Swollen throat and tongue, hanging out of the mouth (340)
- Abundant diarrhea
- Mainly during the wet season and during stress (transport...)
- In young animals: sepsis and shock

### After autopsy

- Very red stomach mucous membranes (*341*)
- Very red lungs (*342*)
- Dark lungs with thick streaks (*343*)
- Thickened throat with yellowish liquid (*344*)
- Thoracic hemorrhages (*345*)
- Hemorrhages on the carcass (*346*)

## Transmission

- Direct: By absorption of nasal secretions or droplets breathed out into the air by the sick animal



## Samples

- Living animal: Blood with anticoagulant (vacutainer 5ml)
- After autopsy: Blood with anticoagulant, long bone, lung fragment

## Treatment

- Curative treatment can be based on TETRACYCLINE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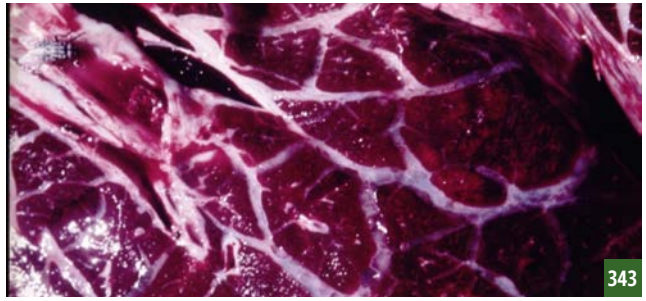
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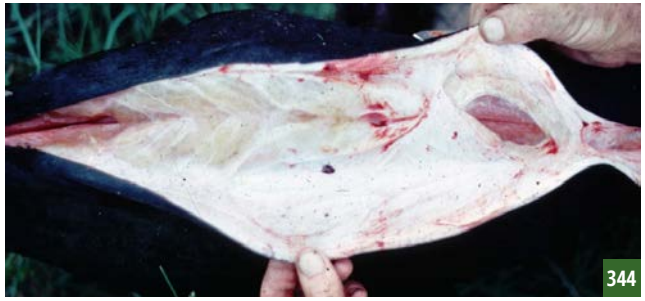
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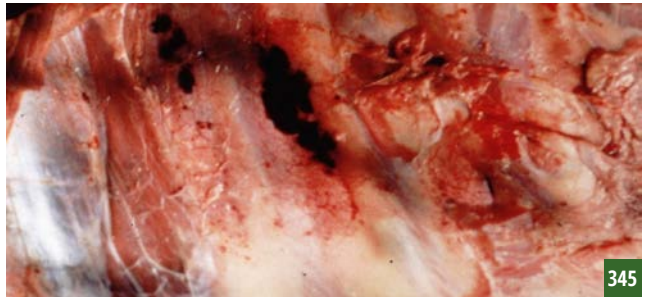
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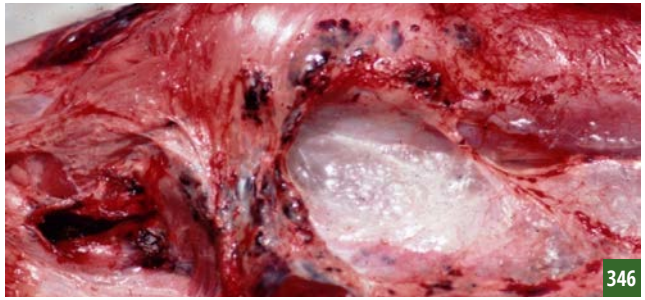
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## *Specific recommendations and measures to be taken in the event of pasteurellosis*

For the CAHW:

- Inspect all animals with the farmer looking for sudden deaths with mucopurulent nasal discharges, difficulty in breathing and abundant diarrhea;
- Take the temperature of all animals twice a day.

For the veterinary paraprofessional:

- Strictly isolate sick animals for two weeks.

For the private and/or public veterinarian:

- Carry out vaccination on herds every year, especially on animals aged 1 to 3 years.

# *Photosensitization*

*Non-notifiable disease*

## Species concerned

- Cattle
- Sheep
- Goats
- Horses

## Pathogenicity

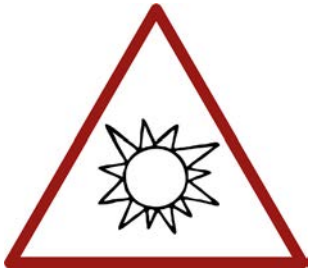
- General information: Photosensitization is an inflammatory hypersensitivity of the skin to sunlight. It can be congenital, or it can occur after the absorption of photosensitizing chemical agents. This disease mainly affects animals with light skin and insufficient coat coverage

## Clinical signs

- Skin lesions: Redness, burning, swelling, depilation, cracked skin (*347*, *348*)
- Fever
- Leanness
- Jaundice

## Principe

- Acquired photosensitization:
  - A photodynamic agent is absorbed, ingested or injected and goes to the peripheral bloodstream (blood vessels of the skin)
  - Type I: Direct, the agent (drug, plant, internal substance) is itself photosensitizing
  - Type II: Indirect, the agent has hepatotoxic properties and leads to the release of photosensitizing chemicals by the liver
- Innate photosensitization:
  - Genetic anomaly that affects pigmentation (albinism)



## Treatment

- Local wound care
- Keep the animals away from the sun
- Remove the source of the photosensitizing agent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## *Specific recommendations and measures to be taken in the event of photosensitization*

For the CAHW:

- Inspect with the farmer the light-colored animals looking for burns, swelling and depilation;
- Advise farmers to keep affected animals inside during the day.

For the veterinary paraprofessional:

- Avoid the development of secondary infections in affected animals by cleaning and sanitizing the lesions.

For the private and/or public veterinarian:

- Advise farmers to eliminate animals with congenital photosensitization from the herds.

# *Intestinal worms*

*Non-notifiable disease*

## Species concerned

- Cattle
- Sheep
- Goats
- Swine
- Horses
- Camelids

## Pathogenicity

- General information: Intestinal worms are parasites that can cause severe infestations in their hosts
- Parasites: Many parasitic worm species are responsible for intestinal infestations
- Incubation period: Variable, in a range of 3 to 4 weeks

## Clinical signs

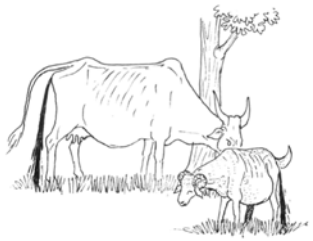
- Diarrhea (*349*)
- Anorexia (*350*)
- Bottle jaw (*351, 352*)
- Swollen abdomen
- Growth retardation
- Drop in milk production
- Spiky hair
- Pale mucous membranes

### After autopsy

- Pale carcass with wet appearance (*353*)
- Worms in the rumen (*354*)

## Transmission

- Direct: By absorbing or licking materials contaminated by the excreta (containing eggs) of infected animals



## Samples

- Living animal: Fresh stools
- After autopsy: Fresh stools

## Treatment

- The preventive and curative treatment is anthelmintic (deworming)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## *Specific recommendations and measures to be taken in the event of intestinal worms*

For the CAHW:

- Inspect all animals with the farmer looking for diarrhea, leanness and bottle jaw;
- Recommend avoiding large concentrations of animals in wetlands.

For the veterinary paraprofessional:

- Carry out coprological sampling before and after deworming;
- Oversee the implementation of deworming campaigns.

For the private and/or public veterinarian:

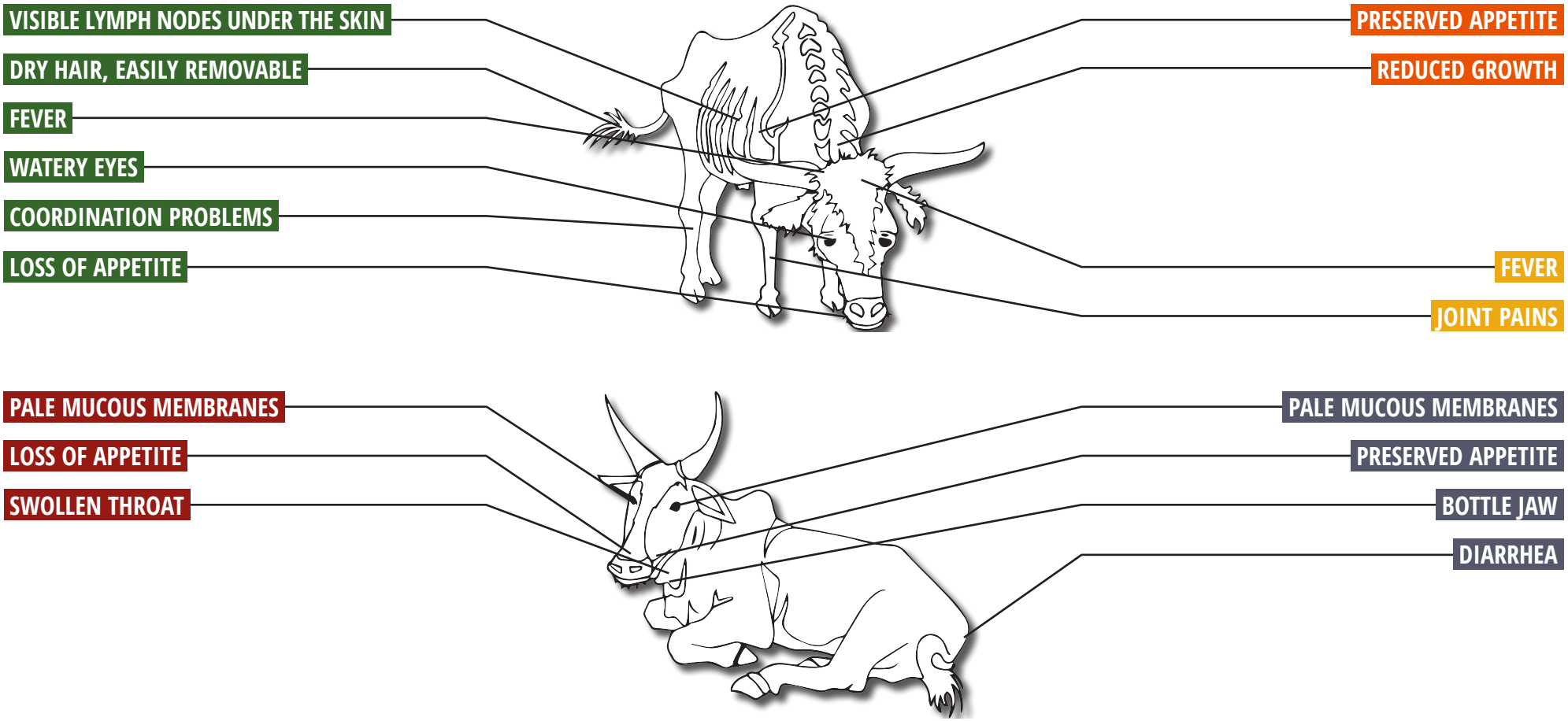
- Train veterinary paraprofessionals and CAHWs in the proper use of antiworm drugs;
- Set up deworming campaigns at the beginning of the dry season and the rainy season.

*Section* 4

# Differential diagnoses

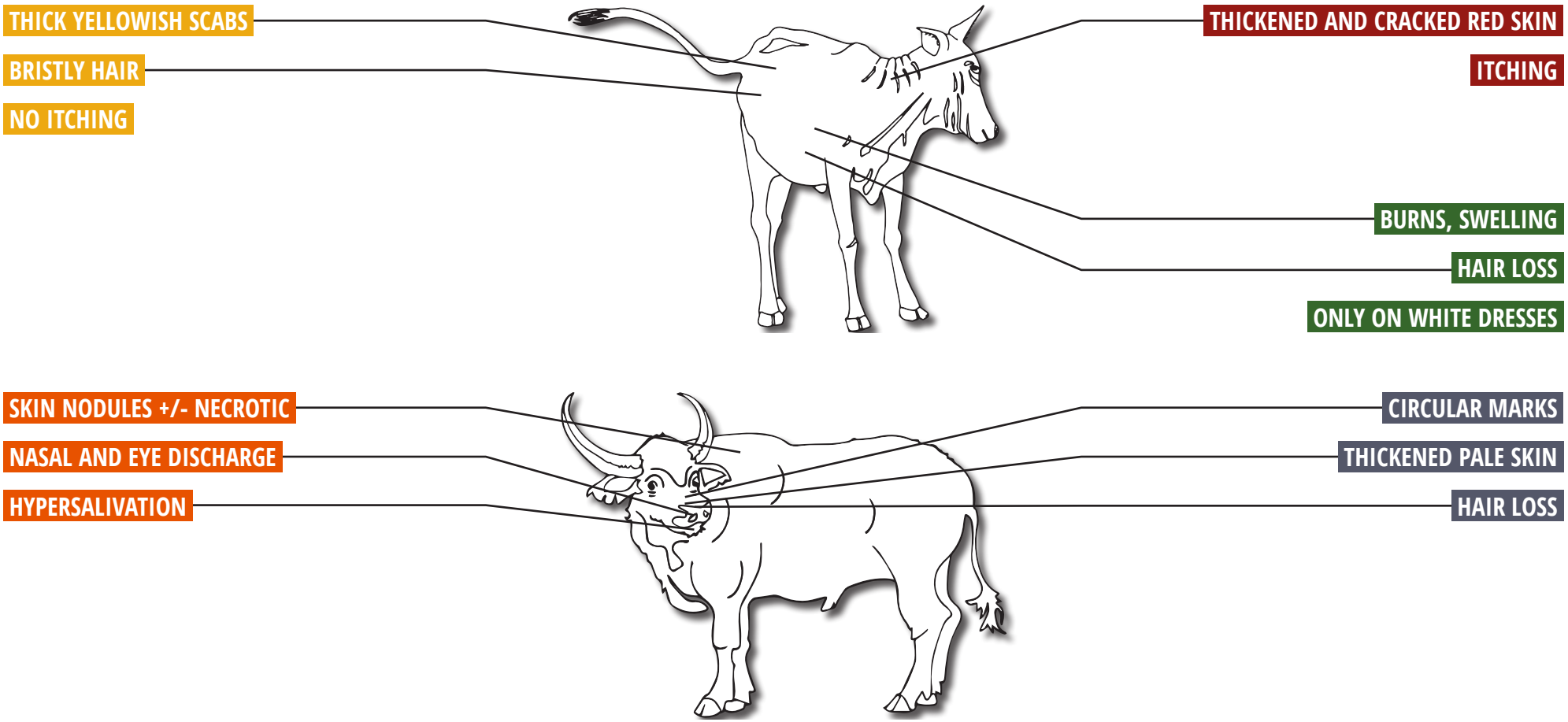
# *Lethargy*

- Anaplasmosis
- Echinococcosis
- Fasciolosis
- Trypanosomiasis
- Intestinal worms



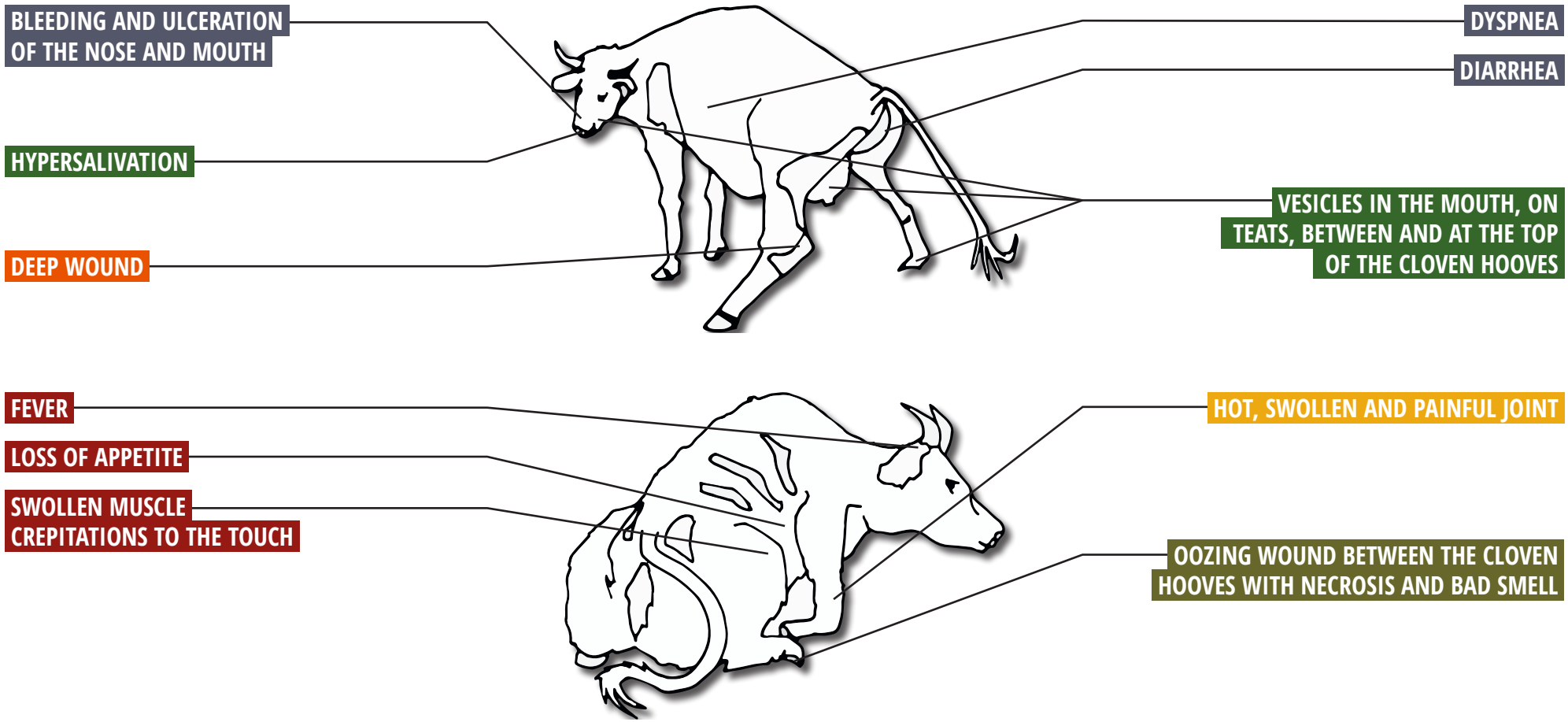
# *Skin diseases*

- Dermatophilosis
- Lumpy skin disease
- Scabies
- Photosensitization
- Ringworm



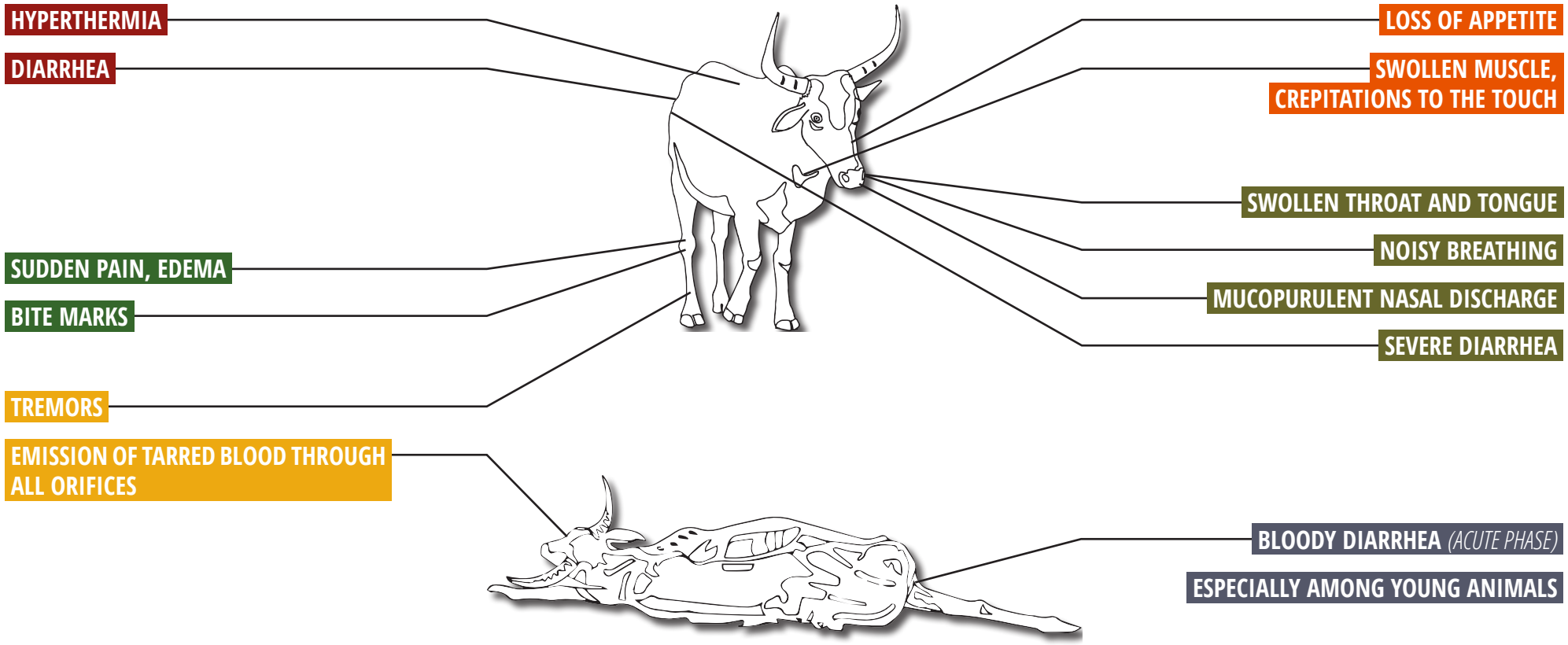
# *Lameness*

Arthritis
Wound
Blackleg
Foot-and-mouth disease
Bluetongue
Foot rot



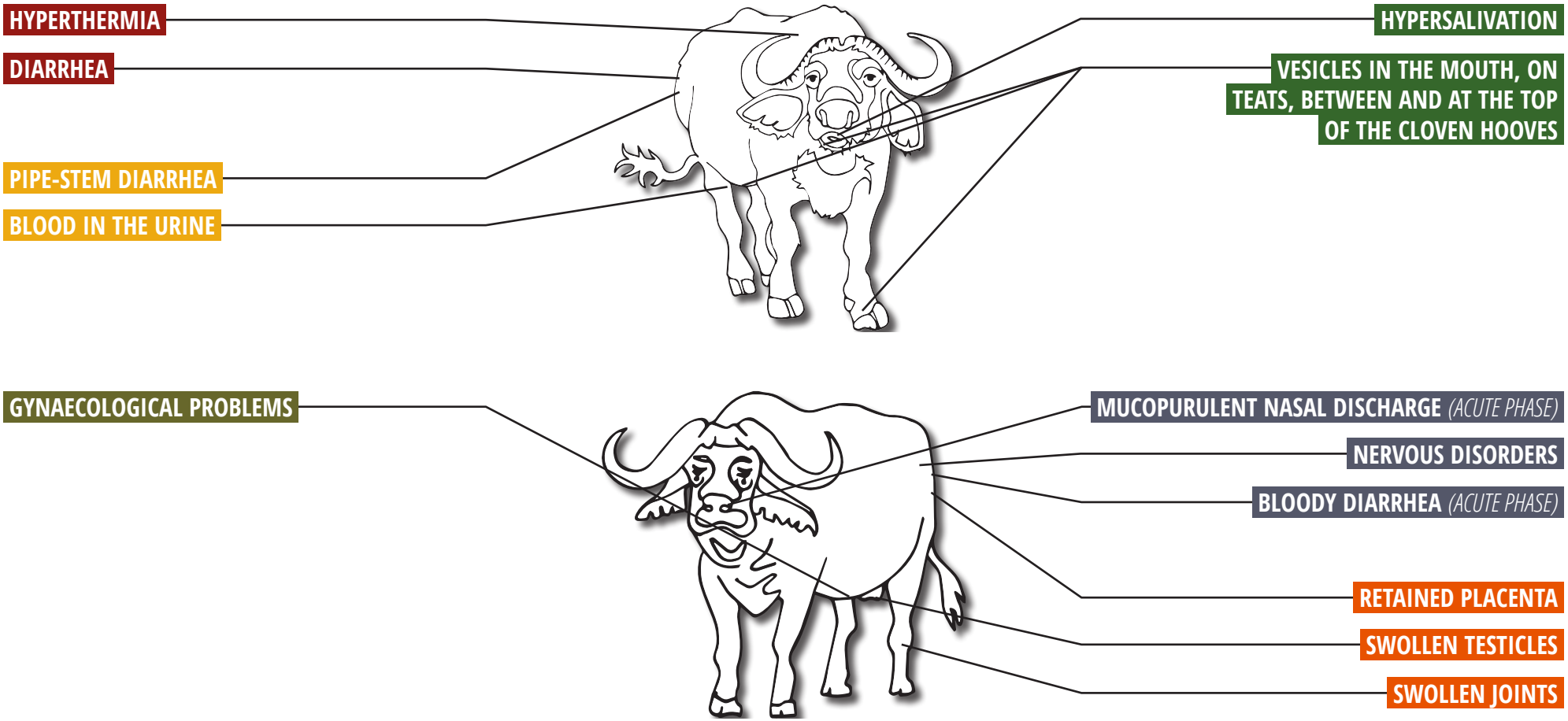
# *Sudden death*

- Anthrax
- Blackleg
- Cowdriosis (hyperacture phase)
- Poisoning
- Rift valley fever
- Pasteurellosis



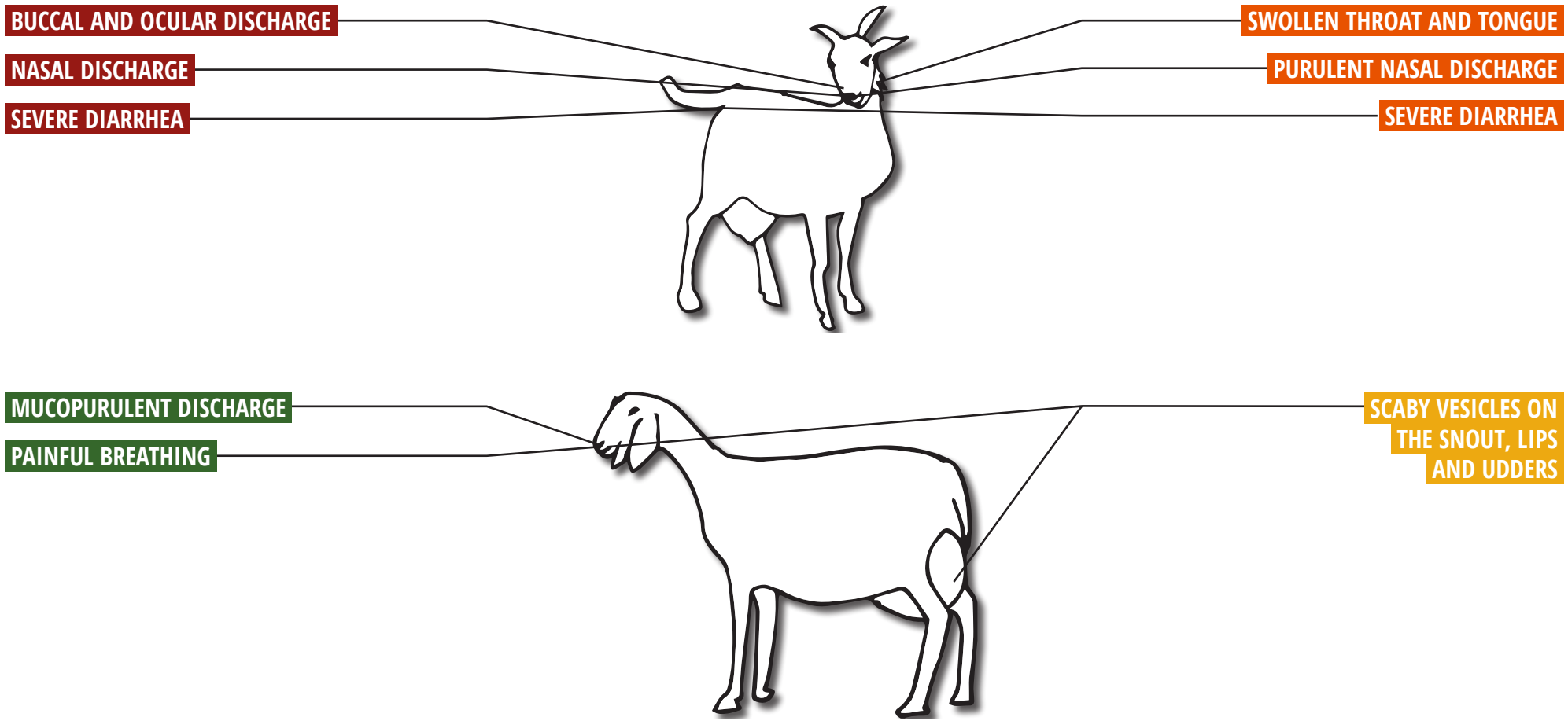
# *Abortion*

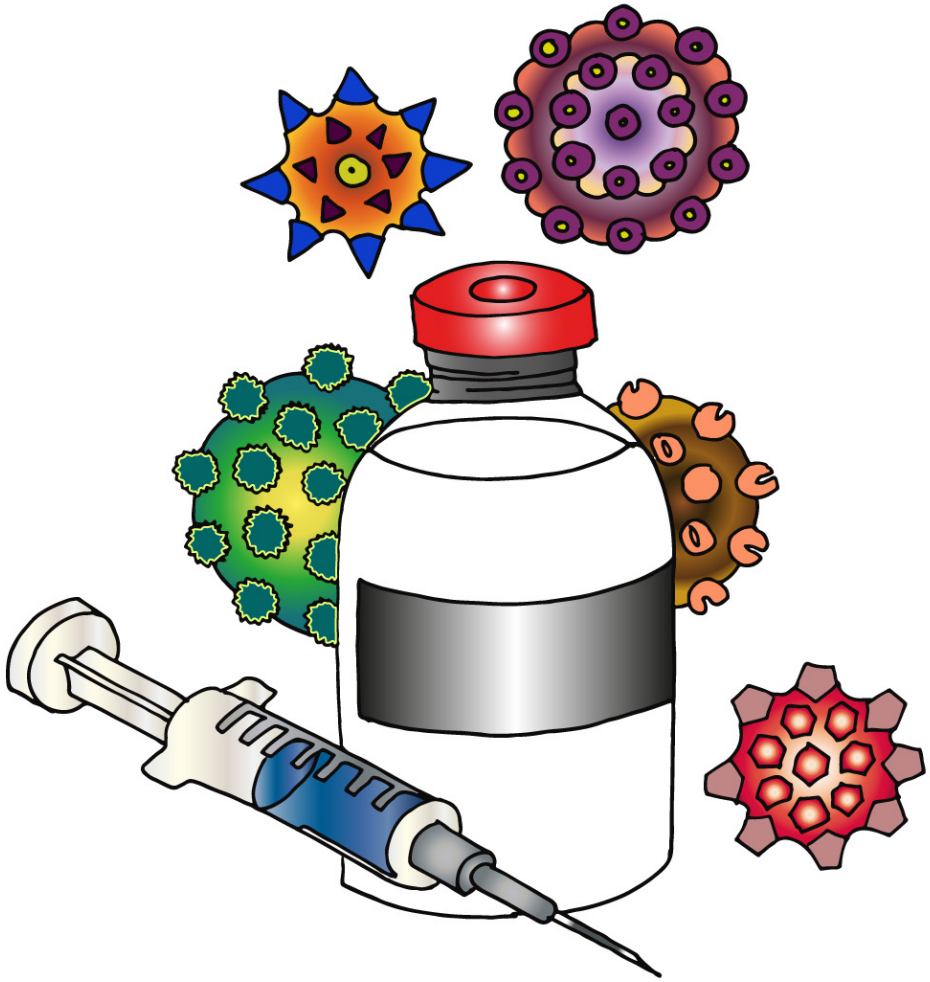
- Babesiosis
- Brucellosis
- Cowdriosis
- Foot-and-mouth disease
- Rift valley fever
- Q fever



# *Respiratory diseases (small ruminants)*

- Orf
- Pasteurellosis
- Sheep and goat plague
- Contagious caprine pleuropneumonia





# Chapter

# Main treatments

*Section* 1

# General information

# *Some definitions*

**Waiting period**. A veterinary drug is not like any other product. Because of its biological activity, its active ingredients or residue remain in the body of the treated animal for some time. They may therefore remain in the tissues or productions for some time. These active ingredients or residue can cause diseases, especially allergies. The waiting period is the amount of time during which animal products from treated animals cannot be consumed. It is usually specified by manufacturers.

**Control device for veterinary drugs**. The veterinary authority frequently organizes controls on the market for veterinary drugs, considering several objectives: the fight against the illegal practice of veterinary pharmacy, the fight against unauthorized drugs and the fight against counterfeit medicines.

**Fake drug (fake medicine)**. It is an illusion, a scam and a danger. A fake drug is a product that looks like a medicine (authorized or not) but is not a medicine. It may contain the right ingredients (but in insufficient or in excessive amounts) or the wrong ingredients. It is manufactured by traffickers to mislead the users into believing that it has a therapeutic effect. It is at best ineffective (no active ingredient) and at worst deadly (contains a toxic product). Because it never treats properly and it is manufactured illicitly without any health control, a fake medicine is always dangerous.

**Identification of veterinary specialties**. A veterinary drug (specialty/medicine) is characterized by the following points: its registered name, its manufacturer, its galenic formulation, its composition.

**List of authorized drugs**. In principle, the veterinary authority must keep an up-to-date and available list of veterinary drugs (specialties/medicines) authorized for import, marketing and use in the national territory. In UEMOA countries (West African Economic and Monetary Union), this list contains drugs with a marketing authorization issued by the UEMOA.

**Medicine (or veterinary drug/specialty)**. Used to cure, identify or prevent a disease. Thanks to its active ingredient(s) (there can be one or several), it can correct or modify organic functions. A drug is therefore not a product like any other: its action and manufacture are carefully controlled, and it cannot be sold without a marketing authorization.

**Generic drug**. Generic drugs should not be confused with fake drugs. A generic drug is an authorized and regulated copy of an original drug. This copy is legal when the patent protecting the original falls into the public domain. However, a generic drug can be counterfeited too.

**Unauthorized drugs**. Any veterinary drug not listed on the national list must not be imported, marketed or used on national territory.

**Dosage**. To be active, a drug must be used in accordance with the manufacturer's instructions. These requirements may differ depending on the species. They always differ depending on the weight and age of the animal (a certain amount of mL/kg of body weight for liquid drugs, a certain amount of mg/kg of body weight for bolus).

**Resistance**. The intensive use of veterinary drugs has allowed some parasites and microbes to develop resistance that makes them insensitive to these drugs. Antibiotic resistance is a major public health problem in the 21st century. It is therefore preferable to promote prevention rather than treatment, as well as to optimize breeding conditions.

**Amount of active ingredient**. An authorized veterinary drug contains a specific quantity of active ingredients. For example, a 100 mL vial of Terramycin 20% contains 20 grams of active ingredient (200 mg per mL).

### *Not to be deceived*

- Do not buy veterinary drugs outside the official market (veterinarian, veterinary paraprofessional, pharmacy);
- Do not buy veterinary drugs that are not on the list of authorized drugs;
- Be suspicious as soon as the presentation of a known product changes (shape of the bottle, color of the label, etc.) and immediately notify the local veterinary authorities.

### *How to calculate a dose*

The calculation is made according to the principle of the rule of three:

- Example 1: If a 3-year-old bull weighing 500 Kg is to be treated with 20% long-acting Terramycin that requires 1 mL per 10 Kg body weight, then the required dose is 500 Kg / 10 kg * 1 mL = 50 mL;
- Example 2: If a 5-year-old cow weighing 350 Kg must be treated with Valbazen bolus 600 mg which requires 1 bolus for 80 Kg body weight, then the required dose is 350 Kg / 80 Kg * 1 bolus = 4.5 boluses.

# *Precautions for use*

## Before using a medication - Take precautions

Preventive and curative drugs are only effective if they are properly used. Otherwise, they can be dangerous. The private and/or public veterinarian is the most qualified to use veterinary drugs properly. It is therefore important for CAHWs and veterinary paraprofessionals to wait for the veterinarian's prescription or at least for his advice before using drugs on animals.

Before using a medication, it should be checked that:

- It effectively cures the disease you wish to treat;
- It can be used on the species concerned;
- It is used at the right dose, frequency, duration (administration and dosage);
- It is not dangerous for the treated animal (contraindications and precautions for use);
- It has been stored in the right conditions (temperature);
- It has not exceeded the expiration date (indicated on each vial and on each box).

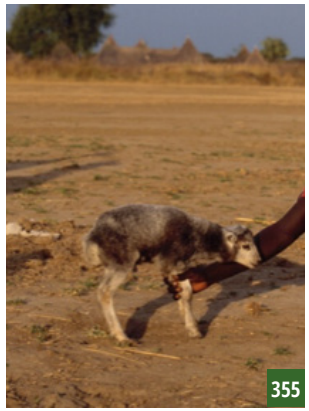
## Using a drug correctly - Measure weight

Many drugs, to be used correctly, require the ability to estimate the animal's weight accurately. This is the case for anthelmintics, antibiotics, anti-inflammatory drugs, some ectoparasiticides and many other drugs. It is imperative not to underdose or overdose the drugs.

The weight of animals can be estimated quite accurately with tapes measuring the chest circumference (metric tapes). With some experience, it can be estimates by simple visual examination of the animal.

For examples, refer to the following illustrations:

- (*355*) : 10 Kg ;
- (*356*) : 20 Kg ;
- (*357*) : 30 Kg ;
- (*358*) : 50 Kg ;
- (*359*) : 100 Kg ;
- (*360*) : 150 Kg ;
- (*361*) : 200 Kg ;
- (*362*) : 250 Kg ;
- (*363*) : 300 Kg ;
- (*364*) : 350 Kg.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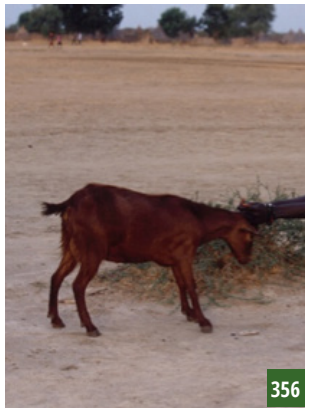
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*Section* 2

# Medicines

# *Antibiotics*

## Antibiotics - What is it?

An antibiotic (from the Greek *anti*: «against», and *bios*: «life») is a natural or synthetic substance that destroys (bactericidal antibiotic) or limits the growth (bacteriostatic antibiotic) of bacteria. An antibiotic can be both bacteriostatic and bactericidal, depending on its dose.

Antibiotics act specifically on bacteria, blocking an essential stage of their development. This blockage occurs when the antibiotic attaches itself to its target, a molecule of the bacteria that participates in one of its vital processes. This interaction between the antibiotic and its target is highly selective, specific to bacteria (inactive on fungi and viruses - There are other molecules active on these other types of infectious agents called antifungals and antivirals, distinct from antibiotics).

Antibiotics are classified into families. Within the same family, the different antibiotics have the same mode of action and often give rise to cross-resistance. This classification of antibiotics is mainly used in the context of their therapeutic use, as antibiotics from the same family often have similar indications, modes of administration and side effects.

*A summary table of the main families of antibiotics used in animal health is available on page 191*

## Antibiotics - Resistance

The widespread use of antibiotics after the Second World War was one of the most important therapeutic advances of the 20th century. However, this widespread use is sometimes abusive when some antibiotics are used as preventive or food supplements in animal feed, or as pesticides for plant treatment. This has introduced a selection pressure that has led to the development of populations of antibiotic-resistant microorganisms and an overall decline in the therapeutic effectiveness of this type of drug.

According to the World Health Organization, at least 50% of the world's antibiotics are used for animal health. The use of these drugs must therefore be strongly monitored and can only be done under the supervision of a veterinarian. It should be noted that some species are particularly sensitive to certain families of antibiotics.

The requirements, including the dosage and waiting periods recommended by the manufacturer, must be strictly observed.

*A table describing some examples of antibiotic prescriptions in animal health is available on page 192*

| Family | Example | Type of activity |
|---|---|---|
| BETA-LACTAM ANTIBIOTICS | Amoxicillin / Penicillin V / Ampicillin | Bactericidal on proliferating bacteria |
| AMINOGLYCOSIDES | Streptomycin / Gentamycin / Neomycin | Bactericidal on proliferating and resting bacteria |
| MACROLIDES | Erythromycin / Tylosin / Spiramycin | Bacteriostatic on proliferating bacteria |
| LINCOSAMIDES | Lincomycin | Bacteriostatic on proliferating bacteria |
| PHENICLES | Chloramphenicol / Florefenicol | Bacteriostatic on proliferating bacteria |
| TETRACYCLINES | Oxytetracycline / Chlortetracycline / Doxycycline | Bacteriostatic on proliferating bacteria |
| SULFONAMIDES | Sulfonamides / Trimethroprim | Bacteriostatic on proliferating bacteria |
| NITROFURANS | Furazolidone / Furaldatone | Bactericidal/bacteriostatic on proliferating and resting bacteria |
| POLYMYXINS | Colistin | Bactericidal on resting bacteria |
| QUINOLONES | Fluoroquinolones / Flumequine / Difloxacin | Bactericidal on proliferating and resting bacteria |

***Summary table of the main families of antibiotics used in animal health***

| Name | Example | Indication | Dosage (for information only) | Administration |
|---|---|---|---|---|
| TETRACYCLINES | Tenaline LA (Oxytetracycline 20% long acting) | Broad spectrum, sepsis, respiratory, digestive and genito-urinary infections, panaritium | 1 mL / 10 Kg | Intramuscular injection, can be repeated 72H later |
| | Oxytetracycline 50% virbac (Soluble oral powder for calves, pigs and poultry) | Sepsis, respiratory, digestive infections | 400 mg powder / 10 Kg | In milk or water for 3 to 5 days |
| | Covunil (Oxytetracycline associated with flunixin (NSAIDs)) | Respiratory infections with fever | 1 mL / 10 Kg | Intramuscular, single injection |
| PENICILLINS (Alone or associated) | Duphamox LA (Amoxicillin delay) | Respiratory infections Gram+, pasteurellosis | 1 mL / 10 Kg | Intramuscular, 2 injections at 48h intervals |
| | Shotapen (Benzylpenicillins and Dihydrostreptomycin) | Sepsis, pneumonia, pleuropneumonia, postpartum infections, urinary tract infections, infected wounds, panaritium | 1 mL / 10 Kg | Intramuscular, can be repeated 72H later |
| FLORFENICOL | Nuflor (300 mg or 450 mg) | Respiratory system disorders | Cattle : 1 mL / 15 Kg<br>Sheep : 1 mL / 15 Kg | Intramuscular 2 times at 48H intervals<br>Subcutaneous 1 single Intramuscular injection 3 successive days |

***Some examples of antibiotic prescriptions in animal health***

# *Antiparasitic drugs*

## Antiparasitic drugs - Anthelmintics

Anthelmintics are preventive or curative drugs used to act against parasites of the digestive tract or liver (worms). Parasites cause animals to lose weight, decrease milk production and cause digestive disorders. Young animals have swollen bellies, bristly hair, diarrhea and are thin. A heavy infestation of liver flukes can kill an adult cow. A heavy roundworm infestation can kill calves or goat kids.

*A table describing some examples of anthelmintics prescriptions is available on page 194*

## Antiparasitic drugs - Ectoparasiticides

Ectoparasiticides are preventive or curative drugs used to treat insects or mites that parasitize animals. Parasites disturb animals, often deprive them of blood, can be responsible for triggering certain diseases such as dermatophilosis or can be the vectors of diseases such as trypanosomiasis, theileriosis or babesiosis.

*A table describing some examples of ectoparasiticides prescriptions is available on page 196*

## Antiparasitic drugs - Endectocides

Endectocides are preventive or curative drugs used to act against both internal (endoparasites) and external (ectoparasites) parasites. The effectiveness of these drugs against ticks is not negligible, although this property is not part of the indications provided by manufacturers.

*A table describing some examples of endectocides prescriptions is available on page 195*

## Antiparasitic drugs - Endoparasiticides

Endoparasiticides are curative drugs, used to act against parasites that infect the blood of animals. Internal antiparasitic agents can be used to treat diseases such as cowdriosis, trypanosomiasis, theileriosis or babesiosis.

*A table describing some examples of endoparasiticides prescriptions is available on page 197*

*The treatments and strategies to be implemented to act against trypanosomiasis and tick-borne diseases are detailed in appendices 1, 2, 3 and 4 (pages 209, 219, 227 and 237)*

| Name | Example | Indication | Dosage (for information only) | Administration |
|---|---|---|---|---|
| ALBENDAZOLE (In 10% liquid or bolus form) | Liquid: Vermitan, Worminex, Albenol, Dolzaben, Valbazen | Intestinal worms<br>Liver fluke | 1 mL / 10 Kg | With a dosing gun or syringe |
| | Bolus: Vermitan, Valbazen, Benzal, Worminex | Intestinal worms<br>Pulmonary strongyles<br>Liver fluke | 10 mg / 10 Kg | With a bolus applicator or by hand |
| OXFENDAZOLE | Synanthic | Intestinal worms<br>Pulmonary strongyles | Drinkable suspension at 22.65mg/ml: Sheep: 2.2 mL/10 Kg or 5mg / Kg Goats: 5mL/10 Kg or 10 mg / Kg<br>Sheep: 2 mL/10 Kg or 4.5 mg / Kg<br>Drinkable suspension at 90.60 mg / mL: 5 mL / 100 kg or 4.5 mg / Kg | Orally by syringe or dosing gun |
| FENBENDAZOLE (Available in bolus, powder or oral suspension form in different concentrations) | Panacur | Intestinal worms<br>Pulmonary strongyles | Goats: 10 mg / Kg<br>Sheep: 5 to 10 mg / Kg<br>Cattle: 7.5 mg / Kg | Orally by syringe or dosing gun<br>By hand or bolus applicator<br>Mixed with the food for the powder form |
| LEVAMISOLE (Available in bolus, powder, drinkable form) | Levamisole 5%, Polystrongle | Intestinal worms<br>Pulmonary strongyles | Cattle, sheep, pigs: 7.5 mg / Kg<br>Poultry: 20 mg / Kg | Orally by syringe or dosing gun<br>By hand or bolus applicator<br>Mixed with the food for the powder form |
| NITROXINIL | Dovenix | Liver fluke and nematodes | Cattle, sheep: 10 mg / Kg or 1 mL / 25 Kg | Subcutaneous injection |

***Some examples of anthelmintics prescriptions in animal health***

| Name | Example | Indication | Dosage (for information only) | Administration |
|---|---|---|---|---|
| IVERMECTIN | Ivomec injectable and pour-on<br>Virbamec injectable and pour-on | Nematodes<br>Larvae of dipterans<br>Lice<br>Scabies | Injectable : 1 mL / 50 Kg<br>Pour-on : 1 mL /10 Kg | Strict subcutaneous injection<br>on the back line |
| DORAMECTIN | Dectomax injectable and pour-on | Nematodes<br>Larvae of dipterans<br>Lice<br>Scabies | Injectable : 1 mL / 50 Kg<br>Pour-on : 1 mL / 10 Kg | Strict subcutaneous injection<br>on the back line |
| EPRINOMECTIN | Eprinex pour-on | Nematodes<br>Larvae of dipterans<br>Lice<br>Scabies | Pour-on : 1 mL / 10 Kg | On the back line |

***Some examples of endectocides prescriptions in animal health***

| Name | Example | Indication | Dosage (for information only) | Administration |
|---|---|---|---|---|
| AMITRAZ | Taktic | Ticks & Lice<br>(One spray session)<br><br>Scabies<br>(Two sprays spaced 9 days apart)<br><br>Melophages | Cattle:<br>Dilute 2 mL per 1L of water<br><br>Sheep, goats, swine:<br>Dilute 4 mL per 1L of water | Sprayer<br>(Do not empty into water points or rivers, destroy empty containers. Do not use near people eating or drinking) |
| SYNTHETIC PYRETHROIDS | Bayticol, Spot-on, Ectopor, Flumethrin 1%, Cypermethrin 1%, Deltamethrin 1% | Flies, horseflies, ticks, lice | Dosage according to weight and product | Distribute the dose evenly over the midline from the neck to the tail. (Dangerous for fish and bees: do not empty into water points or rivers, destroy empty containers) |

***Some examples of ectoparasiticides prescriptions in animal health***

| Name | Example | Indication | Dosage (for information only) | Administration |
|---|---|---|---|---|
| TETRACYCLINES | Tenaline LA<br>Oxytetracycline 20 % long acting | Cowdriosis | 1 mL / 10 Kg<br>20 mg / Kg | Intramuscular injection can be repeated 72H later |
| | Bolus : Vermitan, Valbazen, Benzal, Worminex | Cowdriosis | 400 mg powder / 10 Kg | In milk or water for 3 to 5 days |
| IMIDOCARBE | Carbesia | Babesiosis<br>Anaplasmosis | 1 mL / 100 Kg<br>2.5 mg / Kg | Intramuscular or subcutaneous, single injection |
| BUPARVAQUONE | Butalex | Theileriosis | 1 mL / 20 Kg<br>2.5 mg / Kg | Intramuscular, 2 injections at 48h intervals |
| ISOMETADINIUM | Veridium<br>Trypamidium | Trypanosomiasis | 10 mL / 100 Kg<br>1 mg / Kg | Intramuscular or strict intravenous, single injection |
| DIMINAZENE | Veriben<br>Berenil | Trypanosomiasis<br>Babesiosis<br>Theileriosis | 5 mL / 100 Kg<br>3.5 mg / Kg | Intramuscular, single injection |

***Some examples of endoparasiticides prescriptions in animal health***

# *Anti-inflammatory drugs*

## Anti-inflammatory drugs - What is it?

Anti-inflammatory drugs are curative drugs that are separated in two classes, corticosteroids and non-steroidal anti-inflammatory drugs (NSAIDs).

These drugs lower the temperature in case of fever, limit inflammation (redness, discharge, lumps, etc.) and can reduce pain. Their action reduces symptoms but does not treat the causes of the disease, especially if it has an infectious or parasitic origin.

## Anti-inflammatory drugs - Corticosteroids and NSAIDs

Corticosteroids, which are very effective and less expensive than NSAIDs, can have many side effects such as the impairment of natural defenses or the abortions at the end of the gestation period.

NSAIDs are more expensive but have few side effects (except irritation of the gastric mucosa).

*A table describing some examples of anti-inflammatory drugs prescriptions is available on page 199*

| Name | Example | Indication | Dosage (for information only) | Administration |
|---|---|---|---|---|
| CORTICOSTEROIDS | Dexadreson<br>Dexamethasone | Fever, inflammatory state, allergy, shock, ketosis, calving induction | 3 mL / 100 Kg<br>Calving induction:<br>Cattle : 10 mL<br>Goats: 6 to 8 mL | Intravenous<br>Intramuscular<br>Subcutaneous<br>Intra-articular |
| MELOXICAM | Meloxidyl<br>20 mg / mL | Treatment of inflammatory and/ or painful symptoms, usually in combination with antibiotics | Cattle: 2,5 mL / 100 Kg | Subcutaneous |
| FLUNIXIN | Genixine | Treatment of inflammatory and/ or painful symptoms, usually in combination with antibiotics | Cattle: 2 mL / 50 Kg | Intramuscular |

***Some examples of anti-inflammatory drugs prescriptions in animal health***

# *Other products*

| Name | Example | Indication | Dosage (for information only) | Aadministration |
|---|---|---|---|---|
| EYE OINTMENTS | Pink Eye Powder<br>Oxytetracycline 2.5%<br>Opticlox<br>Cloxacillin, Penicillin 5 g | Irritated, infected, watery eyes | 1 to 3 jets of powder per eye<br><br>3 cm per eye | Open the eyelids<br>Squeeze 3 cm of ointment into each eye, even the healthy eye |
| GYNAECOLOGICAL PESSARIES | Gynobiotic<br>Metricyclin<br>Chortetracycline 500 mg<br>Intrauterine pessaries | Difficulties after calving<br>Abortion | Refer to the manual | Use a glove to gently introduce the pessary into the uterus |
| DISINFECTANTS | Povidone iodine<br>Vetedine<br>Quaternary ammonium<br>Hibitane<br>Chlorhexidine | Disinfection of surgical sites. Wound cleaning, removal of dead tissue<br>Disinfection of wounds and cleaning of equipment (syringes, etc.) | Refer to the manual | Refer to Chapter 2: Wound cleaning |
| ANTIBIOTIC AND ANTISEPTIC SPRAYS | Oxyspray, Alamycin, Limoxin, Vet-mycin, Spray Plus, Pederipra Spray, Vetospray | Wounds or injuries, external treatments<br>Wounds must be properly cleaned (iodine derivatives, quaternary ammonium, chlorhexidine) before spraying | Refer to the manual | Spray the wound widely, for at least 5 seconds Not within 10 cm of the wound |
| INSECTICIDE POWDERS | Organophosphorus powder for poultry<br>(Avoid malathion) | Fleas, lice, flies. disinfection of stables and poultry houses | Refer to the manual | Sprinkle over the body as shown |

***Some examples of other products used in animal health***

## *For poultry*

The mainly used preventive and curative medications are as follow:

- Anthelmintics or anticoccidial drugs;
- Vitamins;
- Anti-inflammatory drugs (aspirin like);
- Antibiotics, as rarely as possible;
- Vaccines (widely used in industrial breeding).

The use of these drugs varies depending on the type of poultry being cared for (e.g. laying hens or broilers) and the type of farming practiced (some chickens in the village, hundred chickens on the ground in a building, thousand laying hens in battery cages, etc.).

In many cases, the use of drugs can be avoided by optimizing farming conditions. Veterinary drugs in general, especially antibiotics, should not be used to compensate for poor breeding conditions. Specific training of CAHWs and veterinary paraprofessionals on drugs (except antibiotics) can be very useful.

**If the use of veterinary drugs is imperative, diagnosis and veterinary advice must always precede their use!**

*Section* 3

# Vaccines

# *Prevention and liability*

## Vaccines - What is it?

Vaccines are preventive drugs. They cannot treat a sick animal with symptoms. They are given to healthy individuals to prevent them from getting diseases that can be very serious or fatal.

Vaccination is very effective in preventing the development of contagious diseases but will only protect the animal a few weeks after administration. In most cases it will require repeated injections. Vaccines are cheap regarding the expected benefit and have zero waiting period.

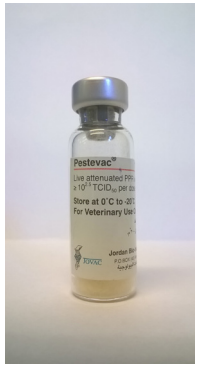
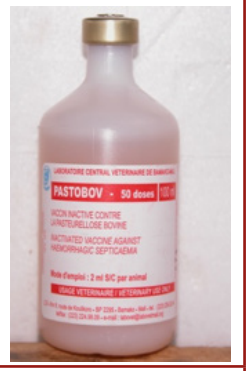
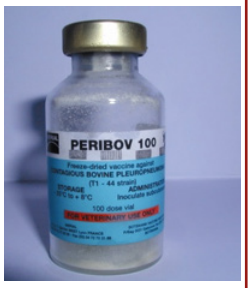
Vaccines are fragile drugs that most often require a successful cold chain to remain effective.

## Vaccination campaigns - Liability

Vaccination campaigns aim to vaccinate large groups of individuals within a specified period. They are organized by the private and/or public veterinarian (according to national legislation), under the direction of the veterinary authority. Vaccines can be delivered to the CAHW or to the veterinary paraprofessional by the veterinarian. They may then administer them under the responsibility of the latter.

*A table describing some examples of vaccines is available on page 205*

# *Examples*

| Anthrax | Blackleg | CBPP | PPR | Bovine pasteurellosis | Sheep pasteurellosis | Newcastle disease | Avian influenza |
|---|---|---|---|---|---|---|---|
|  |  |  |  |  |  |  |  |
| ANTHRAVAC | CLOSTRIVAC | PERI-TI /SR | PESTEVAC | PASTOBOV | | ITA-NEW | FLU-KEM |
|  | |  |  |  | |  |  |
| BLANTHAX | | PERIBOV | PPR-VAC | PASTOVAX | PASTOVIN | ND VACCINE | ITA-FLU |
| 1 mL | 2 mL | 1 mL | 2 mL | 1 mL | 2 mL | 1 mL | 0,5 mL |

***Some examples of vaccines used in animal health***

# *Appendix 1*

# Rational use of trypanocidal drugs

*Adapted from sheet n°3 of animal health technical recommendations, produced and edited by the Cirdes and the Cirad*
*Authors of the original texts: Amadou Lamine Dia and Marc Desquesnes*

# *Basic notions about trypanocidal drugs*

## Trypanocidal drugs - Why?

Animal trypanosomiasis, transmitted by tsetse flies, are a major constraint for cattle breeding in sub-Saharan Africa. Within infested areas, they reduce the cattle herd by half, as well as meat and milk production. Animal's energy declines and overall agricultural production suffers a decrease by 10%. We estimate that, without the tsetse flies' presence, an additional 90 million more bovine individuals could be raised.

## Trypanocidal drugs - Products

In order to treat the trypanosomiasis, the most common method is to use trypanocidal medicine. According to countries, and veterinary and farmers' preferences, many urea (suramin), quinapyramine, diminazene, phenanthridine (homidium, isometamidium) and arsenical (melarsomine) by-products are used to fight against animal trypanosomiasis.

In addition to these products, it should be noted that ethidium chloride and bromide exist. However, ethidium by-products are known to be highly toxic, particularly because of their very advanced mutagenicity. Therefore, it is not advised to use them.

*The main available and usable trypanocidal drugs, along with their conditions and terms of use, are available in the corresponding table page 211*

| Active ingredient | Method of injection | Dosage | Conditions | Concerned species |
|---|---|---|---|---|
| DIMINAZENE ACETURATE | Intramuscular | 3,5mg /kg<br>5mL/100kg | Systematic and iterative treatment (prophylaxis) | Cattle, sheep, goats, horses, camelids, possibly canids |
| | | 7mg/kg<br>10 mL/100 kg | Individual curative treatment | |
| ISOMETAMIDIUM CHLORIDE | Deep intramuscular or strict intravenous injection | 0,5-1 mg/kg<br>5-10 mL/100 kg | Chemoprophylaxis | Cattle, sheep, goats, horses, camelids, canids |
| MELARSOMINE | Subcutaneous or intramuscular | 0,25-0,5 mg/kg<br>5-10 mL/100 kg | *T. evansi* | Camelids and horses |
| SURAMIN | Intramuscular or intravenous | 7,5 mL/100 kg | *T. evansi* | Camelids, horses and canids |
| QUINAPYRAMINE (METHYLSULFATE) | Subcutaneous | 5 mg/kg<br>5 mL/100 kg | All types of trypanosomiasis | Cattle, sheep, goats, pigs, horses, camelids, canids |
| QUINAPYRAMINE SULFATE AND CHLORIDE | Subcutaneous | 2,5 g/15 mL<br>5 mL/100 kg | Chemoprevention | Cattle, camelids, possible with horses |

***Main available and usable trypanocidal drugs***

# *Different types of treatments*

## Treatment - Curative

This is the treatment to give to an animal who is sick from trypanosomiasis. A trypanocide dose, that is said to be "curative" (or "sterilizing"), is administered to the animal. This aims to eliminate the total amount of parasites (*365*).

The average waiting period for consumption by humans is 21 days for the meat and 3 days for the milk.

- Cattle and small ruminant trypanosomiasis: use diminazene aceturate by a dosage of 7mg/kg (drug of choice). If the treatment turns out to be ineffective it is possible to use isometamidium chloride by a dosage of 0,5mg/kg (waiting period for meat consumption: 30 days).
- Horses trypanosomiasis:
  - *Trypanosoma vivax* or *T. congolense*: treat with isometamidium using slow IV (divide dosage for horses);
  - *T. brucei* or *T. evansi*: use melarsomine, quinapyramine or suramin;
  - In all cases, diminazene aceturate can also be used by a dosage of 7mg/kg, but the injection must be divided.
- Camelids trypanosomiasis (*T. evansi*): melarsomine is the ideal product, but diminazene aceturate can also be used by a dosage of 3,5mg/kg.
- Swine trypanosomiasis (*T. simiae*): use quinapyramine.

## Treatment - Preventive

Preventive treatment, also called chemoprophylaxis or chemoprevention, is the treatment applied to a healthy animal to protect it from infections during the period of protection offered by the product, at the used dosage.

- With cattle travelling for transhumance in risky areas (*366*), treatment must be administered the day before departure, with isometamidium which will protect during 2 to 4 months. While returning from the transhumance, treatment must be done with diminazene aceturate to eliminate strains that are potentially resistant to isometamidium and any of them that might have appeared during the end of the disease prevention while still in transhumance;
- For 'meat' animals (destined to slaughter) that are crossing an infested area on foot, isometamidium chloride by dosage of 0,5mg/kg gives enough protection for the journey, but it is important to take in account the waiting period before meat consumption, which is of 30 days;
- For oxen and sensitive animals (zebus) living in high risk areas, protection will take place all year long, every 4 months by isometamidium (1mg/kg) and at least once a year with diminazene aceturate. If the risk is seasonal, isometamidium will only be used during the risky period;
- With trypanosomiasis resistant cows that have been raised in their native region, chemoprevention is not recommended. If they have been newly introduced in

regions with a strong trypanosomiasis impact, it is advised upon their arrival to treat them with diminazene aceturate (7mg/kg) and a week later with isometamidium (0,5 mg/kg);

- For small ruminants, isometamidium (0,5-1mg/kg) allows a protection from 2 to 4 months;
- With horses, isometamidium (0,5- 1 mg/kg) can be used provided that the dose is divided. In areas where *T. evansi* rages, quinapyramine prosalt can be used. The protection lasts 2 to 3 months;
- Camelids can be treated with isometamidium chloride (0,5-1mg/kg); however, they are sensitive to the product if it exceeds 1 mg/kg. Quinapyramine prosalt can also be used.

Another preventive treatment consists of applying diminazene aceturate with a dosage of 3,5mg/kg, approximately once a month. In this case, it can be administered subcutaneously (367).

This technique has the advantage of enabling animal immunization since these treatments reinforce infection control without totally eliminating them (carrying the immunity). The gap between two treatments doesn't leave enough time for parasites to cause a serious illness.

It is the technique of choice to contain trypanosomiasis in highly enzootic environments on resistant or moderately resistant livestock. It must only be applied during high risk periods, otherwise it will also enable the formation of chemoresistance.

*Good to know*

Generally speaking, preventive treatments have a tendency to select resistant strains due to their slow elimination, it is therefore very important to respect the gap between two treatments and to follow-up these treatments with a curative treatment thanks to a trypanocidal drug of another chemical category (diminazene aceturate, for example).

# *Strategic use of trypanocidal drugs*

## Risk - Low all year long

A chemoprophylaxis is unnecessary.

It is recommended to treat, by curative means, with diminazene aceturate (7 mg/kg) only infected or sick animals in isolated cases.

This situation implicates areas with low trypanosomiasis pressure where we mainly breed zebus.

## Risk - One high period in the year

For many countries, the risk period corresponds to the end of raining season or beginning of the dry, cold season.

Two weeks before the end of wintering, the herd must be treated with isometamidium chloride for the sensitive cattle (*368*), or, iteratively with diminazene aceturate (3,5 mg/kg) for the more resistant cattle. As so, they will be protected during the risky period.

Outside of this period, specific cases are treated for curative measures with diminazene aceturate (7 mg/kg).

## Risk - High all year long

In these areas, the choice of bovine breeds or half-breeds resistant to trypanosomiasis is the rule (*369*). However, sensitive animals (oxen, breeding zebu bulls) raised in high pressure areas need preventive treatments.

An annual chemoprevention program can force itself upon all or a part of the herd. Animals must receive a quasi-permanent protection, either by iterative treatment with gaps of a month long using diminazene aceturate (3,5 mg/kg) for cattle resistant to trypanosomiasis, or by permanent protection with isometamidium administered every 3 months by dosage of 1mg/kg on sensitive cattle. In every case, isometamidium and diminazene treatments must be alternated at least once in the year to eliminate strains resisting to a product that has been used in an iterative manner. In order to do so, we administer a diminazene aceturate treatment (7 mg/kg), and 15 days later we start chemoprophylaxis with isometamidium chloride, 1 mg/kg every 3 months.

# *Drug-resistance problem*

## Drug-resistance - Appearance

All trypanocidal drugs can cause the appearance of drug-resistant trypanosoma strains. This phenomenon is due to different causes, usually related to an iterative use and an under-dosing of trypanocidal drugs:

- The effective concentration is not reached as a result of and excessive dilution of the trypanocidal drugs;
- For economic reasons, using a single packet of trypanocidal drug, we want to treat a greater number of animals therefore reducing the dosage given to each one;
- An under-dosing is carried out because of an underestimation of the animal's weight (*370*);
- The purchased product is not authentic, and holds a dose of trypanocidal drug inferior than the one marked on the packaging;
- An abscess has formed at the injection site preventing normal spreading of the medicine;
- There has been an excessive time span between two chemopreventive treatments.

In every case, Trypanosomes find themselves facing low doses of product which allows the most resistant ones to survive. After many generations of parasites, and possible hybrid formations happening with the tsetse fly, highly resistant trypanosoma strains may appear. It occurs that these strains resist to double or triple dosage of product; nothing can eliminate them anymore, except a changing in the overall chemical composition of the trypanocidal drug.

Since, in practice, there are mainly two trypanocidal drugs, resisting strains towards these two products must not develop.

### *Good to know*

The selling of false or falsified trypanocidal drugs by dilution of the real product or by substitution with a trivial compound with the same appearance is common. We must be very attentive to inscriptions written on the packets, and, in general, we must verify the aspect of the company logos to distinguish real from false.

It is necessary to seek advice from mandated veterinarians, to use well-known products and to be loyal to a secure supplier.

## Drug-resistance - Contraindications

Ethidium derivatives, other than their own toxicity, have the capacity to generate resistance to the two other trypanocidal drugs (diminazene and isometamidium); for this additional reason, this product must be strictly banned from veterinary use.

Quinapyramine derivatives favor the development of multiple resistance to the other three trypanocidal drugs (diminazene, isometamidium and ethidium). Therefore, they mustn't be used on ruminants.

## Drug-resistance - Highlight

When treatments have no more satisfying chemical effect, we must suspect drug-resistance. In these cases, trypanocidal drugs should be alternated:

- Resistance to diminazene will be treated with isometamidium, and that which is due to isometamidium will be treated with Diminazine;
- Resistance to suramin may be defeated by melarsomine, and that which is due to quinapyramine prosalt may be defeated by suramin.

In case of multiple resistance, veterinary services must be alerted and the Cirdes must be contacted to determine an efficient strategy adapted to the situation.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# *Appendix 2*

# Trypanosomes: Herd level control strategies

*Adapted from advice sheet n°1 of technical recommendations regarding animal health, written and edited by the Cirdes and the Cirad.*
*Author of the original texts: Marc Desquesnes*

# *Select breeds and food*

## Select - Trypanotolerant cattle

To build their herd, farmers often choose the most productive and large cattle breeds, such as zebu Azawak (*371*) and Goudali (*372*), but their sensitivity to trypanosomiasis is high.

To cope with the parasitic pressure of trypanosomes, breeds such as the Baoule (*373*) and the N'Dama (*374*), small bull breeds, are recommended.

The introduction of zebu blood into bull herds improves animal conformation by maintaining a dominant trypanotolerant breed (*375*). In areas of lower parasitic pressure, on the other hand, the introduction of bull blood into zebu herds increases their resistance to trypanosomiasis while maintaining zebu-type conformation (*376*).

## Select - A good diet

A simple dietary restriction can cause clinical development of trypanosome infection. On the other hand, if a maintenance ration is replaced by a production ration for sick animals, they recover more quickly and clinical signs decrease.

By maintaining excellent food and sanitary conditions, trypanosomiasis symptoms would rarely be observed. But it is still difficult to ensure the quality of food in the dry season, when there is a shortage. It is therefore essential to provide complementary feed during this period - cake, hay -, to ensure sufficient, high-quality watering and to provide a mineral supplement in the form of licks or granular salt (*377, 378*).

# *Control intercurrent diseases*

## Control - Intestinal parasites

Deworming of animals should be carried out regularly, three times during the rainy season, preferably in July, September and October. Use a broad-spectrum deworming agent.

## Control - Ticks

Any significant proliferation of various tick species requires acaricide treatment, especially at the beginning of the rainy season. Acaricides are applied with different techniques: foot bath, shower or «pour-on». However, infestations should not be stopped completely because too much control of ticks can destabilize the enzootic state of hemoparasitosis.

Without tick control, or with insufficient control, pathologies appear. They are either related to ticks - deep skin lesions, loss of a teat, etc. - or related to tick-borne diseases.

## Control - Vaccines

Depending on the area, it is strongly recommended to vaccinate animals against pasteurellosis and contagious bovine pleuropneumonia and sometimes against anthrax.

# *Combating vectors*

## Combating - Local tsetse flies

Local tsetse flies are the main vectors of trypanosomiasis (*Glossina palpalis gambiensis - 379, Glossina tachinoides – 380*).

During dry season, their population is reduced but they gather in gallery forests, and their density is strong. Yet, it is the season where cattle come and drink at the river. The animals find themselves in regular contact with these tsetse flies during a time when they are particularly receptive to the parasite due to an immunodepression targeted by the dearth. It is recommended to use agricultural insecticides all along the riverbanks to reduce the flies' density.

During raining season, tsetse flies' population are more important, but they disperse themselves across savannas and are in contact with the bovines in all places. If the densities are relatively low because the insects are dispersed, host-vector risks of contact are permanent. Therefore, properly fed cattle during this season are less sensitive to infections than in dry season. Only animals that haven't been infected for a long time (loss of immune-response memory) or that suffer from a primo-infection (young animals or animals that have been recently introduced to an infested area) are particularly sensitive.

## Combating - Horse flies and stable flies

They mainly transmit *T. vivax* mechanically (*Tabanus taeniola – 381, Stomoxys calcitrans – 382*).

These insects' density peaks are observed either during dry season, or during wet season, depending on the areas. They represent an important and direct source of nuisance, and favor parasite and clinical upsurges. As trypanosomiasis' mechanical vectors, these insects also favor the circulation of the parasites.

## Combating - Within the herd

The use of insecticides on cattle, applied by showering or pour-on, breaks the parasite cycle because the flies that feed on cattle die after their meal. They can even die before feeding if the insecticide is still fresh. They then do not contaminate the cattle.

These treatments reduce parasite circulation and diminish trypanosomiasis' impact, but they do not eliminate them right away. Carried out simultaneously with the community's action, the effects add up.

## Lutter - At the village's level

The community's fight and action against tsetse flies reduce vector population at villages' or region's level. It is highly recommended. It demands a proper organization to be able to coordinate the various partners' (farmers, action departments, livestock services, veterinary technicians, etc.) and those carried out by each farmer at the level of his own herd.

Pieces of blue fabric soaked in insecticides are placed along riverbanks, tsetse flies' favorite lodging (*383*).

# *Avoid infection*

## Treat - Prevention

We can regularly interrupt trypanosomiasis' development, during the season when cattle is exposed to tsetse flies, by repeated appliance of a curative trypanocidal drug, for example diminazene aceturate that is administered once a month by a 3,5 mg/kg dosage by intramuscular shot.

Another strategy consists of using chemoprophylaxis with isometamidium chloride (0,5-1mg/kg) applied at the beginning of the season since its protection lasts three to four months. This preventive treatment is first carried out at the beginning of the herd's transhumance when it cannot be avoided. While returning from the transhumance, the treatment is applied once more with a different trypanocidal drug, to eliminate potential resistant strains that were picked up in the transhumance zone.

The alternation of both products is a basic rule that limits resistant strains' perpetration and diffusion.

## Avoid - Risk areas

When it's possible, animals mustn't be left drinking alongside temporary or permanent river banks (privileged locations for the concentration of tsetse flies (*384*). Drinking in temporary holds, wells or boreholes must be privileged. The laying of tsetse flies' traps, like the biconical trap (*385, 386*) allows the evaluation of flies' density at the drinking point.

To relieve animals from tabanidae and stomoxys bites, their favorite sites must be identified and the timeframe where their activity is at its highest. We can then avoid risky combinations of "favorite sites" + "time-frame with high activity".

Long transhumances bring animals to various places where they find themselves in contact with new parasites, that are not always controllable. If it's impossible to avoid this, an efficient prophylaxis must be used during this transhumance and the return.


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# *Appendix 3*

# Epicutaneous treatment of cattle

*Adapted from advice sheet n°8 of technical recommendations regarding animal health, written and edited by the Cirdes and the Cirad.*
*Authors of the original texts: Jérémy Bouyer, Idrissa Kaboré, Frédéric Stachurski et Marc Desquesnes*

# *Why treat?*

## Epicutaneous treatments - What is it?

Epicutaneous treatments consist of applying insecticides and/or acaricides to the skin of animals in various ways. They allow simultaneous action against the main ectoparasites: ticks and tsetse.

For tick control, these treatments are very widespread and easily implemented. They can be applied to the individual as well as to the entire herd.

For the control of tsetse, epicutaneous treatments are a good complement to other control methods such as the installation of screens and/or traps impregnated with insecticides. In this case, they require a community-based and participatory approach from farmers.

Epicutaneous treatments are well perceived by breeders who can quickly see their effectiveness, which facilitates their adoption.

There are many techniques for applying acaricides or insecticides to animals. Some can treat the entire body of the animal, others use targeted treatment at preferential ectoparasite binding sites.

*Glossina tachinoides*
Illustration by J. Bouyer

## Ectoparasites - Impact

Ectoparasites are haematophagous insects or mites (tsetse, tabanids, stomoxes, ticks, etc.) present in a more or less durable way on livestock skin. They represent one of the major obstacles to the development of cattle breeding. Tsetse flies transmit animal trypanosomiasis. Ticks cause significant losses due to their vulgar action - irreversible udder lesions, for example - and the blood predation they cause.

Ticks are also responsible for indirect losses, as they transmit haemoparasitosis (cowdriosis, anaplasmosis, babesiosis), leading to significant mortality and productivity losses. The presence of adult ticks aggravates lesions due to dermatophilosis, a chronic skin disease that can be fatal in some cases.

The animal is a «living trap», very attractive to ectoparasites, which spot it thanks to its smells and movements. If impregnated with a toxic product, acaricide or insecticide, this «trap» becomes deadly for the parasites it attracts. In the case of tsetse, this method has the advantage of being effective against certain species that feed mainly on cattle and are not very attracted to screens or fixed traps impregnated with insecticides.

*Amblyomma variegatum*
Illustration by A. Olwage & J.B. Walker

# *How to treat?*

| | |
|---|---|
| BATHS | The technique of bathing or dipping, used for more than a century against ticks, consists of passing the animals in a tank filled with several cubic meters of an acaricid-insecticide formulation, usually an emulsion, the products being insoluble. The balneation is total, the animal dives entirely into the «pool» and emerges carrying the active product all over the body. All ticks and tsetse that come into contact with the animal after treatment will then be intoxicated for the following days or weeks, depending on the type of action and the persistence of the product used.<br><br>Baths can treat a large number of animals in a short period of time. On the other hand, they are expensive, as they require a significant investment for the construction of the facilities. In addition, baths are expensive to use because they contain up to 20,000 litres of water plus 20 litres of acaricide, and an animal carries about 5 litres of acaricid-insecticide formulation with it each time. The baths have been developed mainly for farms of several thousand heads.<br><br>Immediately after the bath treatment, the animals must no longer pass through a pond or river, in order to avoid that the products are rinsed and eliminated by water. Treatment should be done in the evening, before cattle are ushered into the night pen. |
| SHOWERS | The shower is another technique of epicutaneous application. It consists of spraying an aqueous formulation or emulsion of an acaricid-insecticide product onto animals. It requires an infrastructure that is less expensive than a bath but quite substantial. A shower corridor whose measurements must be accurate allows the flow and movements of the animals to be regulated by its width and length. A system of pipes and sprays allowing showering from above, sides and below, with various impacts, ensures complete soaking of the animals (*387*). A system for recovering flows, filtering them and reintroducing them into the pumping circuit helps to limit the waste of liquid flows.<br><br>The shower corridor is an important investment that requires regular use and is only profitable from 800 to 1000 heads. Pump maintenance is delicate and the pumping system requires electricity (generator) and consumes water both for showering and for cleaning the recovery tanks and pipes. The shower application system is therefore not suitable for the majority of cattle farms. |

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| SPRAYING | Manual spraying of animals is an interesting alternative to the previous ones, as it is much less expensive. The sprayer, often referred to as a «pump» by herders, is relatively available in traditional environments, particularly in agro-pastoralist communities, who use it to treat their crops.<br><br>For the treatment to be effective, a sufficient amount of solution, approximately 2 litres for an adult bovine animal, must be applied and treated at intervals. The treatment will be carefully applied to the preferential areas of permanent tick fixation - armpits, scrotum or udder, anal region (*388, 389, 390*) - as well as to the temporary fixation areas - tip of the legs -, privileged attack sites of the tsetse. In all cases, the animal must be completely soaked at the end of the treatment and the product must be allowed to dry before it reaches the watering point.<br><br>A variant of this method consists of spraying, by a special applicator (ElectrodyneND), oily microdroplets of acaricid-insecticide (Lambdacyhalothrin 2.5%) electrically charged (*391, 392*). The electrical charge allows a significant reduction in the volume used and a good fixing of the micro-droplets on the peeling of the sloping parts. |
| DORSAL DEPOSIT OR « POUR - ON » | Applied in small quantity on the dorsal strips of animals (393), “pour-ons” are oily formulas that quickly diffuse on a large part of the body and mix with body oils. If the product diffuses imperfectly or insufficiently, the concentration of active ingredients is too small on ticks’ fixation areas (sides) and the efficiency diminishes.<br><br>These formulas are relatively well tolerated, although cases of local irritation exist depending on the application area, without risks of residue or danger for the manipulator. They do not require heavy, expensive nor permanent installations, and offer ease and speed of use. Furthermore, they do not require water, which is an important asset in dry areas or during the transhumance.<br><br>Their efficiency against ticks makes them very attractive for farmers, but their cost is high and is a major obstacle for most traditional farmers that own large herds. |

| | |
|---|---|
| FOOTBATHS | This method, that consists of a shallow acaricide bath (15-20 cm), is particularly efficient against the *Amblyomma variegatum* tick (responsible for anaplasmosis and cowdriosis) that fixes itself between the cows' hooves during grazing. It's also efficient against tsetse flies and tabanidae since these insects preferably attack the lower parts of the body and limbs. After grazing, a foot bath (*394*) will allow the elimination of ectoparasites, as well as very substantial savings (water and money) compared to techniques that require the whole animal to be soaked (bath and shower).<br><br>Foot baths are much less expensive than baths or shower room corridors. In these conditions, the foot bath technique can be used by sedentary or semi-nomadic farmers. The foot bath allows 400 to 500 animals to be treated, and, if it's accessible to several herds, it is appropriate for collective management by a farmers' cooperative.<br><br>Treatment by foot bathing must be done in the evening after the return from grazing, and same as for the bath, animals mustn't swim in ponds or rivers right afterwards to avoid the acaricide-insecticide from being cleaned right off. |
| ACARICIDE AEROSOL | It's an acaricide-diffusing spray that is only applied, thanks to its thin nozzle, exclusively on tick fixation areas (*395, 396, 397*). Because the quantities of product that are used are much less important than while using a "pour-on" or a classic spraying technique, this spray is less expensive and quicker to use.<br><br>This spray can be used profitably within small herds or on draught animals. It can also be used to supplement other methods to help get rid of ticks on animals that have been rapidly reinfested or that have had insufficient treatment during the whole herd's treatment.<br><br>Therefore, this method is not a good protection against tsetse flies. It must thus be reserved for high tick infestation periods and paired with a method that fights against tsetse flies. |


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# *With what products?*

## Products - Which ones?

Many products tested by the Cirdes have proven a good efficiency both in laboratories and in the field, but their availability on the market is inconsistent.

*Two tables describing each characteristic of a selection of concentrated solutions of acaricides-insecticides and a few pour-on acaricides-insecticides that are most commonly available and that have proven efficiency are available page 234*

### *Good to know*

These treatments do not aim to eradicate vectors, but to maintain their populations at a level compatible with profitable production.

Under these conditions, ticks are abundant enough to maintain animal immunity to transmitted diseases, but their number reduces the risk of direct loss, the importance of skin damage and blood depletion.

## Products - When? How often?

The rate of treatment is a crucial issue, depending on the targets, the season and the climate zone.

Tsetse are generally much more sensitive than ticks. In the case of a mixed purpose tsetse treatment, it is therefore the persistence of the product chosen for ticks that determines the interval between two treatments. In sub-humid areas (between 800 mm and 1,400 mm of rain), tick pressure is seasonal, particularly for *Amblyomma variegatum*, the main species targeted by treatments. Adult stasis appears at the beginning of the rainy season, becomes very abundant one month after the start of the rains and much rarer in the middle of the rainy season. Treatments can then be spaced until the end of the rainy season, when only tsetse, active all year round, are targeted.

These seasonal variations determine the rhythm of treatment in tropical areas. In areas with equatorial climates (two rainy seasons), where ticks persist all year round, the recommended intervals should be applied in the second half of the rainy season.

| Active ingredient | Concentration of origin | Applicable dilution | Tsetse remanence (Days) | Tick remanence (Days) | Waiting time for the milk (Days) | Waiting time for the meat (Days) |
|---|---|---|---|---|---|---|
| DELTAMETHRIN | 50 g/L | 1 mL/L (0,005 %) | 30 | 7 | 0 | 3 |
| FLUMETHRIN | 60 g/L | 0,67 mL/L (0,004 %) | 20 | 10 | 0 | 0 |
| ALPHA-CYPERMETHRIN | 100 g/L | 0,5 mL/L (0,005 %) | 25 | 7 | 0 | 1 |
| AMITRAZ | 125 g/L | 2 mL/L (0,025 %) | 3 | 4 | 1 | 14 |

***Characteristics of a few acaricides-insecticides concentrated solutions (application of 1 L of formula for 100 kg body weight)***

| Active ingredient | Concentration of origin | Tsetse remanence (Days) | Tick remanence (Days) | Waiting time for the milk (Days) | Waiting time for the meat (Days) |
|---|---|---|---|---|---|
| DELTAMETHRIN | 10 g/L | 90 | 7 | 0 | 0 |
| FLUMETHRIN | 10 g/L | 20 | 12 | 0 | 0 |

***Characteristics of a few "pour-on" acaricides-insecticides (application of 10 mL of formula for 100 kg body weight)***

# *In a nutshell*

## Epicutaneous treatment - A community-based approach

Farmers easily adopt epicutaneous treatment for their livestock that directly protects a private property, the animal, against ectoparasites. The effect is immediately felt by a decrease in the agitation of the animals on pasture.

However, this control technique does not provide immediate protection against trypanosomiasis, as many glossins make their blood meal before being killed. To be effective in the medium term (one to two months), treatments must be applied to the majority of livestock in a given area in order to achieve a significant reduction in the tsetse population. Therefore, control must be continued consistently even after the reduction of tsetse populations. Otherwise, even if some livestock continue to be treated, tsetse populations increase again, as does the incidence of trypanosomiasis.

The organisation of livestock farmers into cooperatives or groups makes it possible to guarantee these objectives, by promoting a community approach to all production constraints, for example: group purchases by the veterinarian in charge of the cooperative from wholesalers for veterinary inputs (reduction of treatment costs), regular local distribution (village pharmacies, private veterinarians) and product quality control. Finally, a strong organisation of breeders leads to a group dynamic that reinforces the individual discipline of participants (synchronisation of treatments, etc.).

## Epicutaneous treatment - Advantages and disadvantages

| Advantages | Disadvantages |
|---|---|
| ◆ Versatility of action (ticks, tsetse, other ectoparasites) | ◆ Repetition of treatments that may be expensive or time-consuming in traditional breeding, according to the technique adopted |
| ◆ Effectiveness against vectors not very attracted by traps | ◆ Effectiveness dependent on the relative density of wildlife for tsetse control (need for sufficient livestock density (10 head/km2), treatment of the majority of livestock and good spatial and temporal distribution of animals) |
| ◆ The «animal» support is mobile, attractive, non-degradable | ◆ Remanence depending on the climate (washing the coat) and vegetation (brushing the coat) |
| ◆ Ease of use | |
| ◆ Low environmental impact | |
| ◆ Easy integration with other methods (traps, screens...) | |
| ◆ Strong visual impact («tranquility» of animals on pasture) | |
| ◆ Good adoption, especially in the case of livestock groups or associations | |

# *Appendix 4*

# The acaricide footbath

*Adapted from advice sheet n°1 of technical recommendations regarding animal health, written and edited by the Cirdes and the Cirad*
*Authors of the original texts: Frédéric Stachurski*

# *Fighting against Amblyomma variegatum*

## Fighting against *A. variegatum* - Why?

The damages caused by *Amblyomma variegatum* (*398*) make this tick one of the most harmful for cattle. Its fixation causes important wounds. It is responsible for transmitting anaplasmosis and cowdriosis and aggravates skin lesions from dermatophilosis.

When suffering from an important infestation, animals can suffer from loss of weight that can go from 15 to 20 kg (in average, each *Amblyomma variegatum* couple can cause a loss of 50g of body weight). In milking cows, ticks can cause a diminution of milk production.

What farmers dread the most regarding their animals are wounds on the teats, and on on the chest. These are both preferential fixation zones of the *A. variegatum* (*399, 400*). When they are not eliminated quickly enough, ticks cause lesions that can destroy one or several teats (*401, 402*). The cow's milk production diminishes, the calves' growth before weaning is bad, their resistance to diseases is reduced, and their mortality increases.

## Fighting against *A. variegatum* - When?

*A. variegatum* ticks' development goes through three stages (larvae, nymphs and adults) that, in tropical areas, take turns along the year. After their bloody meal, each stage needs to detach itself from its host and return to the ground to transform or to lay eggs.

Larvae infest animals at the end of raining season, and the nymphs infest during the first two or three months of dry season. These immature stages do not cause wounds: it is useless to try and eliminate them.

Adults parasite their hosts primarily during the first weeks of the raining season. Being already present in the fields since three to six months, they stay hidden, without moving, in the most humid places. This state, called behavioral diapause, stops when the first rains appear. The adults are then in search of a viable host to attach itself on. During the peak of the infestation (first weeks of raining season), it's necessary to fight against adults *A. variegatum*.

## Fighting against *A. variegatum* - How?

Manual pulling-out of the ticks takes too much time. It's a difficult method to use on disobedient animals and is painful for them as well.

The spraying technique is inexpensive, but very long to install because each animal must be immobilized alternately. Pour-ons, which are easier to use, are very expensive.

To reduce treatment costs, certain farmers increase the gap between two applyings of the product or they use a dose of acaricide that is too weak. Others fabricate potions that are supposed to kill the ticks. These practices do not protect the animals correctly, and do not protect against the wounds made by the ticks. They can even turn out to be dangerous for animals or for humans.

The foot bath is an efficient and inexpensive method. At first, ticks settle down between the hoofs, upon the skin in interdigital spaces. They no longer move from this temporary clamping area during the whole grazing (*403*). In the evening, most ticks captured during grazing are still clamped on the feet. They can then be eliminated by a targeted treatment in the form of a foot bath full of acaricide in which the herd would regularly cross.

*A graphic representing the development cycle of A. variegatum tick is available on page 240*


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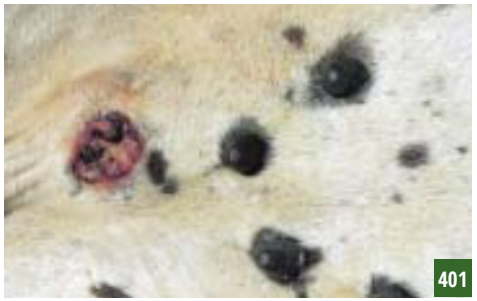
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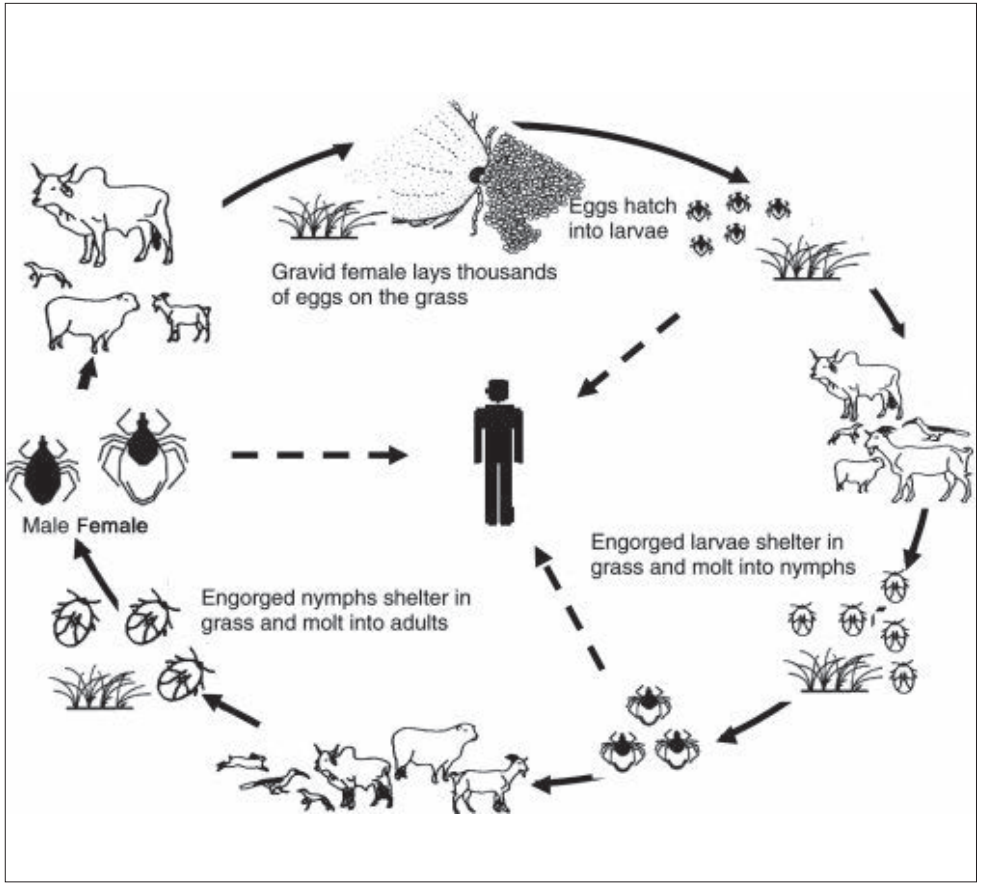



***Development cycle of the tick A. variegatum***

# *How to build a footbath?*

## Building a foot bath - In 10 steps

1. Do not install the foot bath on the path of runoff waters. It must be 15 cm above the ground level so that rainwater does not infiltrate inside. Therefore, to prepare the acaricide mix, running water must be available at a short distance;

2. Dig a hole in the ground using these measurements: length of 370 cm; width at ground level 80 cm; width at the bottom of the hole 70 cm (the sides are inclined); depth in the middle of the foot bath and at both end of the hole: 35 cm. If the foot bath is installed in sandy soil, stones must be placed at the bottom to stabilize the ground under the concrete;

3. Prepare the concrete to pour in the foot bath using a mix of 1 bag of cement, 2 wheelbarrows of sand and 4 wheelbarrows of gravel. Seven bags of cement are necessary: 6 to prepare the concrete, and 1 for the finishing touches at the end with a trowel after the drying. For the finishing touches, mix only cement with sand;

4. Pour the concrete at the bottom of the bath at a thickness of 10 cm. Let it dry for 1 hour, and then equalize on the surface with the trowel, and then let dry for one day regularly wetting the cement;

5. The next day, install a wooden casing to be able to pour the cement on the sides. They should be as thick as 12 cm approximately, and lightly inclined just like the hole. Pour the concrete at half of the height and place the concrete iron. As long as the sides, these iron frames measure 35 cm high and 8 cm large. Use 8 mm iron for the longs and 6 mm iron for the frames, maintained by fastening wire and placed every 30 cm. Sink the iron structure to the bottom of the foot bath and maintain it in the center of the wall. Then pour the rest of the concrete and completely cover the framing. Place frames of the same height at each end of the bath, but that are 15 cm wide, to reinforce the bath's entry and exit. Let it dry for one day;

6. Demold and pour along both inclined surfaces inside the footbath and do the finishing touches with the cement-sand mix. The junction between the bottom and the sides must be perfect so that the water does not infiltrate;

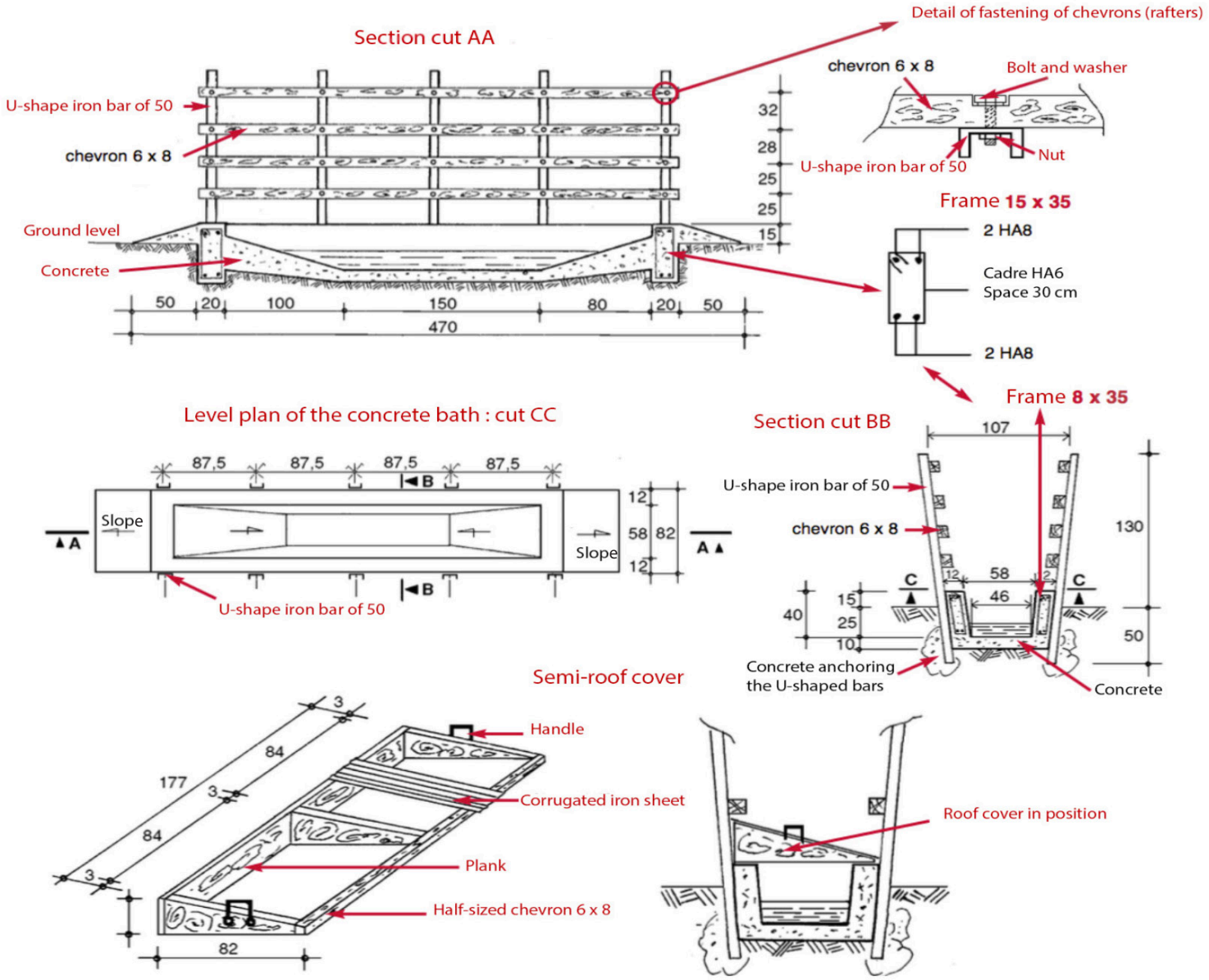
7. Install, on the exterior, along the sides of the foot bath, irons that form a U of 50 mm. Beforehand, drill holes for the installation of 6 cm by 8 cm rafters. Secure the rafters on the irons that form a U before sinking them in the ground. Pour the concrete seal around the base of each U iron bar, to solidify the whole structure. Dig into the wood and push in the bolt heads so that the animals do not harm themselves;

8. Construct inclined surfaces on the outside so that the animals enter and exit without jumping;

9. Build the roof, out of two parts that both measure half of the length of the foot bath so that it's covered and protected from the rain. Make a frame with planks and cover with metal sheeting. The width of the roof must be perfectly adapted to the bath so that the sides are inserted exactly upon the basin, without leaving any space where water could drain. Place the lowest part of the roof in the direction rains usually originate from, that way the water will run along the roof and stay on the exterior of the bath. Install handles on each side of the roofs to allow their handling;

10. Install a waiting park in the shape of a funnel at the entry of the foot bath, to channel the herd.

*A construction plan of the footbath is available page 243*




*Construction plan of the foot bath (these dimensions are given for information purposes only)*

# *How to use the footbath?*

## Using the foot bath - Calibration

The capacity of the foot bath is approximately 200 liters. But, for proper use, it is necessary to know the correct volume corresponding to the height of the acaricide mix. In order to do this, build a wooden gauge that has centimetric graduations, carved in the wood (*404*). Then use a 10-liter bucket of water to fill the bath. After each bucket, write down the height of the water in the middle of the foot bath (this measurement must always be taken at the same place) and establish a grid that gives the volume according to height (heights are approximate to the nearest half centimeter).

Measure the volume until the water reaches a height of approximately 25 cm. For better precision, empty the bath and start the calibration again. Keep track of the average value of both measurements. You can then use this grid to determine the volume of liquid between two scales, which is essential in case of an accidental dilution of the mix due to the rain.

## Using the foot bath - Products

Until now, treatments through foot baths have only been used with pyrethroids, less toxic and more persistent than organophosphorus. The main available and used products are deltamethrin, flumethrin and alphacypermethrin.

Other pyrethroids exist on the market (cypermethrin, cyfluthrin, lambda cyhalothrin, etc.) but they haven't yet been tested in the foot bath. If we respect the concentrations recommended by the manufacturers, as well as the gaps between treatments, these products must also be efficient being used in a foot bath.

Regarding amitraz, it hasn't yet been tested in a foot bath. Its persistency being two times weaker than that of the pyrethroids, it's possible that, applied to a foot bath, it does not persist enough upon the feet and hoofs to allow the elimination of the ticks caught during grazing.

## Using the foot bath - Filling in

The foot bath is filled up using buckets of 10 or 20 liters. Write down the number of buckets needed to fill up the bath to approximately 20 cm and add the corresponding quantity of product. The dilution depends on the used products.

Example : *If we have poured 10 buckets of 20 liters (a total of 200 liters) to have a height of 19 cm in the foot bath, we then add 100 ml of deltamethrin or alpha cypermethrin, or 135 ml of flumethrin. When the level diminishes, after several crossings of the animals in the bath, we then always add water by buckets of 20 liters and the corresponding volume of product (10 ml of deltamethrin or alphacypermethrin; 13,5 ml de flumethrin).*

*The main products that are currently available, as well as the concentrations that should be respected and the necessary volumes according to the quantity of used water, have been classified in the corresponding table page 246*

| Active ingredient | Dose for 10 L | Dose for 20 L | Dose for 200 L |
|---|---|---|---|
| DELTAMETHRIN | 5 mL | 10 mL | 100 mL |
| FLUMETHRIN | 6,7 mL | 13,5 mL | 135 mL |
| ALPHACYPER-METHRIN | 5 mL | 10 mL | 100 mL |

***Main available products: concentrations that should be respected and necessary volumes according to the quantity of water used***

## Using the foot bath - Implementation

For the treatment to be efficient, these instructions must be followed:

1. Treat in the evening, while returning from grazing, at the beginning of rain season, for approximately 10 weeks (*405*);

2. Start the treatment when the animal infestation reaches in average 20 to 30 ticks;

3. Treat the animals every two days at the beginning of the season and then every three days, so about thirty passings through the bath;

4. Limit the loss of product due to splashes. To this end:

   - Get the animals used to passing through the facility before filling it;
   - Make gentle, non-slip slopes (shallow grooves) at the entrance and exit of the foot bath;
   - Do not overfill the bath.

5. Measure the level before and after each treatment to check if rainwater has entered the tank and, if necessary, add the necessary amount of acaricide. To limit this risk, do not forget to replace the roof on the foot bath after use (*406*);

6. Maintain the bath level between 15 and 20 centimetres for the first two months, by regularly adding water and product at the concentration intended by the manufacturer, before the animals pass through. For the last two or three weeks of use, stop refilling the bath but continue to pass the animals through it as long as the level is above 5 or 6 cm;

7. Do not let the animals drink the mixture put in the foot bath and, after passing, do not let them return to the pool, otherwise the product will be eliminated by water. The herd must be brought back and kept in the night park immediately after the passage.

# *Appendix 5*

# Autopsy techniques on small ruminants

*Adapted from the autopsy technical note destined to field officers of the Farming Board - Ministry of agriculture - Republic of Senegal*

# *Fundamentals*

## Autopsy - Introduction

The autopsy is the continuation of the clinical examination performed on the same animal after it's death, or on other animals with the same symptoms.

The autopsy has two essential goals:

1. Observing the internal organs of the animal to search for possible lesions that allow the guiding of the diagnosis;
2. Take samples to do laboratory examinations.

The best autopsy results are obtained on animals that have been slaughtered by bleeding. When we operate on a corpse, the autopsy must be done as quickly as possible after the death.

## Autopsy - Before

Minimum useful equipment (*407*):

- A pair of gloves;
- A big sharpened knife;
- A pair of scissors;
- An autopsy and sample sheet.

If sampling must be carried out, further provide:

- A proper knife or a scalpel;
- A pair of scissors;
- Sampling jars.

Examination of the animal or the carcasses before the autopsy:

3. Interview the breeder and fill out the corresponding section of the available sheet « autopsy and sampling »;
4. Write down everything that can be observed on the carcasses before the autopsy(*408*):

    - General state: good, medium, bad;
    - Ectoparasites' presence: ticks, fleas, lice;
    - State of the mucosa: anemia, congestion, jaundice;
    - Gingival, lingual, oral, nasal, ocular lesions;
    - Examination of natural orifices: nasal discharge, tearing, leakage, diarrhea, hemorrhage;
    - Sampling: ectoparasites, cutaneous scabs, feces, vulva fluid.

# *Surgical technique*

## Technique - Opening the corpse

- Lay the body on its right side;
- Lift the left shoulder and thigh on the same side by dislocating it;
- Fold the 2 limbs partly detached towards the back of the animal (*409*);
- Carefully cut and remove the skin from the white line: first the left side and then slightly turn the animal over to make the right side (*410*);
- Observe the appearance of the skin muscles (colour, haemorrhagic appearance) and the appearance of the connective tissue (colour, consistency);
- Also observe the appearance of the muscle sections on the shoulder and thigh (*411, 412*);
- Open the abdominal wall by first making a small hole in the umbilicus and working on either side of the white line. Be careful not to damage the walls of the digestive reservoirs, which would harm the sterility of any samples and would considerably hinder further observations;
- Then open the chest cavity (*413*). To do this, incise the diaphragm along the ribs and then the ribs themselves near their insertion on the sternum (cartilage region). Then make a second incision of the ribs and an incision in front of the first rib;
- Fold the costal flap towards the animal's back;
- Observe the organs in place: general appearance, presence of fluid in the abdominal and thoracic cavities (abundance, colour, nature).

**Be careful never to leave a hand in the extension of the knife blade, it can slip and cause serious injuries!**

## Technique - Analytical examination of organs

First note the possible presence of fluid in the pericardial sac by carefully incising it and opening the heart to see at the bottom of the sac; note the color and amount of fluid. In its normal state, there is no fluid in the pericardial sac. Also note the appearance of the pericardium. The thoracic organs (lungs and heart) are then examined individually (*414*).

**1.** Lung

Note the possible adherence of the lungs to the rib cage on both sides: this adherence indicates pleurisy. If necessary, note the appearance of the latter (fibrinous, purulent, fibrous...).

The normal lungs are completely free in the rib cage. The lungs must be examined in particular because they are the most frequently affected organs in tropical conditions.

**2.** Heart

Remove the heart from its pericardial sac and cut off the vessels connecting the heart to other organs.

Examine the outer surface of the heart and look for the following lesions by removing the blood covering the surface with the knife blade: degeneration (range of colour different from the rest of the organ), petechiae (small bleeding points).

Cardiac cavities are highlighted by incising the atria and ventricles, allowing the appearance of the cavities, myocardium and endocardium to be seen.

**3.** Liver

It will be removed by cutting off its adhesions to the diaphragm and the associated blood vessels.

Note its volume, colour, consistency, presence of nodules, abscesses, cysticercus, moat, other parasites. The volume of the gallbladder will also be recorded (normal or voluminous).

**4.** Spleen

It adheres to the rumen in the diaphragmatic region. Observe its size, colour and consistency after section.

**5.** Kidneys

They can be easily removed by hand, uncap them by incising the capsule, then observe their external appearance.

Note the presence of petechiae or infarction (small punctiform zone of degeneration) then incise longitudinally and check the condition of the different zones: medullary and cortical (nephritis), as well as the possible presence of abscess or pus (pyelonephritis).

**6.** Lymphatic nodes

The most accessible are the mesenteric lymph nodes located between the intestinal handles on the mesentery.

After removing them, note their external and internal appearance after section (congested, haemorrhagic, purulent).

### 7. Brain

The brain must be examined every time nervous disorders are observed. Opening the skull requires the use of a cut-off knife or a large knife in adults.

To access the brain, after removing the skin, proceed to the sections of the skull. Then remove the flap from the severed skull and observe the external aspect of the brain: edema, congestion, hemorrhage, presence of bruises.

Cut the bone marrow below the bulb and the optic nerves in front of the brain and completely remove the brain from the skull.

### 8. Digestive tract

It must be examined last (*415, 416*).

Start by examining the stomachs: observe the contents. It is very common to find fabric, rope or plastic in the rumen. After removing the contents, observe the condition of the mucous membranes. Then, start examining the intestines: note the external appearance of the different portions (bloating, congestion, bleeding).

Open portions that appear abnormal and observe the mucosa (*417, 418*). Look for parasites: ascaris, tapeworms, strongles, especially in the abomasum and small intestine. Pay particular attention to the sphincters: pylorus, cardiac, ileo-caecal valve. They are often the site of lesions (ulcers, haemorrhages) during viral diseases.

*Good to know*

Aspects of lung lesions (*419, 420*):

- Edema: the normal lung collapses after the animal's death, a swollen or foam-filled lung signs pulmonary edema;
- Congestion: the lung is red while the normal lung is pale pink. Be careful, however, with the animal's supine position, which causes a blood stasis in the agonizing phase on the side where it was lying. It is a physical phenomenon and not a lesion;
- Pneumonia - hepatitis: the lung has dark areas of densification. In the last stage, these lesions can take the appearance and consistency of the liver (*421*) ;
- Extent of injury: unilateral, bilateral;
- Note the number and location of affected lobes (apical, cardiac, diaphragmatic);
- Also note any lymph node lesions (adenitis).

*Samples to be analysed in the laboratory must be kept in the equipment provided for this purpose (422)*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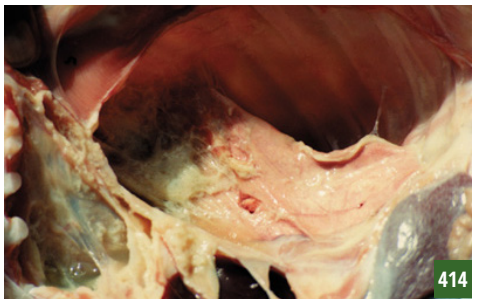
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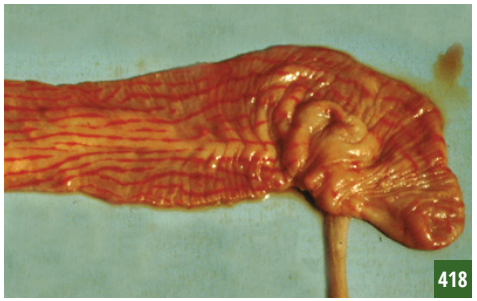
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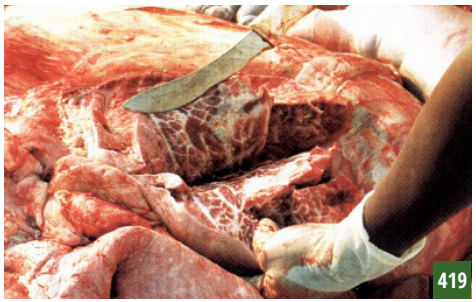
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Géraldine Laveissiere © cirad-astre, 2018

# *Appendix 6*

# Autopsy techniques on poultry

*Adapted from the Autopsy in avian diseases, written by Jean-Luc Guérin and Cyril Boissieu of the National Veterinary School of Toulouse*

# *Fundamentals*

## Autopsy - Introduction

- Use proper equipment, adapted to the age and the type of poultry that is autopsied;
- Never transport birds (dead or alive) in the case of a suspected highly contagious disease (Avian influenza or Newcastle disease);
- Always wear gloves;
- The choice of the animals is decisive: choose a representative sample of the group;
- Be careful with the fast lysis of the carcasses (especially when viral or histological analysis are to be done).

## Autopsy - 10 step protocol

1. External examination and preparation;
2. Exploration of the oropharyngeal cavity and the trachea;
3. Skinning the carcass;
4. Opening the carcass and evisceration: observe the thoraco-abdominal cavity;
5. Examination of the digestive tube and its appendix glands;
6. Examination of the heart and the breathing apparatus;
7. Examination of the urinary and genital apparatus (and adrenal);
8. Examination of haemato-lymphopoietic organs;
9. Examination of the nervous system;
10. Examination of the musculoskeletal system.

# *Protocol*

## Step 1 - Internal examination and preparation

- Assessment of the general state:
  - Weighing, state of fattening
- Examination of the head (*423*):
  - Nasal discharge;
  - Eyes: presence of discharge, eyelids, cornea, conjunctiva;
  - Appendices: crest, barbels, caruncles.
- Examination of the skin covering and mucous membranes (*424*):
  - Ectoparasites, wounds, abscesses;
  - Neoplasms (feathery follicles: Marek) ;
  - Mucous membranes buccal, ocular.
- Euthanize the bird (*425*):
  - Occipital dislocation;
  - Or euthanasia injection into the occipital sinus;
  - Bleeding (allows a better reading of congestivohemorrhagic lesions).
  - Moisten the skin and plumage.
  - Place the animal in supine position.

## Step 2 - Exploration of the oropharyngeal cavity and the trachea

- Open the beak;
- Cut off the corners and extend along the neck in section along the esophagus (*426*);
- Examine the oral cavity and oropharynx (*427*);
- Look for the presence of petechiae, mucus, ulcers.

## Step 3 - Skinning the carcass

- Cut the skin of the groin folds and dislocate the legs by bringing them back towards the back (*428, 429*).

## Step 4 - Opening the carcass and evisceration

- Exposing the thoraco-abdominal organs (*430*):
  - Bouton hole at the tip of the wishbone;
  - Make an incision on each side of the wishbone;
  - Sever pectoral and costal muscles at the junction cartilage, at the coracoid bone and at the clavicular bone;
  - Recline the wishbone towards the front and observe the aspect of the air sacs and the serosa (liver, pericardium) (*431*).
- Examination of the thoracoabdominal cavity:
  - Observe the organs in situ before starting the dissection and sampling phase (*432*);
  - Examination and dissection of the pericardial heart.

## Step 5 - Examination of the digestive tract and its associated glands

- First stages:
  - Cut the digestive tract between the crop and the Proventricule;
  - Cut off the cloaca;
  - Separate the liver from the digestive mass;
  - Unroll the digestive tract (*433*).
- Proventriculus, gizzards (434):
  - Observe the mucous and content (*435*);
  - Remove the gizzard's cuticula;
  - Search for the ulcers and hemorrhagic lesions.
- Jejunum, ileum, rectum and caeca (*436*):
  - Observe mucous, sides, content.
- Liver and gallbladder (*437*):
  - Note the aspect, the color, the volume and the liver consistency;
  - Carry out the cuttings and observe the sections;
  - Observe the color, the volume and the consistency of the bladder.
- Pancreas (*438*):
  - Observe the color, the volume, the consistency.

## Step 6 - Examination of the respiratory system

- Trachea (*439*):
  - Open the trachea and examine the mucosa: congestion, blood, mucus, fibrin.
- Lungs (*440*):
  - Remove the lungs and examine the surface and tissue: pneumonia, nodules.
- Examination of thoracic air bags (*441*);
- Examination of abdominal air bags (*442*).

## Step 7 - Examination of the urogenital system

- In females (*443*):
  - Remove and examine the ovarian cluster after sectioning the base of the pedicle, pull slightly on the oviduct to extract it by dissecting it;
  - Caution: very high variability according to the physiological stage (maturity > 18 weeks in the hen);
  - Observe the kidneys, embedded in the lumbo-sacral bone.
- In males (*444*):
  - Remove and examine the testicles (position, volume, colour);
  - Caution: high variability according to physiological stage (maturity > 18 weeks in roosters);
  - Observe the kidneys, embedded in the lumbo-sacral bone.
- Examination of the urinary tract and adrenals in the duckling (*445*).

## Step 8 - Examination of the hemato-lymphopoietic organs

- Spleen (*446*) :
  - Isolate the spleen from the digestive mass;
  - Observe its appearance, colour, volume and section.
- Bursa of Fabricius (*447*):
  - Located on the ceiling of the cloaca;
  - Observe its volume, appearance and mucous membrane;
  - Regression from 10 to 20 weeks (hen).

## Step 9 - Examination of the nervous system

- Sampling of the sciatic nerve (*448, 449*):
  - In the case of suspected Marek's disease, the sciatic nerve and lumbosacral plexus are collected for histological analysis;
- Brain sampling (*450, 451*) :
  - Strong scissors are inserted into the occipital hole (neck) and the skull cap is cut;
  - The cerebral hemispheres, the cerebellum and the trunk (in the ventral position) are removed as a single unit.

## Step 10 - Examination of the musculoskeletal system

- Legs (*452*):
  - Search for malformations along the long bones, inflammations of tendon sheaths, plantar abscesses.
- Articulations (*453*):
  - Observe the exterior aspects of the articulations, open them;
  - Note the presence of outpourings, urate deposits or fibrin.

## Last point - To conclude

- Conditioning the sampling:
  - Histology: immediate fixation of the sections with 10% formol or Bouin fixator.
  - Virology/bacteriology: dispatching under positive cold regime (conditions must be specified with the laboratory beforehand).
- Draft a complete autopsy report:
  - Properly identify the collected subjects and tissues to analyze them.
- Condition and eliminate waste:
  - In case of a suspected highly contagious disease (Avian influenza or Newcastle disease): condition and leave the waste on the site of the farm.
- Be careful with biosecurity:
  - The autopsy is a highly contagious act!

*All the illustrations of this appendix are available on pages 263 to 265*


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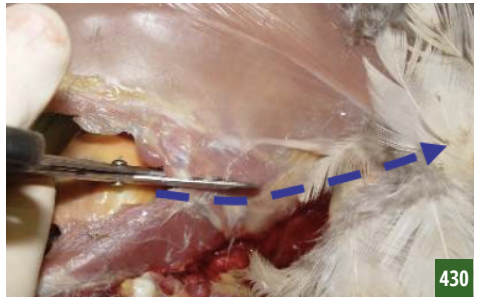
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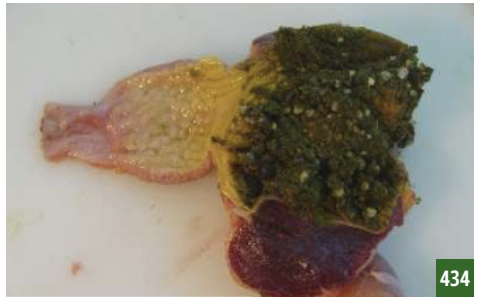
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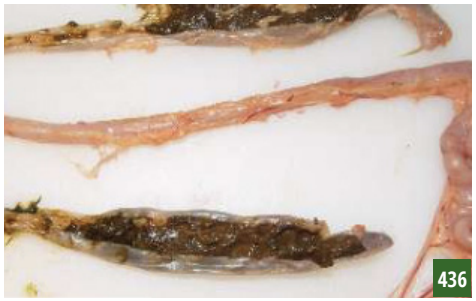
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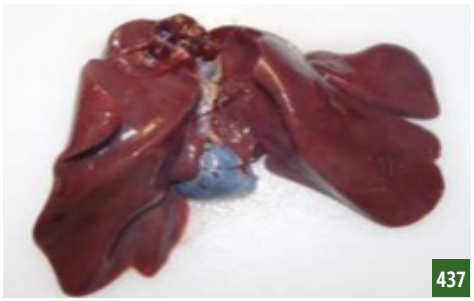
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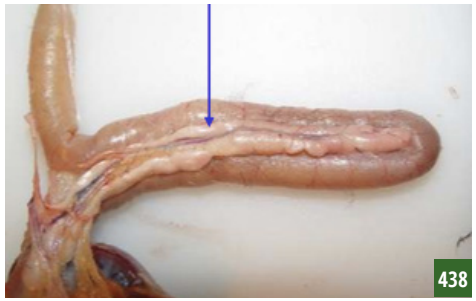
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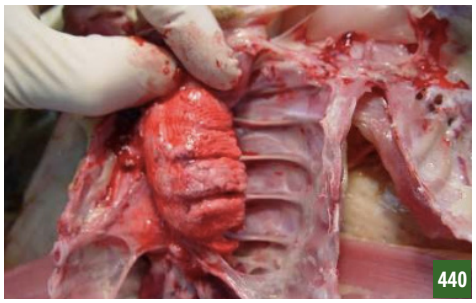
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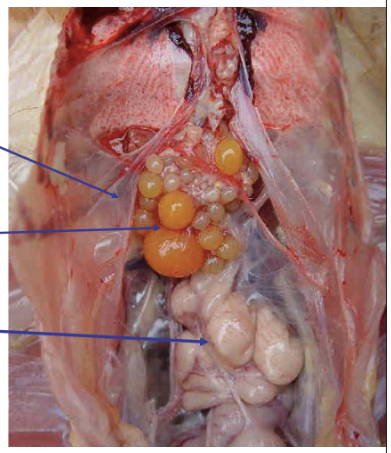

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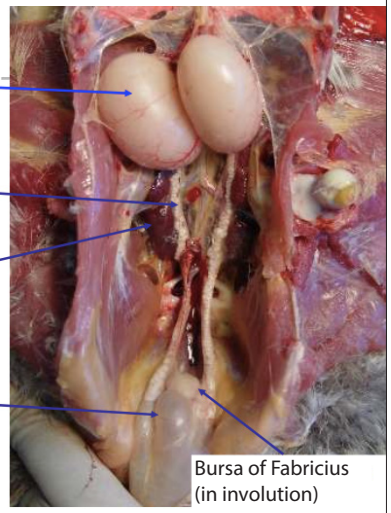

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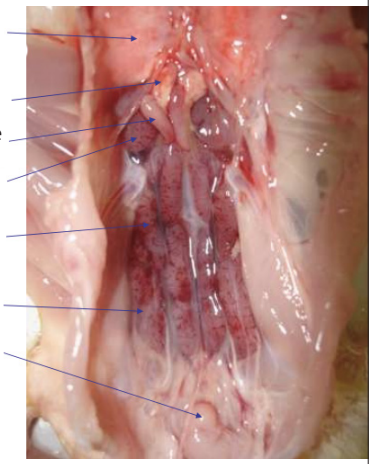

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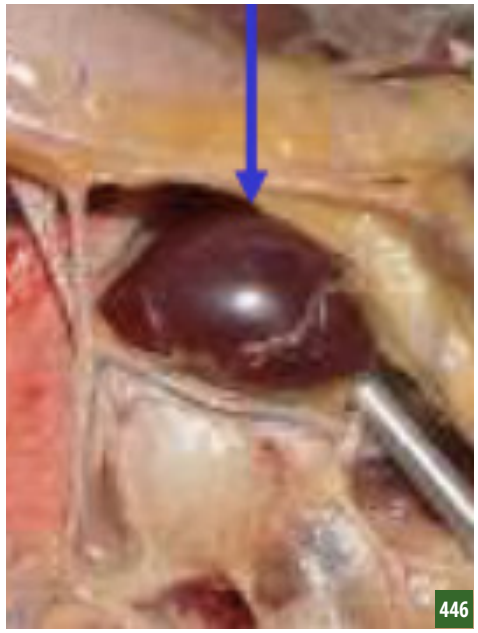
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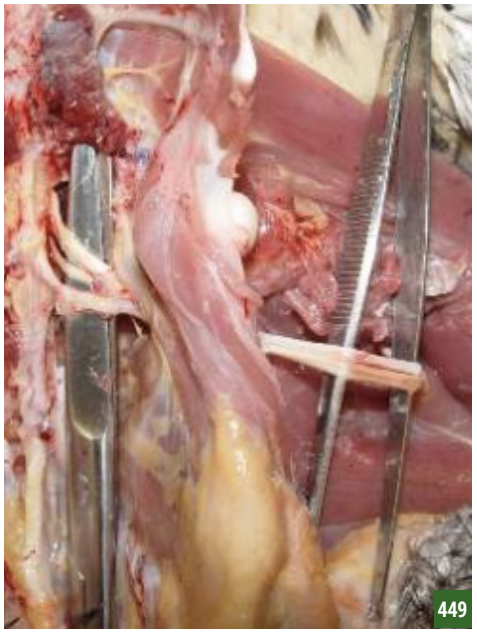
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# *Appendix 7*

# Restraint techniques

*Adapted from the « Guide for the training of MMAV »*
*edited by AVSF, in partnership with the MPAE and the ONDVM*

# *Fundamentals*

## Interventions - Risk

Interventions on cattle are quite frequent:

- Treatment against ticks;
- Treatment against internal parasites;
- Injections by your veterinary when ill;
- Artificial insemination;
- Caring for wounds;
- Prophylaxis campaign;
- Identification, placing ringlets;
- etc.

There manipulations are often risky for the person taking action: the farmer or a member of his family or the animal health personnel. A good restraint of the animals ensures a safely and correctly carried out process.

**Ensure everyone's safety!**
**A kick or a gore can happen fast!**

## Manipulations - An adapted approach

Keeping your calm during each manipulation is a valuable preliminary.

Animals perceive an approaching person's excitement or fear. So, it is important to be patient with animals that are thinking of jumping an obstacle or that aren't going towards the entry of a restraint hallway or another handling area. It's preferable to let the animal "think" for a few seconds without rushing or stressing it.

Unnecessary brutalities, as well as losing your calm builds up a lot of stress and greatly reduces the handling's success. The restraining must be precise, gentle, tight and as brief as possible to limit stress induced mortality risks.

The restraint must allow the animal to be maintained, examined and treated without being wounded, as well as the handler or the other present people. The handler is responsible for the global security. He/she must have secure gestures.

## Vision - A strong sensitivity

Cows have a panoramic vision (Almost 360° - *454*). They can see everything that's happening around them without turning their head, although the sides and the back are unclear. It is necessary that the sides of the hallway be full so that the animal does not see the possible sharp movements that the farmer is doing near the restraint area.

The animal is sensitive towards a brutal change in luminosity. So, as soon as it enters the hall, it must be able to see the daylight. This will facilitate the cow's progress without forcing it or having to use brutality.

# *Restraint techniques for cattle*

## Technique 1 - The restraining hallway

The restraining hallway (*455*) is the most efficient stockbreeding tool to guarantee correctly applied treatments towards the cattle, and very secure for the personnel. It must not only allow the personnel to work in a secure environment but also to carry out fast collective interventions (disinfestation, vaccination, prophylaxis...).

Animals behave better in small groups (5/6 animals), hallways 8 to 10 meters long are a good choice. Beyond this length, to ensure a good "filling", a 15° angle should be considered at the end of the hallway so that the animals do not see its extremity once he is engaged. The entry of the hall on a side (45° angle) with a resurgence at the end to facilitate the entry and limit exits by backing up. The installation is about 75 cm wide so that the bulls can move forward easily, while limiting the possibility of other cows to turn around

## Technique 2 - The nose holder

Position the nose holder in the animal's nostrils, tighten it, and hold or attach the cord tied to it to hold the animal (*456*).

Without the nose holder, the best way to hold a large ruminant is to firmly hold the nostrils between the thumb and the index of one hand, while holding on to the horn or the ear with the other hand.

## Technique 3 - The halter

The animals must be accustomed to the halter, preferably when they are still young.

You have to talk to the animal held by a halter to encourage it to move.

Hold the halter no more than 20 cm from the animal's cheek and walk next to its neck (*457*).

## Technique 4 - Standing

There are many ways to effectively contain a cow while standing up, without harming it, just as shown on these illustrations (*458, 459*).

## Technique 5 - Laying the animal down

To trim the clogs or hoofs of an animal without restraining it, by making it lay down (*460*).

In order to do this, you must:

- Be at least 3 people;
- Have a halter for the head;
- Have a cord 10 to 12 m long;
- Choose a place where the animal can securely fall to the ground, with a soft ground or full of hay.

The method is as follows:

- First place the halter on the animal;
- Secure the long rope around him as shown on the illustration;
- Ask someone to hold the halter, while the others pull on the rope;
- Once the animal is on its back, immediately place a knee on its neck and a hand on its head to prevent it from getting up.

## Technique 6 - Using a rope

There are several ways to efficiently contain a cow with a rope without hurting it, by the body or the members, just as shown on the illustrations (*461, 462, 463, 464*).

**Do not leave the animal lying down for too long as this can cause bloating!**

**To avoid injury to humans and/or animals, perform these operations safely!**

# *Restraint techniques for small ruminants, pigs and poultry*

## Restraint - Small ruminants

- Hold the animal's head (*465*);
- Place it against the wall. If there is no wall, hold it between your legs (*466*);
- Tie it up with a simple rope forming a buckle or use a hooked metal peak to maintain it against the soil (*467*);
- Place yourself on its right and hold it under its head with your left hand;
- Grab its skin, right above the right hind leg, with your right hand;
- Pick the animal up gently and place it on its rear (*468*).

## Restraint - Pigs

There are many ways to efficiently hold a pig with a rope or a lasso without hurting it, just as shown in these illustrations (*469, 470, 471, 472*).

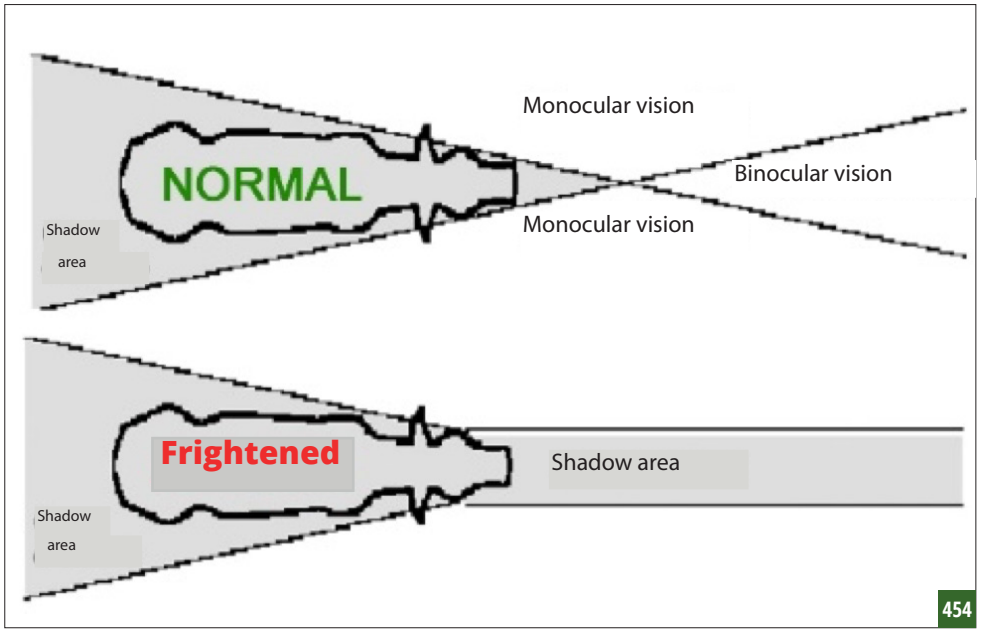
Restraining a small pig can be done without a rope (*473*).

## Restraint - Poultry

To grasp a large bird, like a turkey, hold it by the wings and by a leg on the opposite side.

For chickens, hold them under the thorax or by the legs (*474*).

For ducks, look after the front part of their neck. Grab them under the thorax and hold them by the wings.



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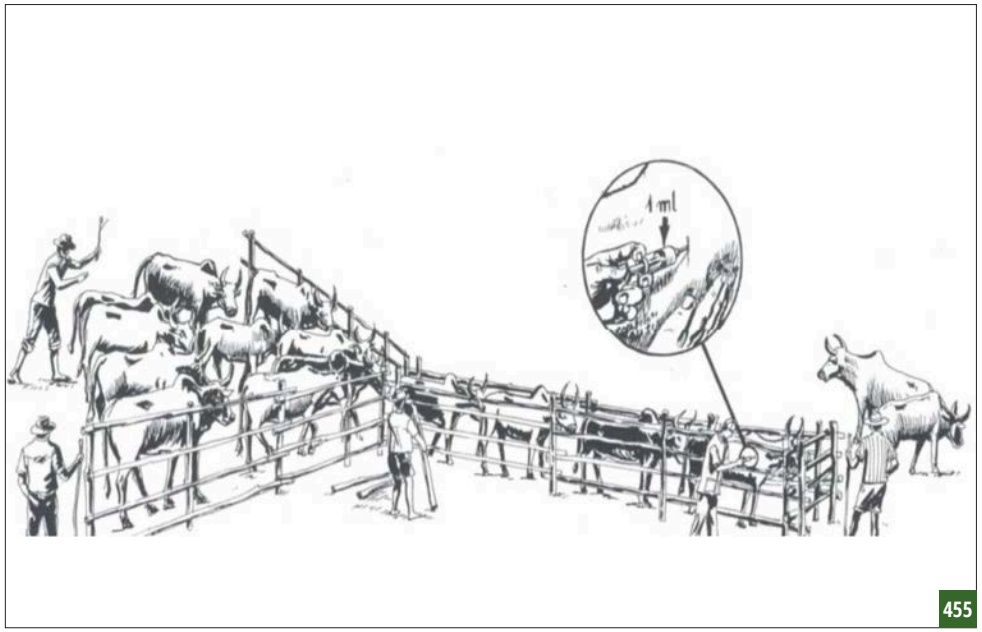

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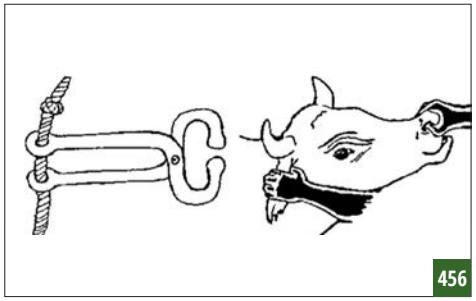
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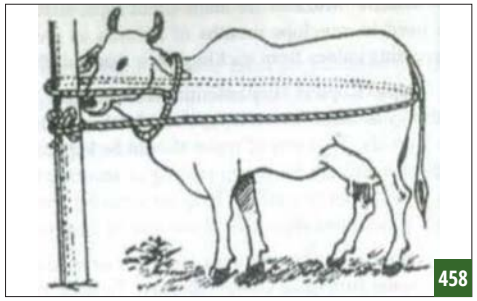
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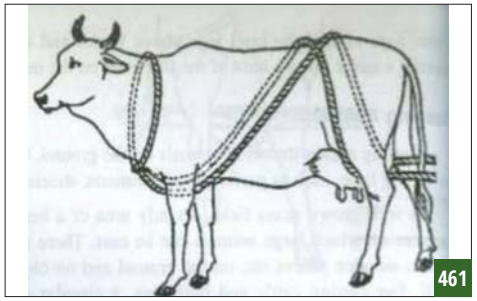
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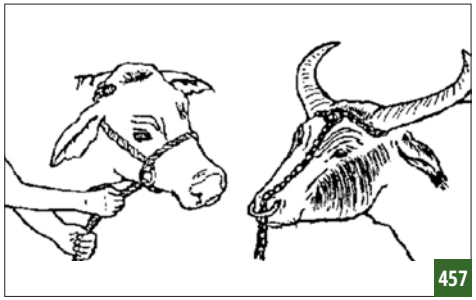
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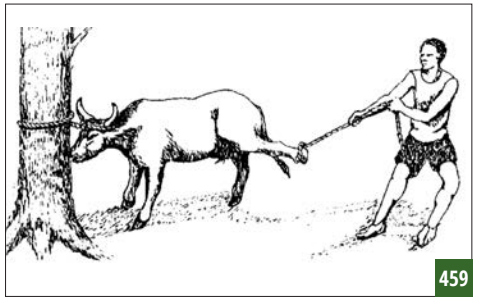
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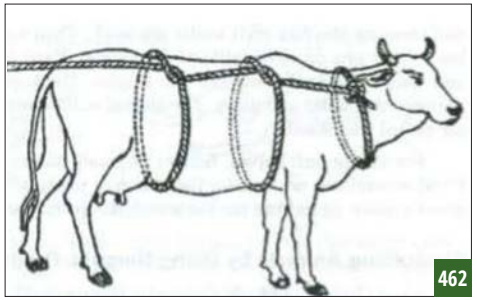
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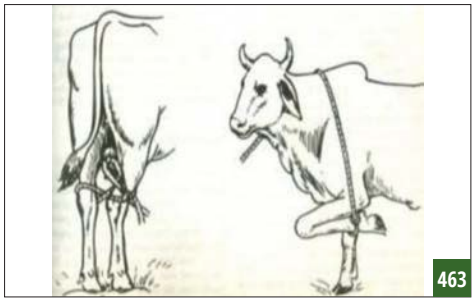
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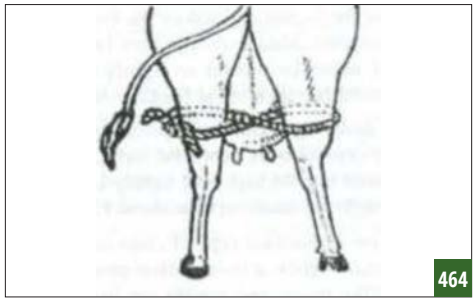
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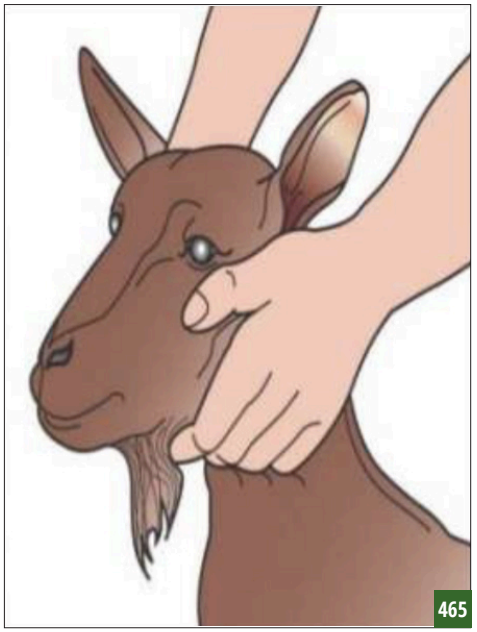
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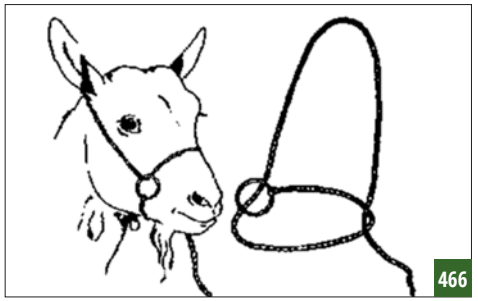
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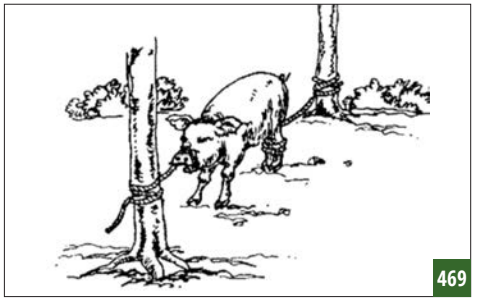
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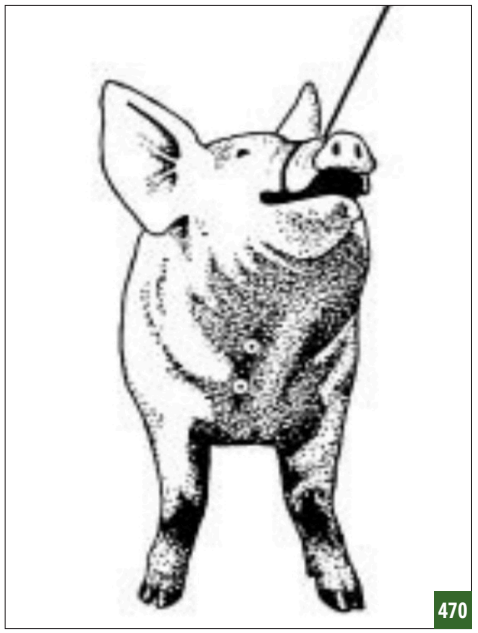
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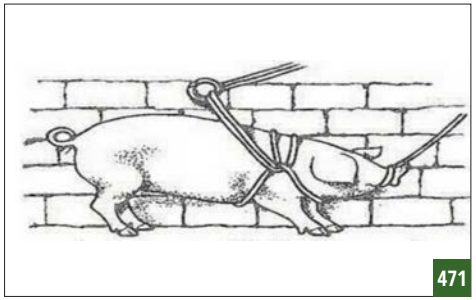
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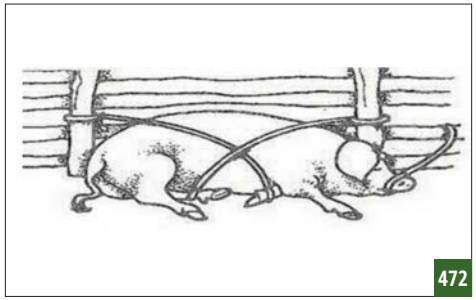
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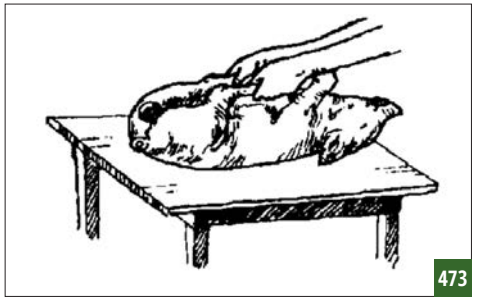
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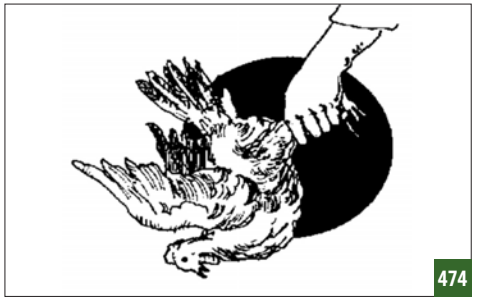
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# *Appendix 8*

# Some national or international diagnostic and reference laboratories

*These competent laboratories, stated here-after, have specific competences, but are only given as examples*

*According to the examination and the desired credential, it is often possible to find a national or regional laboratory*

*A listing of laboratories and their competencies ranked by country and region is available on the OIE website.*

*Each shipping must systematically be preceded by an agreement with the concerned laboratory which must specify the recommended packaging category for the transport of the samples*

| Laboratories | Abilities |
|---|---|
| **ANSES - National Reference Laboratory**<br>Laboratoire de santé animale de Maison-Alfort<br>22 rue Pierre Curie, 94703 Maisons-Alfort cedex, France<br>Tel : +33 (0)1 49 77 13 00 | *Brucellosis, anthrax, foot-and-mouth disease, bluetongue, West Nile fever, tuberculosis* |
| **ANSES - National Reference Laboratory**<br>Laboratoire de Ploufragan-Plouzané<br>Unité VIPAC<br>BP 53 Zoopôle Les Croix 22400 Ploufragan, France<br>Tel : +33 (0)2 96 01 62 58 | *Avian influenza, Newcastle disease, African swine fever* |
| **CIRAD TA A A15/G - National Reference Laboratory**<br>Laboratoire de l'UMR ASTRE (Animal, Santé, Territoires, Risques, Ecosystèmes)<br>Campus international de Baillarguet, 34398 Montpellier Cedex 5, France<br>Tel : +33 (0)4 67 59 37 24 | *Sheep pox and goat pox, Lumpy skin disease, Rift Valley fever, contagious bovine pleuropneumonia, sheep and goat plague, contagious goat pleuropneumonia* |
| **ANSES - National Reference Laboratory**<br>Laboratoire de Sophia Antipolis<br>Les templiers, 105 route de chappes, BP111-06902, Sophie Antipolis cedex, France<br>Tel : +33 (0)4 92 94 37 00 | *Q fever* |

| Laboratories | Abilities |
|---|---|
| **CIRAD Guadeloupe - National Reference Laboratory / OIE Reference Laboratory**<br>Laboratoire de l'UMR ASTRE (Animal, Santé, Territoires, Risques, Ecosystèmes)<br>Site de Duclos 97130 Capesterre-Belle-Eau, France<br>Tel : +59 (0)5 90 25 54 42 | *Cowdriosis* |
| **Istituto Zooprofilattico Sperimentale della Sicilia - OIE Reference Laboratory**<br>C.R.A.Ba.R.T.<br>Via Gino Marinuzzi 3, 90129 Palermo, Italie<br>Tel: +39 (0)9 16 56 53 41 | *Anaplasmosis, babesiosis, theileriosis* |
| **Laboratoire Départemental d'Analyses 71**<br>267, rue des épinoches 71009 Mâcon, France<br>Tel : +33 (0)3 85 33 52 20 | *Pasteurellosis* |
| **ANSES - National Reference Laboratory**<br>Laboratoire de la rage et de la faune sauvage de Nancy<br>CS 40009, Domaine de Pixéricourt, BP954220 Malzéville, France<br>Tel : +33 (0)3 83 29 89 50 | *Rabies, echinococcosis* |

# *Appendix 9*

# Regulatory framework for the transport of samples

*Adapted from the Pasteur Institute's references*

# *Policy framework for infectious substances*

## Regulation - Reminder

Any transport of possibly infectious biological material is under the sole responsibility of the sender. The regulation relating to dangerous merchandise requires all personnel participating in the transport to have had an appropriate training course.

## Regulation - A few definitions

**Infectious substances**. « Infectious substances » means that these are materials that we know, or have reason to think, contain pathogens. These pathogens are defined as microorganisms (including bacteria, viruses, rickettsia, parasites and mushrooms) and others like prions, that can provoke diseases towards humans or animals. Infectious substances are split into two categories A and B.

**Samples taken from patients**. « Samples taken from patients » means that these are human, or animal substances directly taken from human or animal patients including, but not limited to, excreta, secretions, blood and its components, tissues and tissue fluids and organs transported for research, diagnostic, investigation, treatment or prevention.

**Biological products**. « Biological products » means that these are by-products of living organisms that are fabricated and distributed in accordance with competent national authorities' prescriptions that can enforce special authorization conditions. They can be used to prevent, treat or diagnose diseases in humans or animals, or in order to develop, experiment or research. They can cover finished or unfinished products like vaccines but are not limited to these.

# *Classification of infectious substances*

## Classification - Category A

A category A infectious substance is an infectious substance, depending on the way that it is transported and when an exposure occurs, that can cause permanent disability or a deadly or potentially deadly disease for humans or animals that were in good health until then.

Infectious substances, including new or emerging pathogens, that do not appear in it but answer to the same criteria must be classified in the A category. Furthermore, a substance for which we cannot determine if it answers to the criteria or not must be included in the A category.

Therefore, when cultures are destined to diagnostic or clinical purposes, they can be classified as category B infectious substance.

*Infectious substances, answering to these criteria, that cause diseases for humans or simultaneously for humans and animals are assigned to N°UN 2814*

## Classification - Category B

A category B infectious substance is an infectious substance that does not answer to the category A classification criteria.

*Infectious substances of the B category must be assigned to N° ONU 3373*

# *Category A Microorganisms Instructions*

## Transport of category A infectious substances - Instructions ADR P620 (by road) or IATA 602 (by air)

Three levels of regulatory requirements:

- Triple authorized packaging and regulatory labelling;
- Formalized shipment document;
- Transit conditions.

A few general observations:

- If there are several primary packaging within one and only secondary packaging: wrap them separately to avoid any contact;
- The name of the sender and an emergency phone number (in case of an incident during transport) must appear on the outside of the package, as well as the regulatory label;
- Temperature controlled transport: the refrigerant is placed on the exterior of the secondary waterproof packaging, in a tertiary isolating packaging, which is also waterproof if water is used, and not waterproof if dry ice is used, the secondary packaging must stay chocked after liquefaction or sublimation of the refrigerant;
- List of contents placed between the secondary and tertiary packaging;
- If unknown, note: Suspected category A infectious substance.

## Packaging requirements - Instructions ADR P620 or IATA 602

It is imperative to use a triple packaging system, certified by the Ministry of Transport, including:

- A primary waterproof container, containing the culture or the biological substance;
- Attention: the quantity of infectious substance is limited to 50 ml or 50 g per air package;
- Insert in a second waterproof box, that is resistant to shocks, with sufficient absorbing material;
- The full ensemble is placed and choked in a resistant tertiary package whose minimum size is superior to 10 cm, in order to bear the specific tagging and the regulatory label.

## Mandatory labelling on the external side of the tertiary package - ADR 5.2.2. - IATA 7 - instruction 602

- Clear identification of the recipient and the sender with a name and phone number;
- Indication of the hazard's classification: Standard hazard labels 10*10 cm in the shape of a diamond / Suppliers;
- UN identification number of the hazardous material. Indicate:
  - If the strain is « human »: « UN 2814 Infectious for humans »;
  - In the strain is « veterinary »: « UN 2900 Infectious for animals only »;
  - If it's a diagnostic sample: « UN 3373 Clinical sample » and see P650 directive;
- If dry ice is used, the « Carbon dioxide » indication must be used or the wording « dry ice » must be indicated on the exterior of the package, according to the ADR (see P650 directive) specify: UN 1845 « dry ice » (only for air transfer) ;
- For air transfer: label + shipping official designation + quantity of dry ice are mandatory.

Options :

- If the culture's environment is liquid: the label of the handling's direction (ADR 5.2.2.2. et IATA 7.2.3.3.);
- If there is a specific precise temperature: temperature label (non-standardized).

## Mandatory shipment documents - ADR 5.4.1./5.4.3. - IATA 8 - instruction 602

Accompanying documents must be completed, they are to be used for any biological sample (cf. GBEA) that are placed between the secondary and the tertiary container such as:

- Detailed list of the packages content;
- Medical or information follow up sheet provided to allow the efficient and relevant achievement for the patient and/or the public health of the required expertise.

Regulatory documents or hazard statements must indicate:

- Designation of the strain, cf. designation in the next paragraph + strain's official name (in italic);
- Hazard classification: 6.2;
- Packaging group, IATA dry ice;
- Number and description of the packages;
- Solid or liquid nature of the culture's used environment, as well as its volume and weight. It must be regulatory. (Cf. instructions 602);
- Name and precise addresses of the recipient and sender with an emergency phone number that is reachable in case of an incident;
- Standard declaration signed by the sender that certifies the conformity of the package and its shipping.

The ADR 5.4.3. regulation also demands a safety notice that must be followed in case of an incident or an accident during the transport: CEFIC sheet.

For air transport (IATA 8.1.):

- LTA determined by the freight forwarder;
- The standardized « Declaration of dangerous merchandise », must necessarily start by the ONU N°, the "solid" or "liquid" entry isn't mandatory anymore, neither is the "only" entry for the UN 2900;
- The package designation is necessary, example: «1 fibreboard box x 1g » after the package type and before the package instruction;
- It must be established at least in duplicate (written at least in English and placed on the exterior of the package, at the disposal of the carrier).

Extra customs' documents are also necessary out of the EEC. Pro forma invoice (in 5 copies) with:

- The recipient's address, phone number and SIRET n°;
- The number of packages;
- The content: bacterial/viral strains (without further details);
- The total weight of the package and its size;
- The wording «no commercial value » and an estimated custom' value;
- The signature and professional seal of the sender;
- Various authorizations (if there is a risk of bioterrorism).

## Transit conditions and licensed carriers - ADR 1.3./1.4.2. - IATA instruction 1.3.3.1./602

- The sender, who is responsible for the shipping even in the case of a sub-contracted carrier, must obtain from the carrier a written guarantee regarding security, delay, transport traceability and available means;
- For safety reasons, infectious substances must be conveyed as quickly as possible (even if it isn't a medical emergency);
- Each transport must be planned by the sender, in cooperation with the recipient and the carrier. Efficient tracking will verify the schedule;
- The sender must plan and ensure the cold chain as soon as the packaging is done and according to possible delays;
- Specific observations for road transport: Written safety recommendations (CEFIC form) corresponding to declared risks must be given to the driver;
- Specific observations for air transport: The quantity of infectious substance is limited to 50 ml or 50 g per package (except a special derogation).

As a reminder, chapter 5.5 of the ADR prescribes the following measures:

- Prior arrangements between the sender, the packer, the carrier and the recipient (especially for category A substances). The shipping of infectious substances must not be undertaken before the prior arrangements have been made between the sender, the carrier and the recipient, or before the recipient receives confirmation from their competent relevant authorities that the substances in question can be legally imported and that there will be no delay in the shipment to destination;
- Any road transport (even private) of infectious substances must be done within regulation (packaging, labelling, declaration...) so that health authorities can take the necessary measures in case of an incident;
- Any air transport of infectious substances in a carry-on or handbag is strictly forbidden.

Guarantees for the sender using road transport:

- Driver's training certification for the transport of hazardous material lasting from less than 5 years is mandatory if the vehicle's tonnage is > 3,5 t of controlled merchandise or training certificate in security matters (8.2.8. et 2.2.2.).

Mandatory for any tonnage since January 2007:

- Identification document including a photo for each member of the crew;
- Passenger transport prohibited (8.3.1.);
- Properly marked vehicle: orange sign at the back (8.1.3. et 5.2.2.3.);
- Vehicle surveillance and security: vehicle conditions, for possible storing and parking during transport (8.4. et 8.5. S 9) Security plan (ADR 1.10.);
- Handling conditions: hazardous material separated from others and correctly secured (7.5.).

# *Category B Microorganisms Instructions*

## Transport of category B infectious substances - Instructions ADR P650 (by road) ou IATA 650 (by air)

- Triple packaging, «of good quality and strong enough » in normal transport conditions and usual transshipment incidents, including absorbent, chock and same characteristics as P620 or 602 instructions. Therefore, there is no required authorization. The manufacturer, however, is obligated to provide clear instructions on the package, its packing and closing;
- Labelling on the exterior package : No 'hazard label' for Class 6.2, but must label the UN 3373 N° in a diamond-shaped signal of a different color and at least 5 cm sides ; The only valid for UN 3373 is : « Category B biological material » in lettering of at least 6mm high, as well as the name, address and phone N° of the person responsible for the expedition in case of an incident. The entry « Diagnostic or clinical sample » is prohibited. Moreover, for air transport, the name and phone n° of the person responsible for the expedition must be indicated on the AWB (Airway Bill) or on the exterior of the package;
- Documents:
  - For the ADR: no obligations;
  - For the IATA: see conditions;

Transit conditions, general notes:

- Regulatory quantities: Primary package (ADR no limitations, IATA < 1L or 1 kg) / Secondary package (ADR no limitations, IATA < 4L or 4 kg);
- Several primary packages in the same secondary package: same as Instruction 602;
- Temperature controlled transport: same as Instruction 602;
- In case of over packing it must be marked in the same conditions.

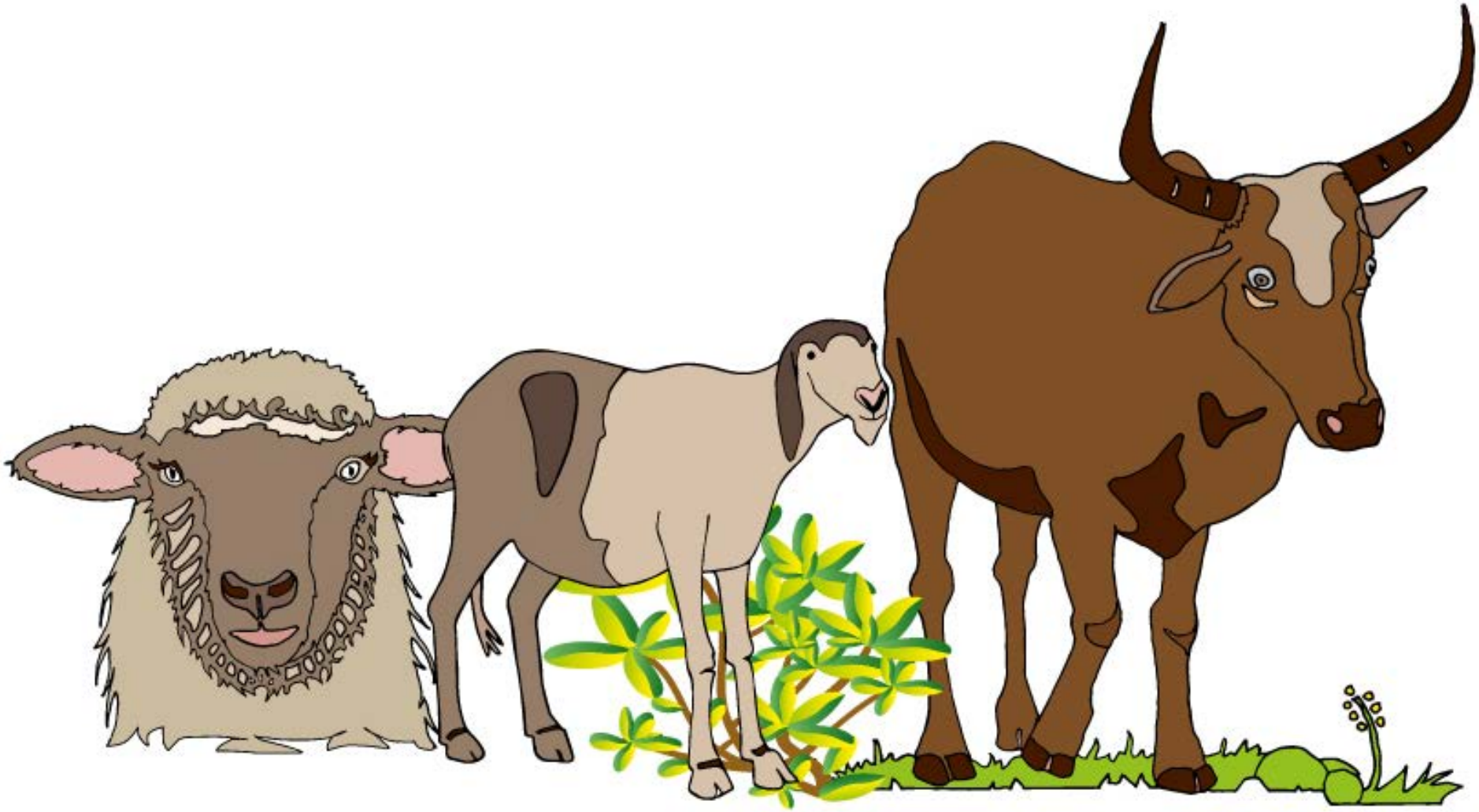
For air transport:

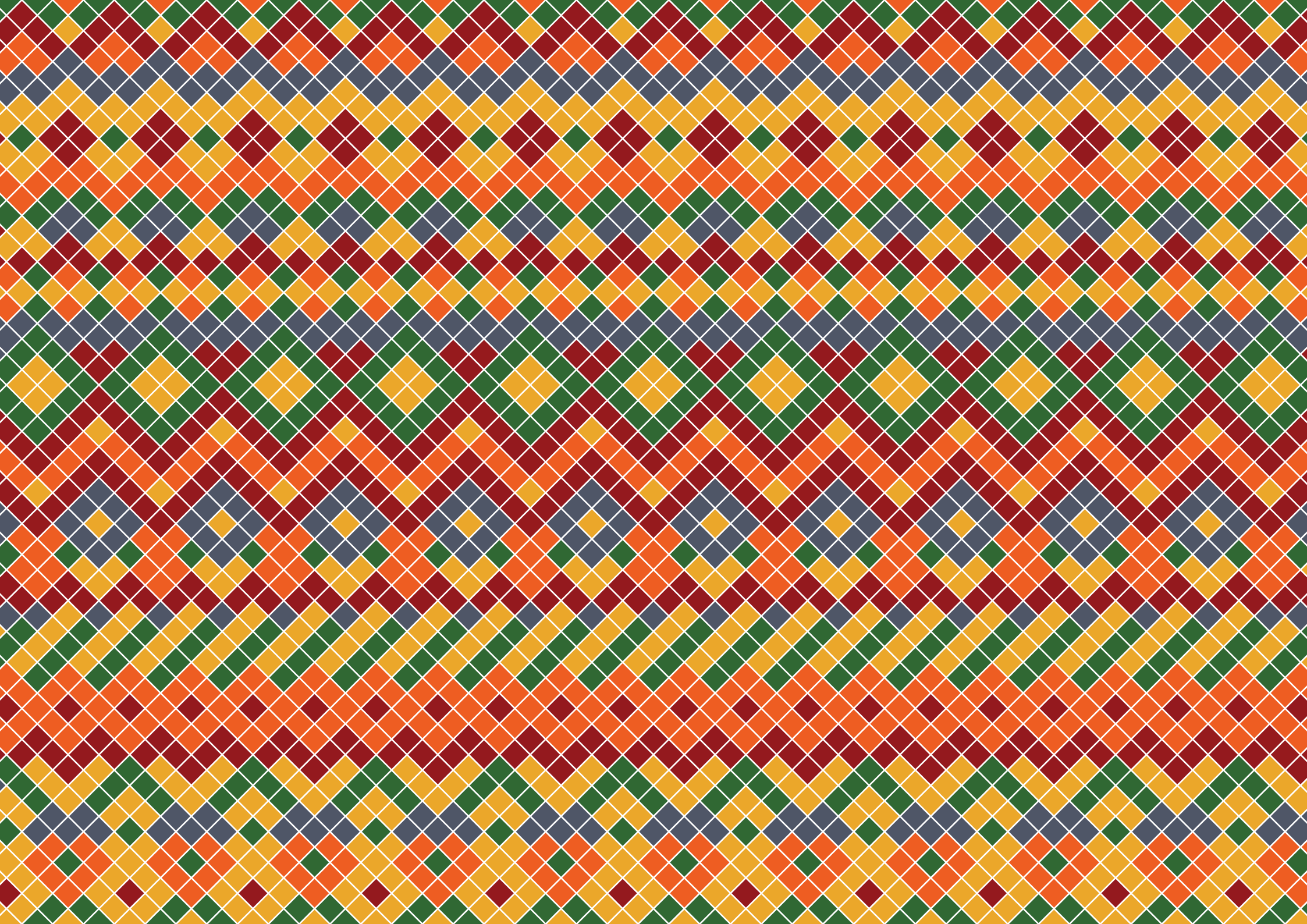
- Certain airlines refuse to take responsibility these kinds of « P650 » packages and demands instruction 602 for all infectious substances, even those of category B;
- It is forbidden for passengers and members of the crew to transport these infectious substances, whatever the packaging or category, even in their hand luggage, their checked-in luggage or on their own person.

# Transport Regulations

## Recommendations on the transport of dangerous goods (United Nations)

- International
  - IMO → International Maritime Organisation
  - IATA → International Air Transport Association
- European
  - ADR → European Agreement concerning the international transport of Dangerous goods by Road
  - RID → Règlement International concernant le transport des marchandises Dangereuses per chemins de fer
  - ADN → Accord europeen rélatif au transport international des marchandises Dangereuses par Navire sur le Rhin





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# MANUAL
*for*
# ANIMAL HEALTH STAFF
## Animal Health Pedagogical Toolkit

This Manual for Animal Health Staff constitutes a support for continuous training and a reference guide for the field. It contains five sections organized around the main areas of animal health. Each section provides a clear and illustrated explanation of the important concepts to be aware of for the daily exercise of community-based animal health workers, veterinary paraprofessionals and private and/or public veterinarians. The role of each of these actors, the recognition of priority animal diseases and the basic animal health techniques are fully explained in this handbook.

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