



School of Veterinary Medicine

# ANIMAL HEALTH AND DISEASE CONTROL

## Chapter 2: *Bacterial & Viral Diseases*

By

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# Economic losses attributed to LS diseases

- ☺ Mortality
- ☺ ↓Productivity (Milk yield, body weight gain..)
- ☺ ↓Reproductive performance (infertility, abortion, stillbirth...)
- ☺ Ban from international market

# Examining the health condition of an animal

## Routine health & Diagnostic procedure

- History
- Environment
- Animal examination

# Healthy Animal

- Has a good appetite
- Appears bright, alert and responsive
- Stay with the flock
- Has smooth, clean and shiny coat
- Has clear eyes
- Has an erect tail and a moist nose



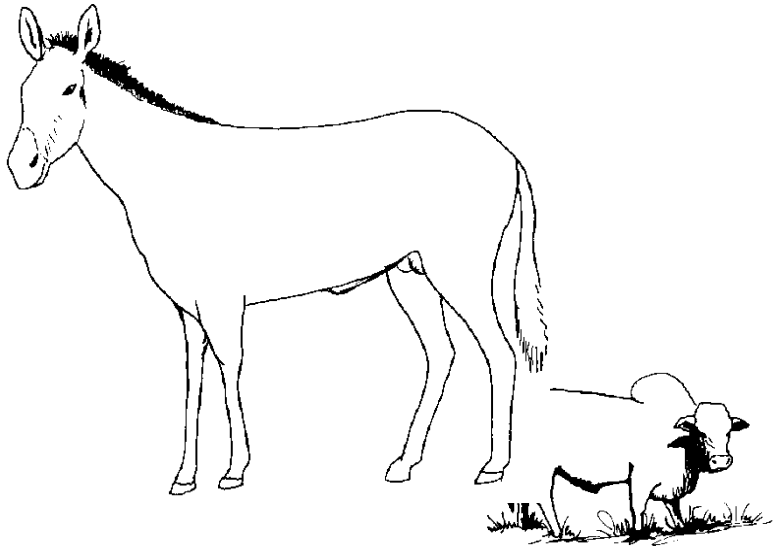
# Examining the health cont..

Healthy lambs/kids are:

- Active and alert, breath normally.
- They are up on their feet in 30-60 minutes after birth, moves freely and feed often.

# Pictures of animals in health conditions





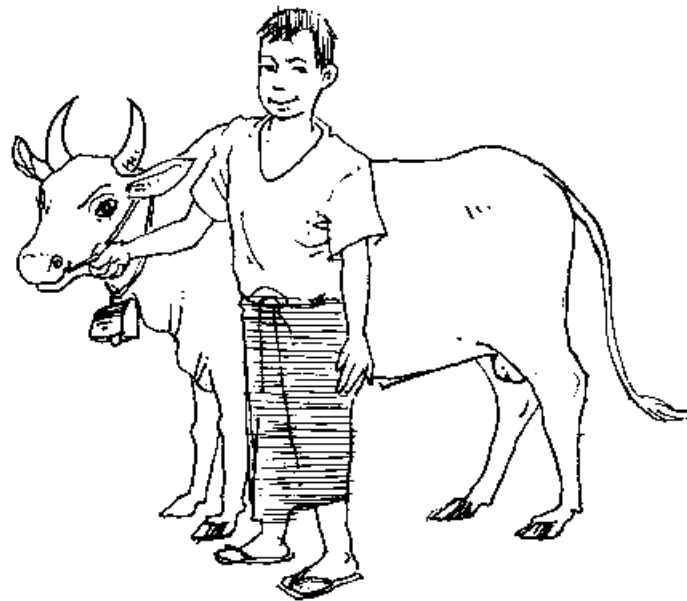






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# Sick/unhealthy animal

- Has reduced appetite , Has fast or slow breathing
- lay down separated from the flock/herd
- Has ill appearance with a dull matted coat, hunched up stance, tail and ears down
- Has dry nose or discharge from the nose, eyes, mouth

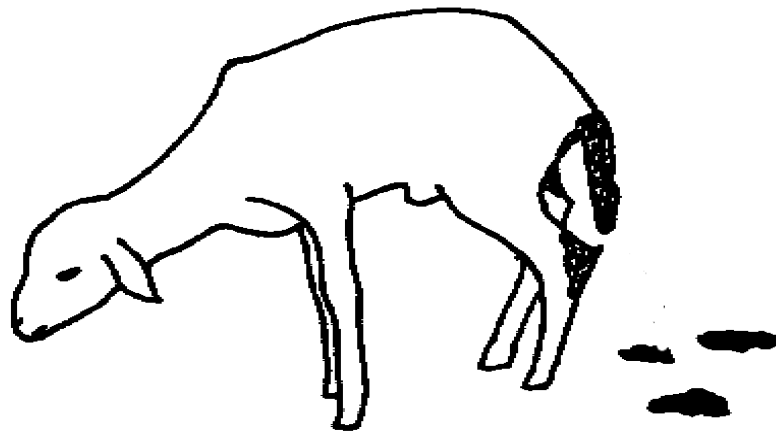
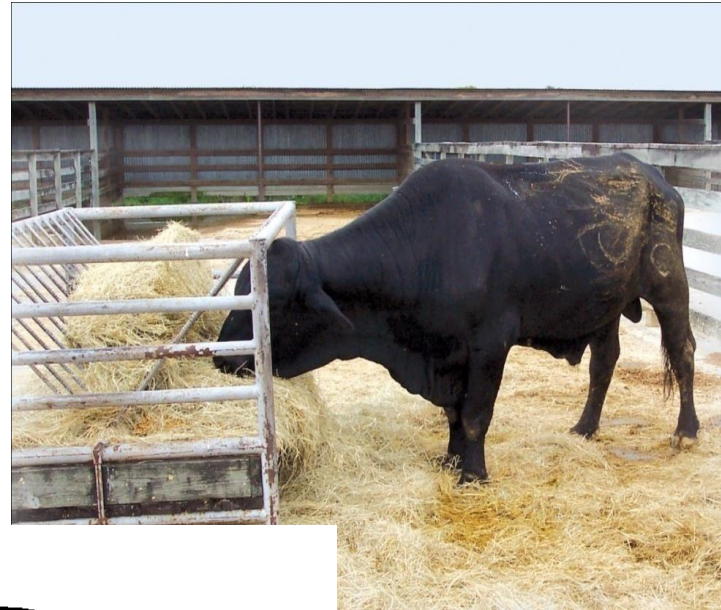
# Sick cont...

Unhealthy lambs/kids are

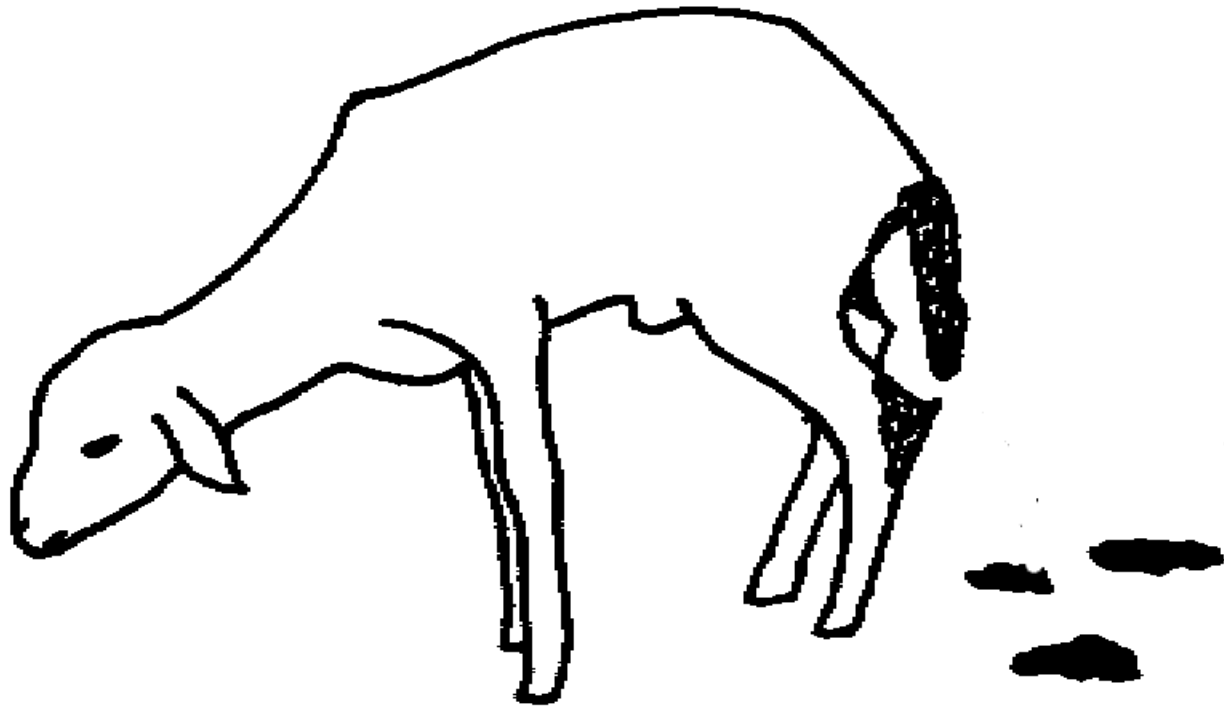
- Often unwilling to move or feed, they appear weak, cold, lazy and hunched up.
- Unhealthy older lambs/ kids show similar clinical signs. Often they stand separate from the rest of the flock in pain, scouring, moving slowly



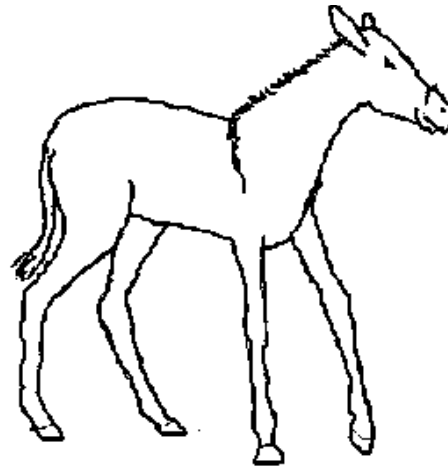
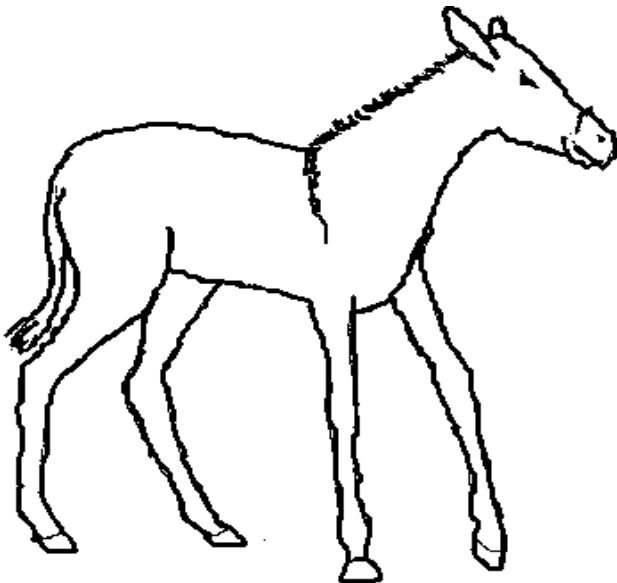
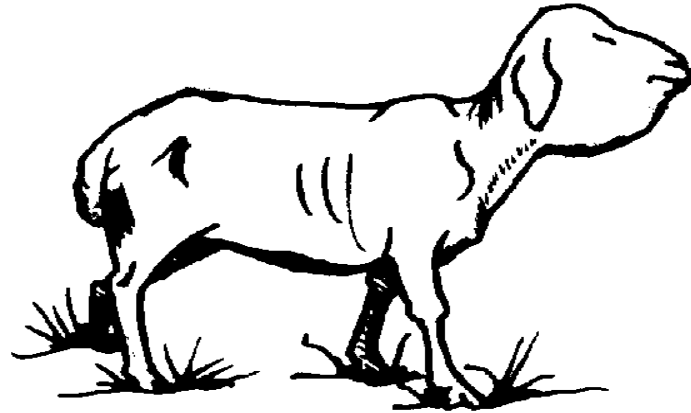
# Pictures of diseases that cause diarrhea



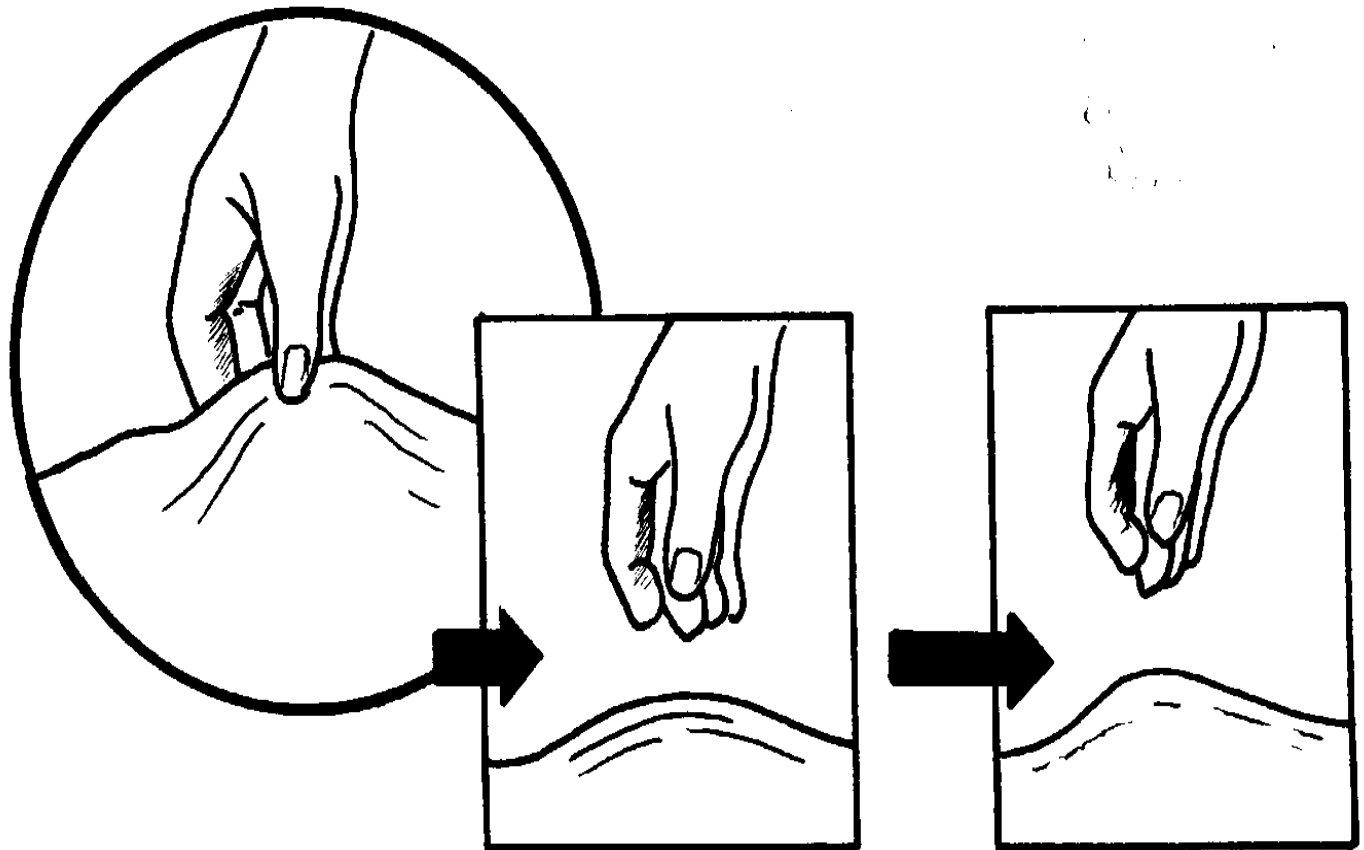
# Pictures of animals in diseased/sick conditions

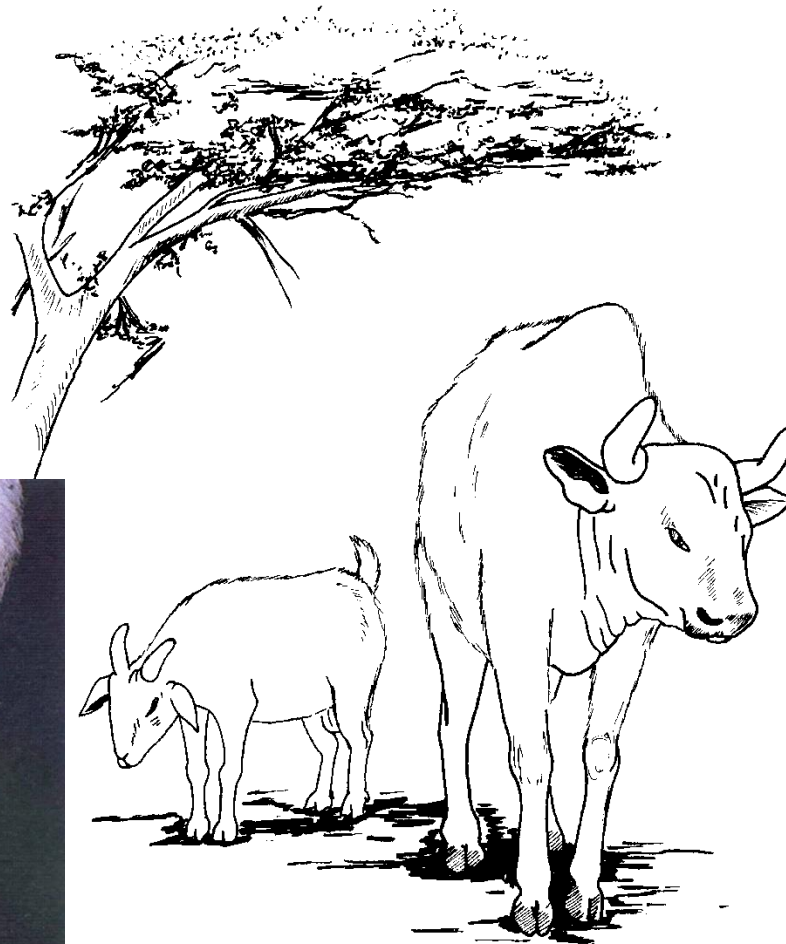


# Lameness. fasciolosis



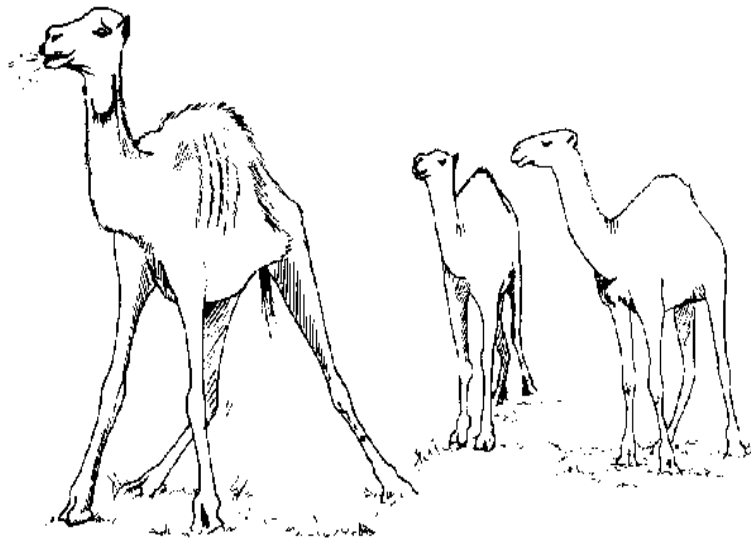
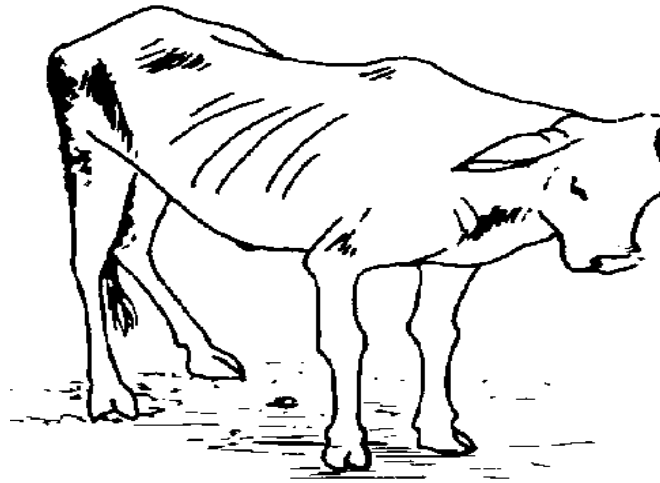
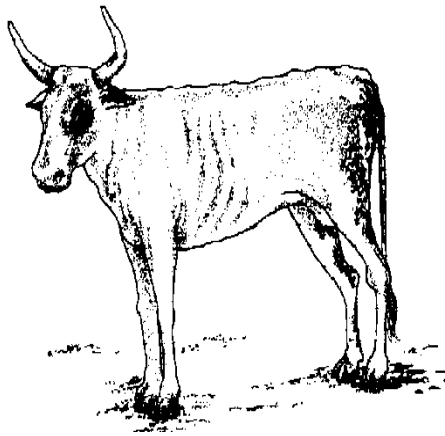
# Dehydration problem





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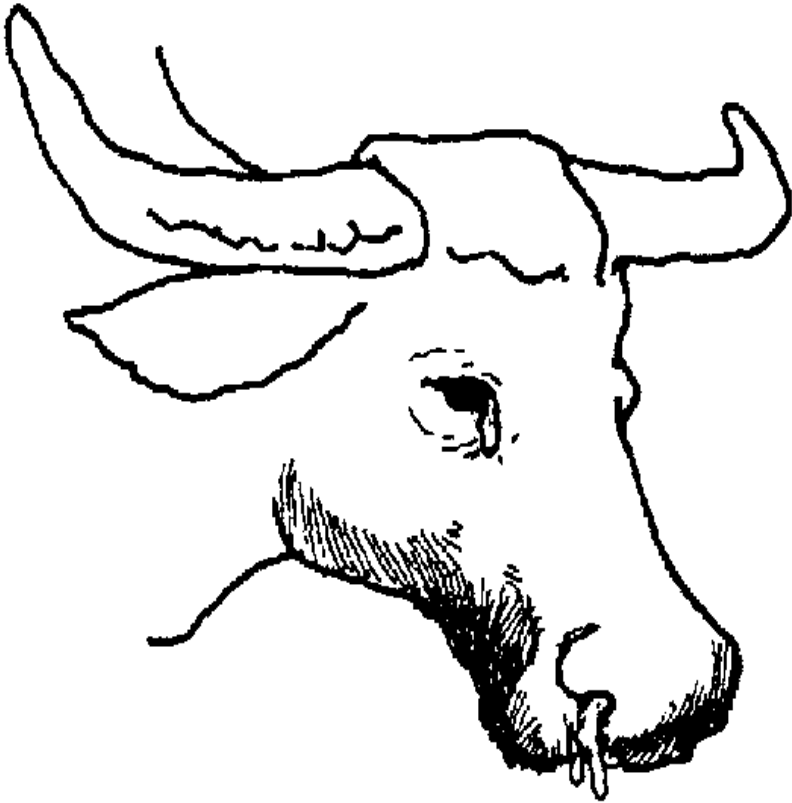
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# Eye problem



# Respiratory problem/Nasal discharge





# Skin disease



# Milk fever,



Milk fever  
(HYPOCALCEMIA)

# Mastitis



# Classification of disease

Based on the nature of its cause disease could be broadly classified as:

- ☺ Infectious diseases: are associated with living agents, such as bacteria, virus..
- ☺ Non infectious: Mechanical injuries, nutritional deficiencies, poisoning, genetic disorder...

# Bacterial & viral infectious diseases

- Anthrax
- Blackleg
- Tetanus
- Mastitis
- Tuberculosis
- Brucellosis
- Shipping fever
- CBPP & CCPP
- FMD
- Newcastle disease

**So under each disease the following points will be discussed**

- **Definition of the disease**
- **Cause of a disease**
- **Epidemiology of each disease (distribution, host range, transmission, risk factors)**
- **Major clinical signs/symptoms**
- **Socioeconomic impacts of each disease**
- **Control and prevention measures**

# Anthrax

☐ In Animals and

☐ In humans



# Anthrax (Synoname= Spleenic fever)

## A. What is anthrax?

❖ Anthrax is an peracute, acute and sub-acute soil borne infectious disease of domestic and wild animals and man.

## *B. Etiology: Bacillus anthracis*

*It is a rod-shaped, square-ended, aerobic, gram positive, spore-forming organism. The spores are found centrally.*

*It is nonhemolytic, opaque white to gray on culture*

## Cont...

Local Names :” Afrit”, “Aba Sanga “

Sources of infection for animals :

- Soil
- Blood and one meal

Symptoms in animals. Fever, sudden death, blood oozes out of natural orifices (openings)

Mode of transmission in man:

- Contact. With hide or carcass.
- Ingestion :Raw meat
- Inhalation : of spores in tannery or wool factory



## Cont....

- *Favorable soil factors for spore viability are:*
  - ✓ *High moisture*
  - ✓ *Organic content*
  - ✓ *Alkaline pH*
  - ✓ *High calcium concentration*

*Spores resistant to extreme temperature, chemicals & disinfectants*

*Pathological factors:* *It has three Virulent antigens*

- *Protective antigens (factor)*
- *Edema toxin*
- *Lethal toxin*

# C. Epidemiology

**Distribution:** worldwide but not common in West.

**Source of Infection:**

- Contaminated soil.
- Contaminated feed and water.

**Transmission and Route of Infection:**

Human to human or animal to animal transmission is rare ( not contagious)

**Animals**

- Ingestion
- mechanical (bitting flies)

**Humans**

- Contact (Cutaneous anthrax)
- Ingestion (Pulmonary anthrax)
- Inhalation (Intestinal anthrax)

## *Anthrax Bioterrorism*

- Attacks–United States, 2001
- *B. anthracis* sent through U.S. mail
- 22 cases (11 inhalation, 11 cutaneous)

## Patterns of Disease:

- **Epidemic:** are usually associated with drought, flooding, or soil disturbance.
  - A. Spread to contiguous geographic areas by infected animal
  - B. Non contiguous geographic areas by
    - biting flies
    - Vultures
    - Contaminated surface water pool
- **Sporadic:** During interepidemic periods, sporadic cases may help maintain soil contamination.

## Cont...

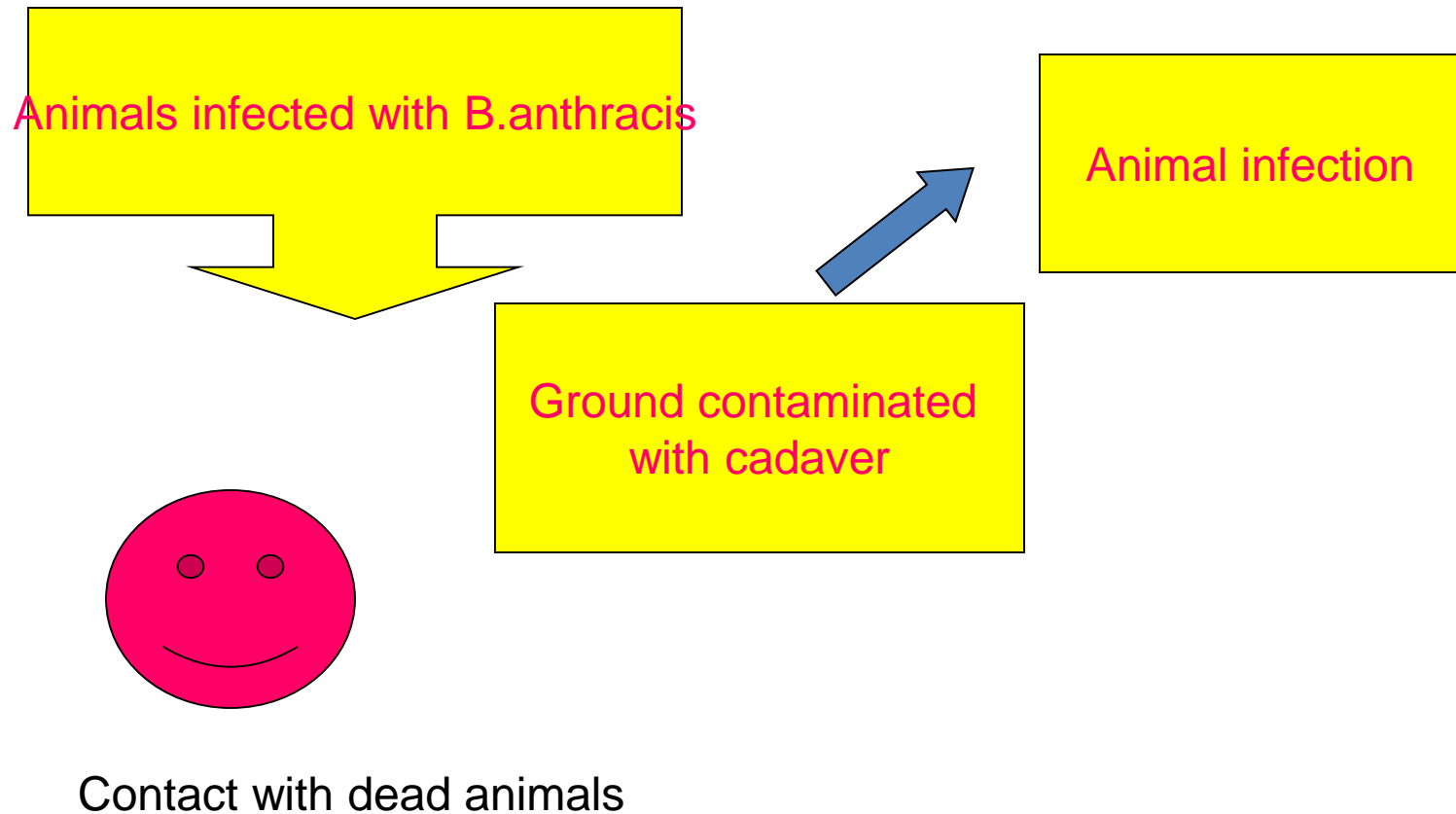
### Species Affected (host range) -.

**Rank in susceptibility:** cattle & sheep > man > goats & equine > swine, dog & cat.

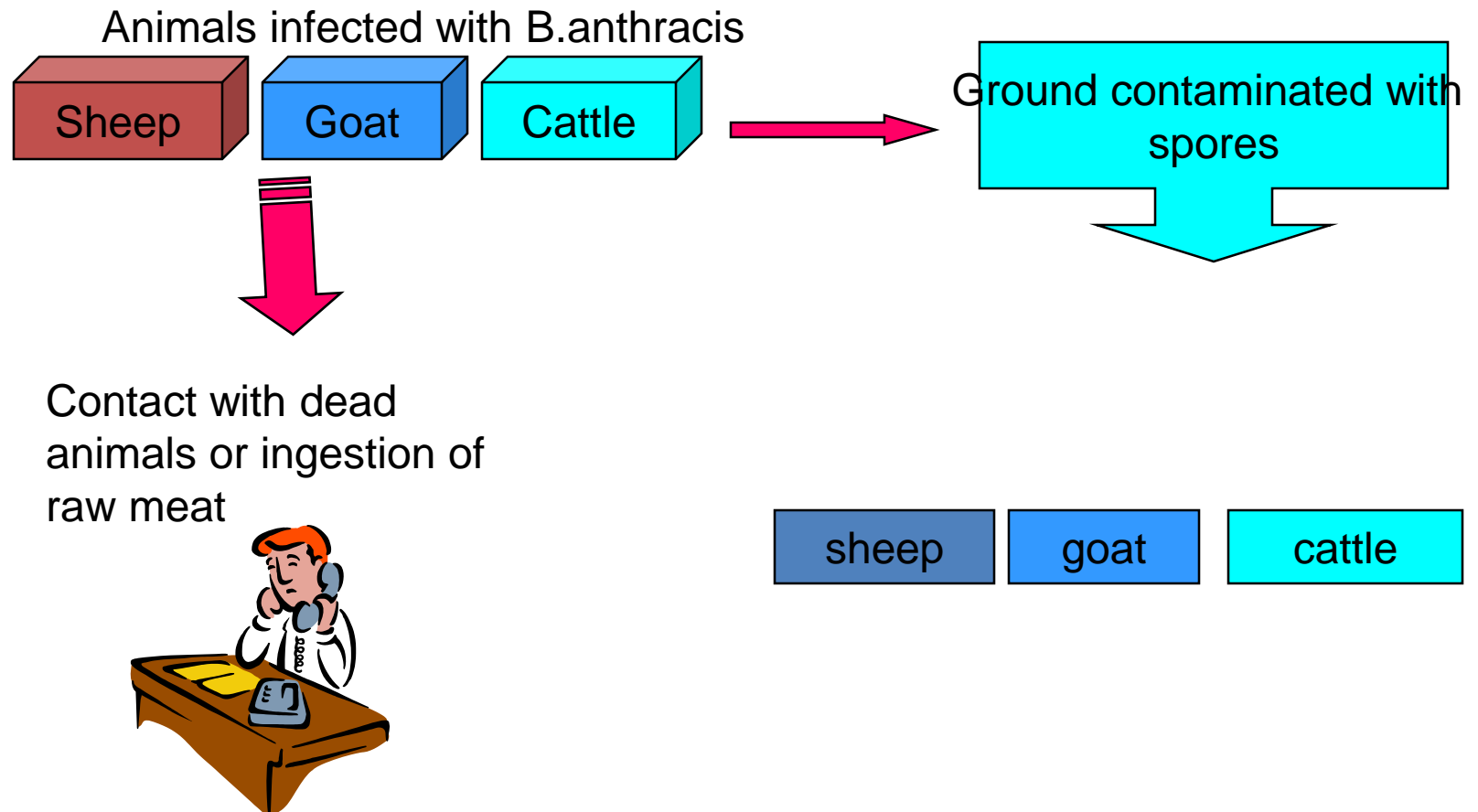
### Predisposing factors & occurrence

- Soil pH: alkaline suitable than acid for the spore to shift to vegetative form in the soil
- Climate change: flooding, heavy rain after drought, or warm & humid weather
- Heavy grazing in previously contaminated pasture, water holes
- Effluent from tanneries, abattoirs

# Anthrax Transmission cycle



# Anthrax: transmission cycles



# Cont....

## E. Clinical findings -

The incubation period varies from 2 to 10 days.

- ✓ Severe depression and listlessness are usually observed first.
- ✓ High body temperature up to 42° c
- ✓ Rapid and deep respiration.
- ✓ Congested and hemorrhagic mucous membrane.
- ✓ Increased heart rate.
- ✓ Anorexia and ruminal stasis is evident.
- ✓ Pregnant cow may abort.
- ✓ Milk may be stained with blood.
- ✓ Alimentary tract involvement is usual and is characterized by diarrhoea and dysentery.
- ✓ Local edema of the tongue, in the region of the throat, sternum, perineum and flank may occur.

# Anthrax :Clinical signs in man.

The diseases in man appears in 3 forms

1. Cutaneous (skin) form,
2. Pulmonary forms
3. Gastro intestinal form

- ❖ Pulmonary form is acquired through inhalation of spores from contaminated wool or hair.
- ❖ Gastro intestinal form: is acquired through ingestion of meat contaminated with the microorganisms.
- ❖ This is denoted by severe abdominal pain, fever and septicemia. It results exclusively from eating raw or undercooked meat.
- ❖ Lab acquired anthrax has been primarily the problem of technical assistants and veterinarians in anthrax research labs.



# Coetaneous anthrax in human



## F. Lesions (postmortem findings)

- ❑ Rigor mortis is absent or incomplete.
- ❑ Dark blood may ooze from the mouth, nostrils, and anus with marked bloating and rapid body decomposition.
- ❑ The blood is dark and thickened and fails to clot readily.
- ❑ Hemorrhages on the serosal surfaces of the abdomen, thorax, epicardium and endocardium. .
- ❑ An enlarged, dark red or black, soft, semifluid spleen is common.
- ❑ Congested and enlarged liver, kidneys, and lymph nodes .

# Postmortem examination.....

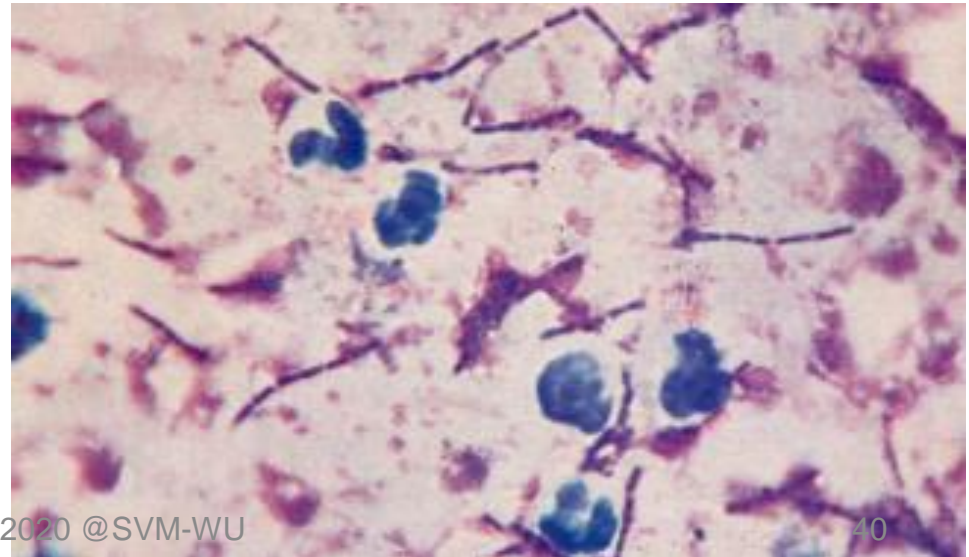
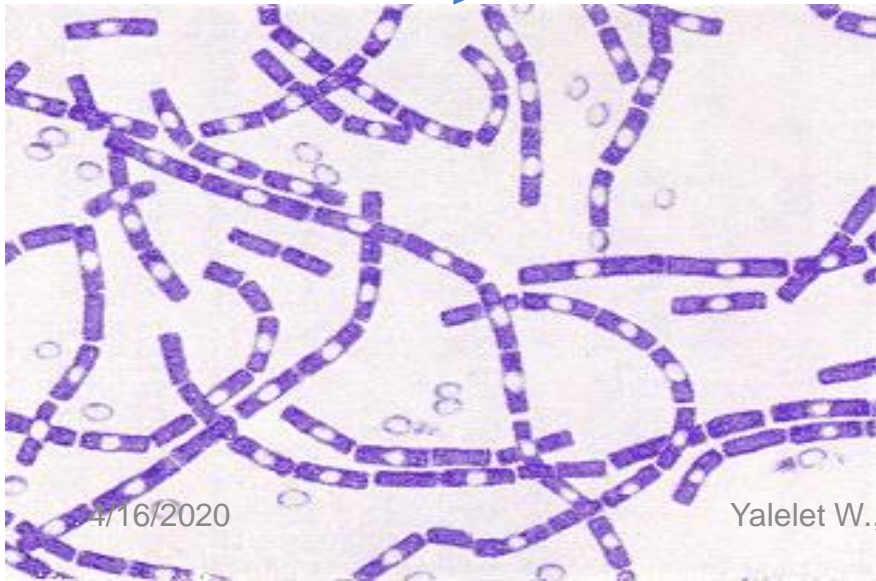


# Diagnosis

## 1. Identification of the agent:

**Sample:** Cotton swab dipped in whole blood and allowed to dry. In pigs- lymphatic tissue.

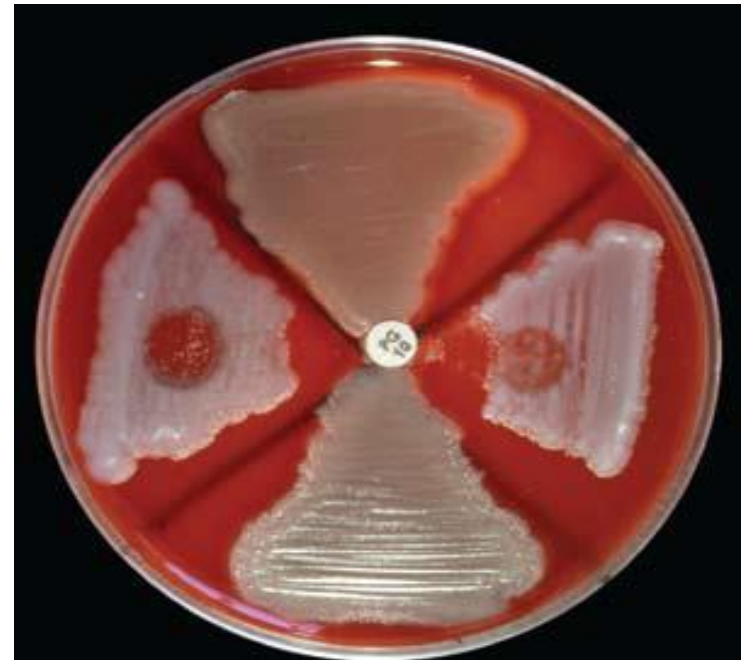
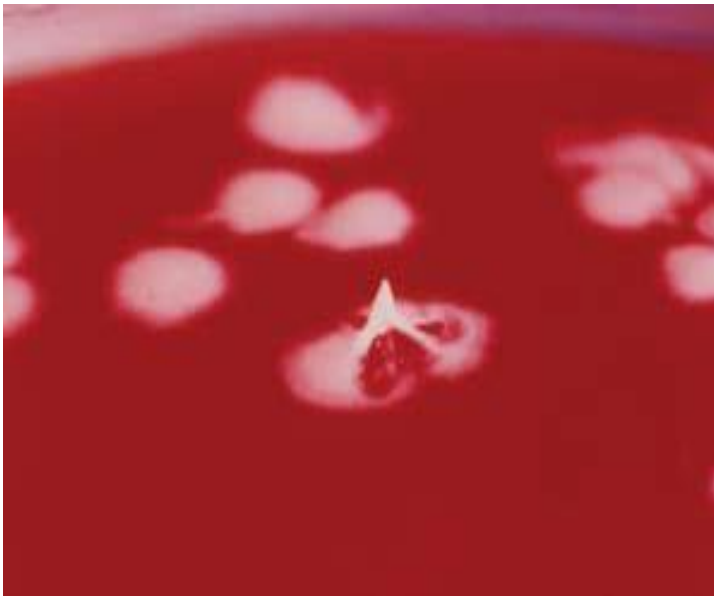
**1. Staining:** Gram Stain, polychrome methylene blue (M'Fadyean reaction )



**Sample:** Cotton swabs of blood, body fluids.

**2. Culture:** The colony is:

- large
- approximately 0.3–0.5 cm in diameter.
- grey-white to white
- non-haemolytic with a rough, ground-glass
- tacky consistency.





## H. Treatment, Control, and Prevention:

1. Annual vaccination: with nonencapsulated Sterne-strain vaccine.
  - Vaccination should be done 2-4 wk before the season when outbreaks may be expected.
  - Antibiotics should not be administered within 1 wk of vaccination.
2. Rapid detection and Reporting
3. Quarantine,

#### 4. Treatment of asymptomatic animals (postexposure prophylaxis)

- Livestock at risk should be immediately treated with a long-acting antibiotic.

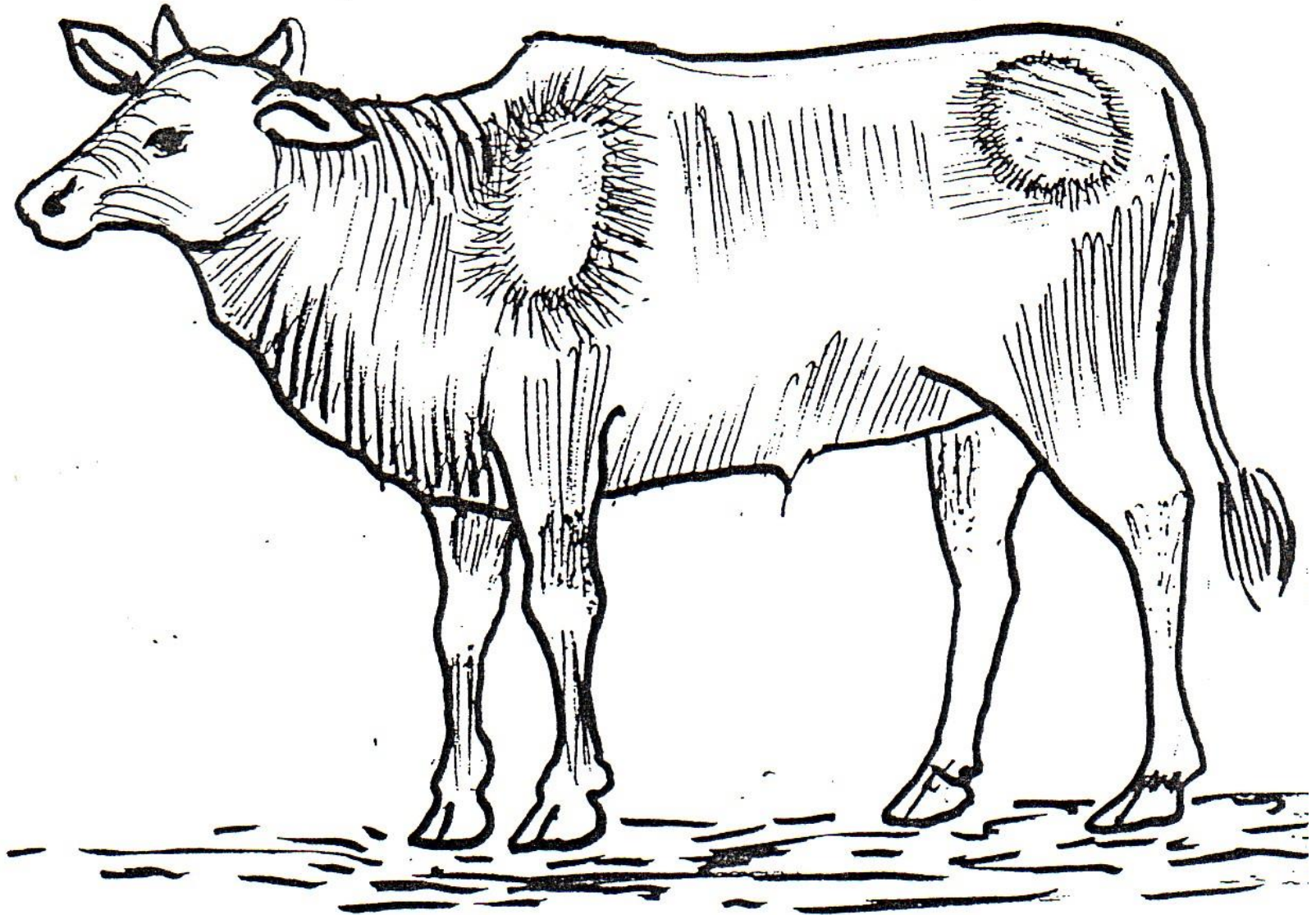
(penicillin, oxytetracycline, amoxicillin, chloramphenicol, ciprofloxacin, doxycycline, erythromycin, gentamicin, streptomycin, and sulfonamides)

- Followed by vaccination ~ 7-10 days after antibiotic treatment

#### 5. Burning or burial of suspect and confirmed cases.

#### 6. Observation of general sanitary procedures by people.

What do you know about this disease?





## 2.BLACKLEG

**Synonyms:** Black quarter

**Def.** Blackleg is an acute infectious but not contagious disease of cattle, goat and sheep and characterized by inflammation of the muscles, severe toxaemia and high mortality.

**Etiology:** caused by *Clostridium chauvoei*, a gram-positive, spore forming and toxin producing anaerobe. The spores are highly resistant to environmental changes and disinfectants and persist in the soil for many years.

# Cont...

**Occurrence:** The disease is wide spread in most of the tropical countries of the world. Blackleg is a soil-borne infection. In cattle the disease is largely confined to young stock between the ages of 6 months and 2 years and it appears to occur most frequently in rapidly growing cattle and highly nourished animals.

**Species Affected:** Cattle are the most susceptible animals but infection may spread to sheep and goats following trauma of muscles. Horse and pig can also be infected in a very rare occasion.

# Cont...

**Transmission:** The disease spread from contaminated soils. The organism gains entry through ingestion of infection feeds or possibly through contamination of wounds.

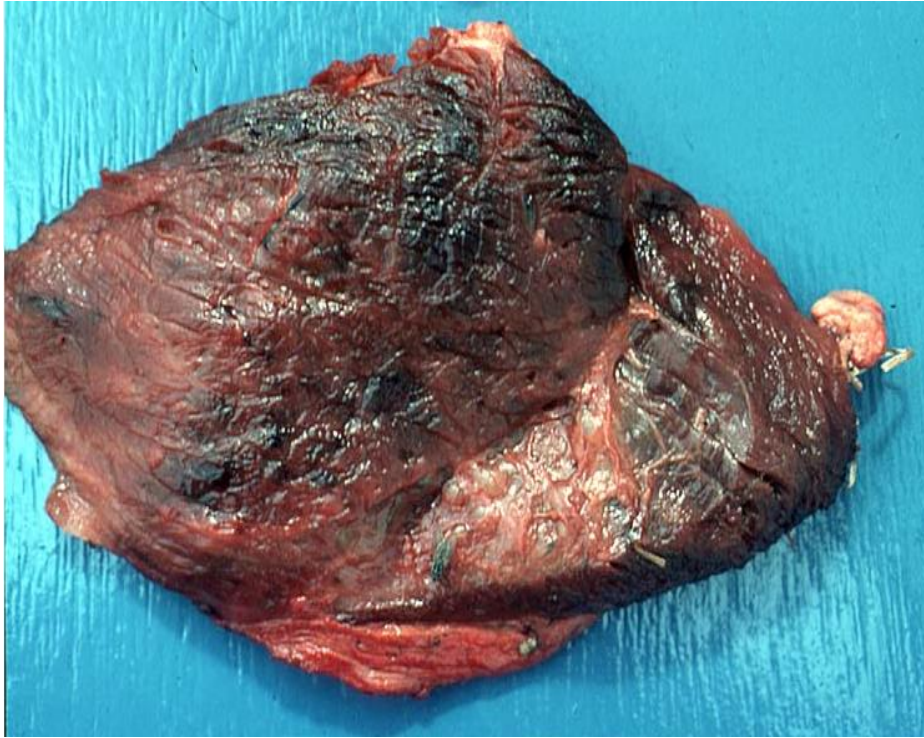
## **Clinical Findings:**

- Incubation period is usually 2 to 5 days.
- In cattle the first symptom is fever (41 °C).
- Anorexia, ruminal stasis and there is lameness in one of the limb.
- Swelling develops in thick layers of muscles. Most commonly the lesions are located on the thigh, shoulder, neck and lumbar region.
- Swellings are hot and painful in the early stage and become cold and painless later.
- The muscle tissues are swollen, dark in colour and turn dry.
- On palpation swellings emit cracking or crepitating sound due to emphysema.
- There is also laboured breathing and abdominal pain.

# Cont...

## Necropsy Findings:

- ✓ Crepitating swellings of the muscle
- ✓ Dark-red edematous fluid in the subcutaneous
- ✓ Affected muscles turn black.
- ✓ A rancid odour (butyric odour) emanate from the muscles
- ✓ Blood stained discharge may ooze from the nostrils but here the blood rapidly clots
- ✓ Rapid putrefaction and bloating occur.



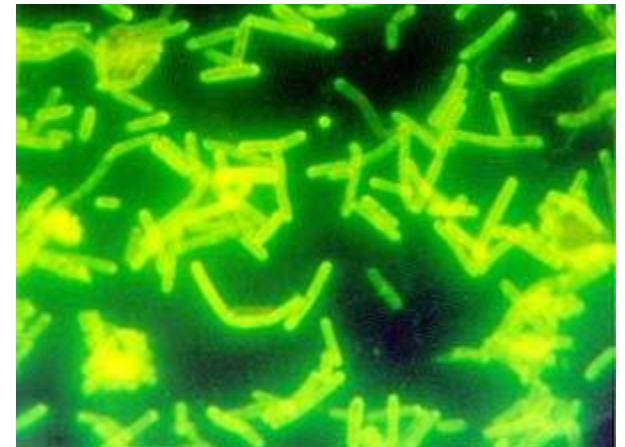
*Diseased muscle from a heifer that died suddenly from blackleg. The muscle tissue is dark red and has a dry appearance due to gas formation.*

# DIAGNOSIS

- In establishing a **diagnosis** the **clinical signs, history, epidemiology** and **necropsy findings** are very suggestive.

## Confirmation of diagnosis

- **Bacteriology:**
- **Samples for Bacteriology:-** muscle, impression smears of lesion.
- Definitive identification of *C. chauvoei* is by fluorescent antibody staining (FAT).



## DIFERENTIAL DIAGNOSIS

- Anthrax
- Malignant edema
- Lightning strike
- Bacillary hemoglobinuria
- Other causes of sudden unexpected death.



# Cont...

**Treatment:** Satisfactory response has been reported from the use of **penicillin** and oxytetracycline. The antibiotic may be injected into the affected muscles. Penicillin at the dose of 10,000 units / kg body weight / day is extensively used and considered as drug of choice.

## **Control:**

- In endemic areas annual vaccination of all cattle between 6 months and 2 years of age should be carried out prior to the anticipated danger period.
- Immunity following vaccination doesn't develop for 14 days and deaths may continue for some days if vaccination is carried out during an outbreak.
- Therefore, to avoid new cases during this time antibiotics (penicillin at a dose of 6000 unit / kg body weight intramuscularly) should be administered at the time of vaccination.
- The carcasses of animals dying of blackleg are destroyed by burning or deep burial to limit soil contamination.
- Mineral feeding to prevent soil licking
- Minimizing hardy and dry feed feeding

### 3. TETANUS (Synonym = lock jaw)

**1. Definition:** It is a highly fatal, non-contagious, non-febrile infectious disease of mammals caused by toxin and characterized by spasmodic contraction of skeletal muscles.

**2. Etiology:** *Clostridium tetani*. The organism is anaerobic and it is gram-positive bacteria. The bacteria is spore forming and are capable of persisting in the soil for many years. The spores are also resistant to many standard disinfectants.

**3. Occurrence:** Tetanus occurs in all parts of the world and in all farm animals as sporadic case. The portal of entry is usually through deep puncture of wounds. A high incidence castration, shearing, docking and vaccination of tetanus may occur following for other diseases in lambs.



# Cont...

## 4. Species Affected:

- ❖ Horse (most susceptible)
- ❖ Cattle (least susceptible)
- ❖ Human (beings are extremely susceptible)

## 5. Transmission:

- ✓ *C. tetani*. live in the faeces for a long period of time and thus remain as a potential source of infection to man and other animals.
- ✓ The organism gains entrance through deep punctured wound contaminated with bacteria spores.
- ✓ Organisms may gain access during **parturition** and manual handling of the genitalia with contaminated hands.

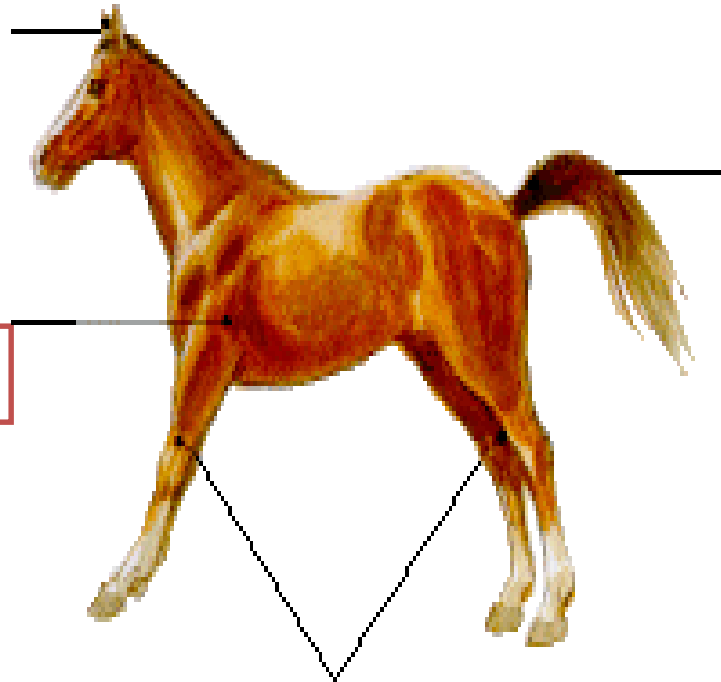
# Cont...

## 6. Clinical Findings:

The clinical picture is similar in all animal species.

- Prolapse of the third eyelid.
- Restriction of jaw movements
- Drooling of saliva from the mouth.
- Stiffness of the hind legs
- Erection of the ears
- Dilation of the nostrils and exaggerated responses to normal stimuli.
- As the disease progresses, muscular tetany increases and the animal adopts a '*Sawhorse*' posture.

Ears held pricked up



Tail held out and stiff

Paralysis of breathing  
muscles

Stiff legged gait

Calf with tetanus following castration.  
Note the rigid limbs due to muscle spasm.







# Cont...

**7.Diagnosis:** Fully developed tetanus is so characteristic clinically that it is seldom confused with other diseases. The muscular spasms, prolapse of the third eyelid and a recent history of accidental injury/surgery are characteristic findings.

## **8.Differential Diagnosis:**

- ✓ Strychnine poisoning
- ✓ Grass tetany
- ✓ Milk fever and
- ✓ Rabies may be confused with tetanus.

# Treatment

- The main principles in the treatment of tetanus are to:

Principles of Treatment	Treatment
Eliminate the causative bacteria	• Penicillin in large doses, IV
Neutralize residual toxin	• Tetanus antitoxin
Control muscle spasms	• Chlorpromazine (0.4-0.8 mg/kg (BW) IV, 1.0 mg/kg BW ,IM. three or four times daily) and • Acetyl promazine (0.05 mg/kg BW twice daily) administered until severe signs Subside. • A combination of diazepam (0.01-0.4 mg/kg) and xylazine (0.5-1.0 mg/kg, IM,IV)
Maintain hydration and nutrition	• Intravenous or stomach-tube feeding
Provide supportive treatment	• Good nursing care

Cont...

## 10. Control

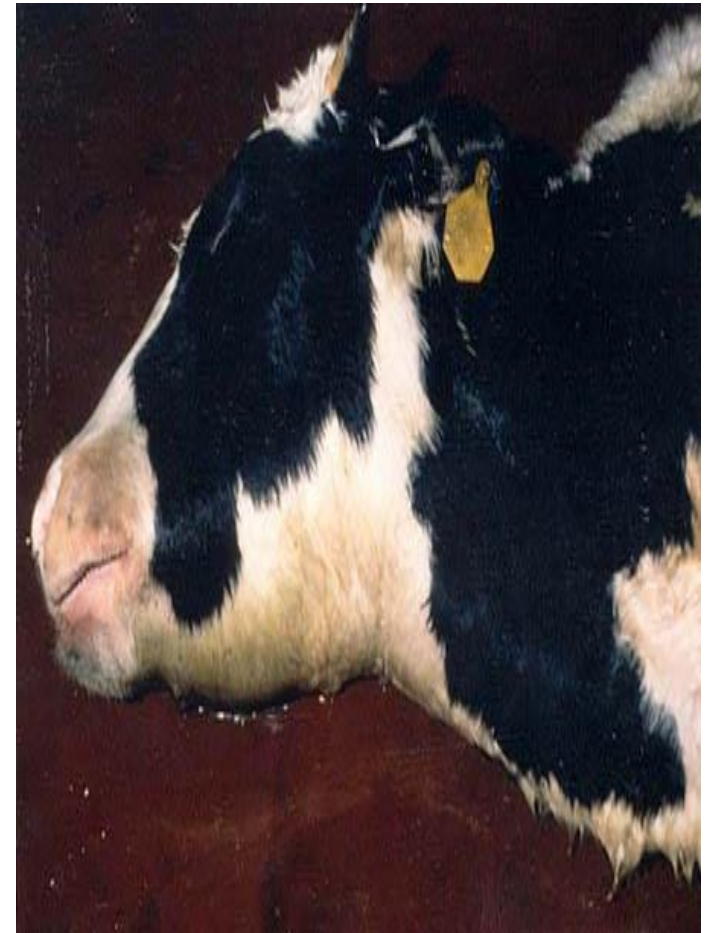
- Proper skin and instrument disinfection during castration, docking and **shearing** time.
- For short-term prophylaxis, passive immunity can be achieved by the injection of antitoxin subcutaneously.
- In endemic areas all susceptible animals should be actively immunized with 'toxoid' \_formalin treated toxin.
- Vaccinating their mothers at late pregnancy can protect young foals and lambs.



## 4. Pasteurellosis



# Septicemic pasturellosis



# Pasteurellosis....

- ➡ **Pasteurellosis** is a common **acute infection** occurring worldwide and resulting in a **bronchopneumonia** affecting cattle aged between **one month and two years**
- ➡ Pasteurellae are part of the **normal flora** of the **nasopharynx**
- ➡ A number of **factors**, including respiratory viruses, weaning, overcrowding and poorly ventilated buildings, transportation, adverse weather and starvation, promote an increase in numbers and/or **virulence** of pasteurellae in the nasopharynx and **invasion** of the lungs
- ➡ **M. haemolytica** is believed to be responsible for **up to 90%** of cases and the others are attributable to **Pasteurella multocida**

# Introduction ...

- ➡ **Septicemic pasteurellosis** of cattle (hemorrhagic septicemia or barbone), commonly associated with infection by ***P. multocida* type 1** or ***B***, characterized by a ***peracute septicemia*** and a ***high mortality rate***
- ➡ **Pneumonic pasteurellosis** of cattle commonly associated with infection by ***Mannheimia*** (formerly ***Pasteurella***) ***haemolytica biotype A serotype 1***
- ➡ Pasteurellosis in **pigs** is usually associated with infection by ***P. multocida*** and is mainly ***pneumonic*** in form
- ➡ Pasteurellosis of **sheep** and **goats** is usually associated with infection by ***M. haemolytica*** and, although it is often ***pneumonic*** in form, a septicemic form of the disease is not unusual, especially in lambs

# **4.1.PNEUMONIC PASTEURELLOSIS (SHIPPING FEVER PNEUMONIA)**

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# Etiology

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- ➡ *Mannheimia (Pasteurella) haemolytica* biotype A serotype 1 is the most common cause
- ➡ History of **stressors** (such as transportation, mixing of groups of cattle from different sources, confinement of cattle and ineffective housing and ventilation) and infection with viruses or mycoplasmas may act synergistically to allow the bacteria to be pathogenic
- ➡ Also known as '**shipping fever**' because the disease occurs after transportation, often over very large distances and taking several days
- ➡ Impact : Death

# Epidemiology

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## Occurrence

- ➡ Common disease of **young growing cattle**, most commonly in recently weaned beef calves 6 - 8 months of age shortly after being placed into feedlots

## Risk factors

### *Animal risk factors*

- ➡ The disease occurs most commonly in **young growing cattle** from 6 months to 2 years of age but all age groups are susceptible
- ➡ **Calves** that are **non-immune** to *M. haemolytica* are considered to be more susceptible



# Epidemiology ...

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## Risk factors ...

### *Environmental and management risk factors*

- ➡ **Mixing** of cattle from different sources and different age
- ➡ **Deprivation** of feed and water
- ➡ **Confinement** in unfamiliar surroundings, drafty or humid and poorly ventilated barns, exposure to inclement weather, transport and fatigue are commonly followed by outbreaks of the disease in cattle

### *Pathogen risk factors*

- ➡ Infection with several different **viruses** and **mycoplasma** predispose to pneumonic pasteurellosis
- ➡ **Lung injury** caused by the organisms after entry into the lung is dependent on important virulence factors



# Epidemiology ...

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## Risk factors ...

### *Pathogen risk factors ...*

☞ **Four virulence factors** have been associated with *M. haemolytica*

1. **Fimbriae** - enhance the colonization of the URT
2. **Polysaccharide capsule** - inhibits complement-mediated serum killing as well as phagocytosis and intracellular killing of the organism
3. **Endotoxin (lipopolysaccharide)** - alter bovine leukocyte functions and is directly toxic to bovine endothelium
4. **Leukotoxin** - a heat-labile protein exotoxin, a pore-forming cytolysin that affects ruminant leukocytes and platelets

# Epidemiology ...

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## Method of transmission

- ☞ Transmission of pasteurellas probably occurs by the ***inhalation*** of infected droplets coughed up or exhaled by infected animals, in which the infection persists in the upper respiratory tract
- ☞ *M. haemolytica* and *P. multocida* are ***highly susceptible to environmental influences*** and it is unlikely that **mediate contagion** is an important factor in the spread of the disease

# Clinical presentation

- ➡ Affected cattle are **dull and depressed** and their respirations are rapid and shallow
- ➡ There may be a **weak protective cough**, which become more pronounced and frequent if they are urged to walk (*most noticeable after sudden exercise*), but *coughing is not a feature of pneumonic pasteurellosis*
- ➡ Mucopurulent **nasal discharge**, a crusty nose, and an **ocular discharge** are common
- ➡ The rectal temperature is typically **41 - 42°C**
- ➡ **More severely affected cattle** may **stand with the neck extended** and the **head lowered**, with **frothy saliva** at the mouth
- ➡ Clinical disease caused by **P. multocida** is generally **more severe**, with more evidence of thoracic pain

# Clinical presentation ...



*Young calf with  
pasteurellosis is dull  
and inappetent*



*Severely affected animal  
is standing with its  
neck extended, the  
head lowered and with  
frothy saliva*

# Prevention and control

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- ➡ Successful control begins with the **adoption** (**integration**) of *effective management techniques* when beef calves are still on the range, the *judicious use of efficacious vaccines* and *antimicrobials prophylactically*, and *care* in handling and transportation of cattle

## Management strategies

### *Preconditioning programs*

- ➡ Prepare the weaned calf for the feedlot environment by *vaccinating* it for all the commonly anticipated diseases before weaning and *distributing all stressful procedures* such as castration, dehorning, branding, and deworming over a period of time rather than concentrating these at weaning time



# Prevention and control ...

## Conditioning programs

- ☞ In the **absence of preconditioning programs**, conditioning programs become the usual procedure for preparing beef calves or yearlings for the feedlot
- ☞ Begins with movement of the animals from their farm source to the feedlot, ***move the cattle directly from the ranch to the feedlot***; avoiding public sale yards
  - ✓ *Minimize the stress of handling, overcrowding, temporary starvation, exposure to aerosol infection from other cattle, and the unnecessary delays associated with buying and selling cattle*

# Prevention and control ...

## Vaccines

- ➡ **Modified-live *M. haemolytica* and *P. multocida*** vaccine in calves between 14 and 20 days of age was effective in increasing titers of antibodies against *M. haemolytica*
- ➡ Replicate at the site of injection and produce the important immunogens that stimulate a protective immune response
  - ✓ *However, live vaccines are associated with side-effects such as fever, local abscessation, and lameness*

# **4.2.SEPTICEMIC PASTEURELLOSIS (HEMORRHAGIC SEPTICEMIA,**

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# Etiology

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- ☞ Hemorrhagic septicemia is caused by **two serotypes** of *P. multocida*; namely, **B:2** and **E:2**
- ☞ The **letter denotes** the **capsular antigen** as determined originally (**Asian serotype** is designated **B:2**, and the **African serotype** is **E:2**) by the indirect hemagglutination test
- ☞ The **numeral 2 stands** for the **somatic or O antigen** as determined by the agar gel diffusion precipitin test

# Epidemiology

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## Occurrence

- 👉 Animals of **all ages** are **susceptible** but the **most susceptible** age group is **6 months to 2 years of age**
- 👉 There is **no difference** in susceptibility between **breeds**
- 👉 In **endemic areas**, adult animals develop a **naturally acquired immunity** and large outbreaks no longer occur in these areas
- 👉 **Spread** occurs by the **ingestion of contaminated foodstuffs**, the infection originating from clinically normal carriers or clinical cases, or possibly from ticks and biting insects

# Epidemiology ...

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## Transmission

- ☞ The disease is **transmitted** by *direct* and *indirect contact*
- ☞ The **source** of the infection is *infected animals* or *carriers*
- ☞ **Close herding** and **wetness**, as occurs during the *rainy season*, appear to contribute to spread
- ☞ **During intervening periods** the causative organism persists on the *tonsillar* and *nasopharyngeal mucosa* of carrier animals

# Clinical presentation

- ➡ **Majority of cases** are **acute** or **peracute** with death occurring from 6 to 24 hours after the first recognized signs
- ➡ **Dullness**, reluctance to move, and **Fever** are the **first signs**
- ➡ Following these signs, **profuse salivation** and **nasal discharge** appear, and **edematous swellings** are seen in the **pharyngeal region** and then spread to the ventral cervical region (throat, dewlap, brisket or perineum), and **severe dyspnea** may occur if the **respiratory system is obstructed**
- ➡ **Visible mucous membranes** are **congested** (submucosal petechiation), and **respiratory distress** is soon followed by **collapse** and **death**
- ➡ In the **later stages**, some affected animals develop **signs of pulmonary** or **alimentary involvement**

# Clinical presentation ...



*Extensive edematous swelling of the head and neck*



*Cow standing with its neck and head extended, evidence of thoracic pain*

# Control

## Vaccine

- ☞ **Stable vaccine** composed of **killed organisms** in an **adjuvant** base containing **paraffin** and **lanolin**
  - ✓ **Highly effective** especially when used **prophylactically**
  - ✓ **Immunity** after vaccination appears to be **solid** for **at least 12 months**
  - ✓ The only apparent **disadvantage** is the development of **persistent subcutaneous swellings** when the vaccine is improperly administered
- ☞ **Plain broth bacterins** or **alum-precipitated** and **aluminum hydroxide gel vaccines** are administered **twice a year** since these vaccines offer immunity of **4 – 6 months**



# Control ...

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## Vaccine ...

### ☞ Oil adjuvant vaccine (OAV)

- ✓ The **most efficacious** and gives both a **higher degree** and a **longer duration** of immunity, up to 1 year
- ✓ Vaccine of this type is **more slowly absorbed** and **produces a longer-lasting immunity** than do regular and alum-precipitated-type bacterins
- ✓ **Advantage** of requiring **only one dose** annually
- ✓ **Disadvantages** of being **difficult to syringe** and occasionally produces a **marked local reaction**



## 5. MASTITIS

**Mastitis** is inflammation of the parenchyma of the mammary gland.

It is therefore characterized by a range of physical and chemical changes in the milk and pathological changes in the glandular tissue.

Clinical cases: swelling, heat, pain and edema in the mammary gland.

Subclinical mastitis: no visible clinical signs

# Bovine Mastitis

## 1. ETIOLOGY

- 1.1 Contagious mastitis pathogens: which are spread from infected quarters to other quarters and cows. Eg. *M. bovis*, *brucella* spp, *leptospara* spp.
- 1.2 Teat Skin Opportunistic mastitis pathogens: that are normal teat skin inhabitants and eg. *Staplococci* spp, *streptococci* spp
- 1.3 Environmental mastitis Pathogens: which are usually present in the cow's environment and reach the teat from that source. Eg. *E.coli*

## 2. EPIDEMIOLOGY of mastitis

### Occurrence and prevalence of infection

#### 2.1 Source of infection

Contagious pathogens reside primarily in the udder of infected cows, E.g. *S. agalactiae* and *S. aureus*.

Teat skin opportunistic pathogens reside primarily on the teat skin of cattle.e.g. coagulase negative staphylococcus.

Environmental pathogens are common inhabitants of the cow's environment such as bedding. E.g. *S. uberis*, *S. dysgalactiae*, and *coliforms*.

### 3. Methods of transmission

- Infection of each mammary gland occurs via the teat canal which results **Environmental mastitis)**
- Infection originating from infected udders is transmitted to the teat skin of other cows by
  - ✓ Milking machine
  - ✓ Milkers' hands, wash cloths and
  - ✓ any other material that can act as an carrier.

Which results **Contagious mastitis**

## 2.3 RISK FACTORS

### Animal risk factors

- *Age and parity*: The prevalence of infected quarters increases with age and parity.
- *Stage of lactation*: most new infections occur in the dry period and in early lactation.
- *Breed*: the incidence of mastitis is greater in Holstein-Friesians than in Jerseys.
- *Milking characteristics and morphology of udder and teat*: *high milking rate* and *large teat canal* diameter have been associated with increased risk of infection.
- *Udder hygiene*: Dirty udders are associated with increased infection.
- *Nutritional status*: Vitamins E and selenium may be involved in resistance to certain types of mastitis.

- *Genetic resistance to mastitis:* a variety of morphological, physiological and immunological factors contribute to resistance or susceptibility to mastitis.
- *Milk yield:* animals genetically above average for milk yield are more susceptible to mastitis.
- *Other concurrent diseases:* retained placentas, teat injuries and teat sores may be associated with a higher incidence of mastitis.
- *Previous mastitis:* Cows with a history of mastitis are more susceptible to clinical mastitis.
- *Pre-existing intra mammary infections:* natural infection with minor pathogens has a protective effect against infections with major pathogens.

### 3. PRODUCTION AND ECONOMIC LOSSES

- Mastitis results in economic loss for producers by increasing the costs of production and by decreasing productivity.
- The component economic losses can be divided into:
  - ☐ Loss of milk production
  - ☐ Discarded milk from cows with clinical mastitis and treated cows
  - ☐ Replacement cost of culled cows
  - ☐ Extra labor required for treatment and monitoring
  - ☐ Veterinary service for treatment and control
  - ☐ Cost of first trimester abortions due to clinical mastitis
  - ☐ Cost of control measures.



**The production and economic losses are commonly divided into those associated with subclinical and clinical mastitis.**

Types of mastitis	Production and economic loss
Subclinical mastitis	• Total milk production losses (10-26 %).
	• discarded milk from treated cows
	• loss due to changes in composition (fat, casein, and lactose are reduced) (1 %)
	• Increased culling rates
	• costs of treatment
Clinical mastitis	• marked decreases in milk production and duration of lactation.
	• death of cows
	• complete loss of quarters
	• costs of treatment

# 5. CLINICAL FINDINGS

Three categories of **clinical mastitis**:

1. Abnormal milk,
2. Abnormal gland and
3. An abnormal cow (systemic disease).

Clinical mastitis can be categorized according to their severity.

1. **Peracute**: severe inflammation, with swelling, heat and pain of the quarter, with a marked systemic reaction, which may be fatal.
2. **Acute**: severe inflammation without a marked systemic reaction.
3. **Subacute**: mild inflammation with persistent abnormality of the milk.

# Clinical mastitis

## Abnormalities of the Udder

- Swelling
- Pain
- Increased warmth
- Gangrene in some cases
- Abscess formation in some cases

## Abnormalities of the milk

- decrease in milk yield
- presence of the products of inflammation (clots, discoloration, flakes)
- marked changes in the composition of the milk

## Abnormal cow

- pyrexia
- depression
- decreased appetite or milk production

## 6. DIAGNOSIS

### 6.1 Detection of clinical mastitis

- The initial diagnosis of clinical mastitis is made during the routine physical examination.
- Laboratory culturing of milk samples for bacteria.

### 6.2 Detection of subclinical mastitis

- Subclinical mastitis can only be detected by laboratory examination.

### *6.3 Detection at the individual cow level*

- Detection requires indirect tests and microbiological examinations.

# Indirect tests for subclinical mastitis

- Indirect tests include SCCs, the California Mastitis Test, increases in electrical conductivity of milk, and increases in the activity of cell associated enzymes (such as NAGase) in milk.

## Somatic Cell Count (SCC)

- SCC increases markedly with intramammary infection of the quarter.
- Healthy quarters have a SCC below 100 000 cells/mL, and this cut-point should be used.

# California Mastitis Test (CMT)

- The CMT is the most reliable and inexpensive cowside test for detecting subclinical mastitis.
- The CMT reagent contains a detergent that reacts with DNA of cell nuclei, and a pH indicator (bromocresol purple) that changes color when the milk pH is increased above its normal value of approximately 6.6 .
- The CMT is mixed with quarter milk samples is gently swirled; the result is read within 15 seconds as a negative, trace, 1, 2, or 3 reaction depending on the amount of gel formation in the sample.

## 6.3 Culture of individual cow milk

- An intramammary infection is defined as the presence of the same pathogen in duplicate samples collected immediately after each other, or the presence of the same pathogen in two of three consecutive cultures obtained on different sampling dates.

## 7. Necropsy finding:

Necropsy findings are not  
Of major interest in the  
diagnosis of mastitis.





# 8. TREATMENT

## Clinical mastitis



- should be treated with antimicrobial agents given by intra mammary infusion (all cases) and parenterally (selected cases).

## Dry cow therapy

- Dry cow therapy is the use of intramammary antimicrobial therapy immediately after the last milking of lactation.
- Intramammary infusions at drying off decrease the number of existing infections and prevent new infections during the early weeks of the dry period.

## 9. CONTROL

### ❖ Principles of control:

- A. Eliminate existing infections
- B. Prevent new infections
- C. Monitor udder health status

### ❖ Components of Mastitis Control Program:

1. Use proper milking management methods
2. Proper installation, function, and maintenance of milking equipment
3. Dry cow therapy
4. Appropriate therapy of mastitis during lactation
5. Culling chronically infected cows
6. Maintenance of an appropriate environment
7. Good record keeping
8. Monitoring udder health status
9. Periodic review of the udder health management program

# 6. Colibacillosis

**Synonyms:** Calf scour, white diarrhoea

**1. Def:** It is a diseases of new borne animals (calves, piglets, lambs and foals) caused by pathogenic *Escherichia coli* and characterized by marked prostrations, profuse diarrhoea and septicaemia. So there is enteric and septicemic colibacillosis.

**2. Etiology:** *E. coli* is the causative agent. The agent produces endotoxin. The virulence of *E.coli* varies depending on the absence or presence of Ags (pillus and fimbriae in order to adhere to the intestinal mucosa, those that do not have these are invassive so they enter in to the circulation to cause septicemia.

- ❖ K+99, K+88 are strains of *E.coli* that affect calf
- ❖ K98 are strains of *E.coli* that affect piglets

# 3. Epidemiology

## 3.1 Occurrence:

- The disease is common in farm animals under 3 days of age but it may occur as early as 12-18 hours after birth and occasionally occurs in calves up to several days of age when there is mixed infection with viral pathogens. There is high mortality in calves (10-75%) and piglets.
- Adverse climate (snow storm, wind, extreme heat & cold, poor hygiene, overcrowding are stress factors of the disease. So it is a disease of intensification (dairy farm).

**3.2 Species affected:** Incidence of colibacillosis is higher in dairy herds (calves) but also affect piglets, foals, lambs & kids.

### **3.3 Transmission:**

- The disease is transmitted through contaminated feed and water.
- In most species the major primary source of infection is the faeces of infected animals.
- In addition calves obtain the organism from contaminated bedding and calf pans, diarrheic calves, mastitic milk (coliform mastitis) and from the skin of the perineum and udder of the cow, and from the animal attendant.

## 5. Clinical findings:

The disease appears as **peracute**, **acute** or **chronic form**.

❖ **In per acute** infection there is marked diarrhoea, prostration and death within 12 hours

❖ **Acute** signs appear when the newborn animal is 1-2 days old. The usual signs are depression, inappetence, stiffness, sunken eyes, tucked up abdomen, rough hair coat, elevation of temperature and rapid pulse and respiratory rate. There are profuse loose faeces (yellowish brown to greyish white) with rapid peristalsis. There is straining in evacuation of faeces, which has a fetid odour. There is soiling of the anal, and hindquarter region. There is rapid dehydration and ultimately death.

❖ **Chronic cases** show joint ill, navel ill and pneumonia.

6. **Necropsy Findings:** in Per-acute cases there will not marked changes in organs, except hypermia of gastro-intestinal mucosa.
- Acute cases show edema and haemorrhages of the abomasal folds in calves. The intestinal mucosa will show hemorrhage and wrinkling.
  - In chronic cases, there is a suppurative change in the joints. Changes may be seen in umbilicus, lungs and kidneys.
8. **Diagnosis:** This is based on history, clinical findings, lesions, isolation of organism in culture and serological tests.



## 7. Treatment:

The consideration for treatment of acute neonatal diarrhoea includes.

- ❖ Alteration of the diet. i.e. provide readily absorbable substances such as glucose and electrolyte mixtures.
- ❖ Fluid & electrolyte replacement to prevent dehydration, acidosis and electrolyte imbalance. Give by parenteral or oral route. Glucose, sodium bicarbonate, sodium chloride; potassium chloride and water.
- ❖ Anti microbial therapy
  - Chloroamphenicol 25-50 mg/kg
  - Ampicillin 7-10 mg/kg for 5-7 days may be given orally or parentally.
  - Streptomycin and tetracycline may also be used.

## 8. Control

The following three principles are important in control of colibacillosis

- Reduce the degree of exposure of new borne calves and piglets to the infectious agent.
- Provide maximum non-specific resistance with adequate colostrums and optimum animal husbandry.
- Increase the specific resistance of the newborn by vaccination of the dam or the new born by *E. coli* K<sup>99</sup> antigen.
- **NB-**When outbreaks of colibacillosis occur, every effort should be made to isolate affected animals from other susceptible calves and piglets.
- Dieteric diarrhoea should be differentiated in which the faeces are voluminous, pasty to gelatinous in consistency; the animal is bright and alert.

## 7. Diseases associated with *Mycoplasma* species (called Mycoplasmosis)

2- types

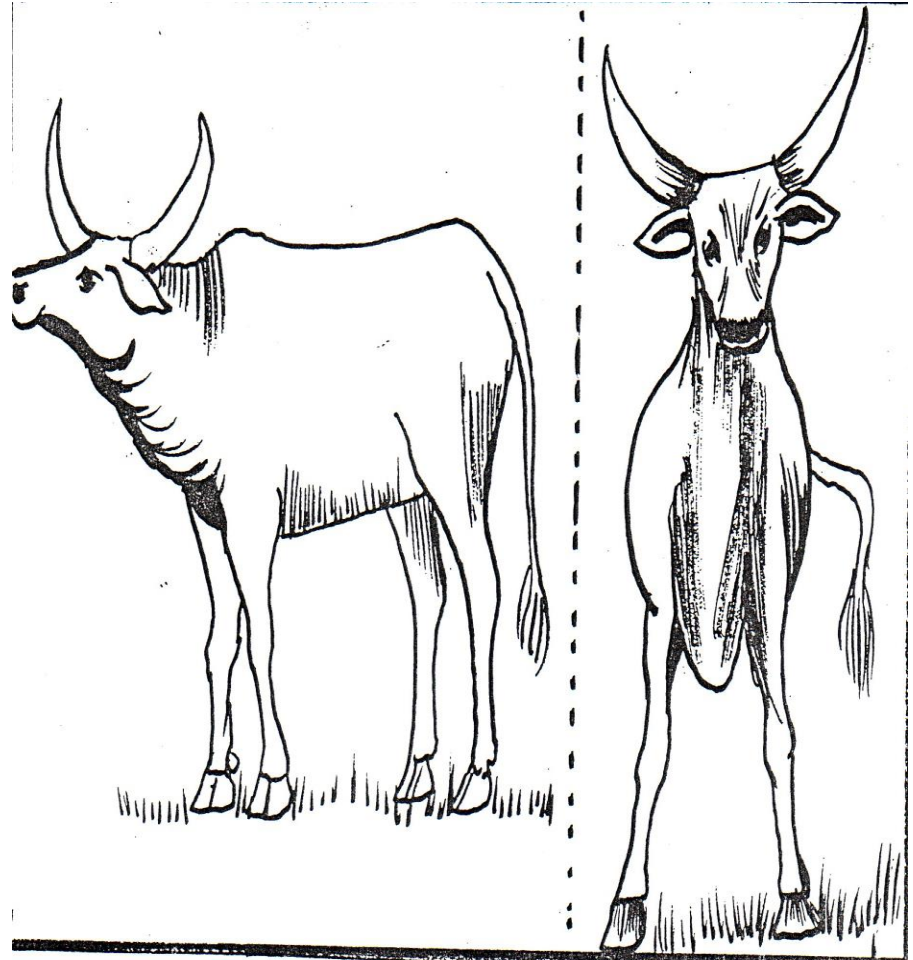
### 7.1. Contagious Bovine Pleuropneumonia (CBPP)

-This one affects cattle

### 7.2. Contagious Caprine Pleuropneumonia (CCPP)

-This one affects goats

# What do you know about diseases?



# Etiology

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- ➡ Contagious bovine pleuropneumonia (CBPP) is caused by *Mycoplasma mycoides mycoides* small-colony type
- ➡ Highly infectious acute, subacute, or chronic disease, primarily of *cattle*, affecting the *lungs* and occasionally the *joints*
- ➡ Survives well *only in vivo* and is quickly inactivated when exposed to normal external environmental conditions
- ➡ Many of the routinely used disinfectants will effectively inactivate the organism

## *Contagious caprine (goats) and bovine (bovine) pleuropneumonias*

- Caused by Mycoplasma agents
- cattle and goats
- transmitted by inhalation
- occurs in outbreak form
- impact
  - death
  - one reason for export restriction of animals from Ethiopia to other animals

# Epidemiology

## Host range

- ➡ Predominantly a disease of the genus **Bos**; both **bovine** and **zebu cattle** are naturally infected
  - ✓ *European breeds tend to be more susceptible than indigenous African breeds*

## Source of infection

- ➡ **Recovered 'carrier' animals** in which a **pulmonary sequestrum preserves a potential source of organisms** for periods as long as 3 years
- ➡ **Conditions of stress** due to starvation, exhaustion or intercurrent disease can cause the **sequestrum to break down** and **convert the animal into an active case**

# Epidemiology ...

## Transmission

- ☞ Transmission occurs from **direct** and **repeated contacts** between sick and healthy animals
  - ✓ *Relatively **close contact** is required for transmission*
- ☞ **Principal route** of infection is by the **inhalation** of infective droplets from active or carrier cases of the diseased animal
- ☞ **Mediate infection** by contamination of **inanimate objects** is **unlikely** under natural conditions
- ☞ Cattle exposed to infection for periods of up to 8 months before the disease becomes established and this necessitates a **long period of quarantine before a herd can be declared to be free of the disease**



# Clinical presentation

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- ➡ Usually the **first abnormality** noticed is a *depressed, inappetent* animal with *fever*
- ➡ *Coughing* may be the **next sign** followed by *evidence of thoracic pain* and an *increased respiratory rate*
- ➡ As **pneumonia progresses**, animals are *inclined to stand with elbows abducted* in an attempt to *decrease thoracic pain* and *increase chest capacity*
- ➡ When **pulmonary involvement** is **extensive** and **severe**, there will be much *labored respiration* and, sometimes, *open-mouthed breathing*
- ➡ CBPP often evolves into a **chronic disease** characterized by *ill thrift* and *recurrent low-grade fever*

# Clinical presentation ...

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- ☞ There is considerable **variation in the severity** of clinical disease from *hyperacute* to *acute* to *chronic* and *subacute* forms

## Acute form

- ☞ Sudden onset of high fever, a fall in milk yield, anorexia and cessation of rumination
- ☞ Coughing, at first only on exercise, and thoracic pain are evident; affected animals are disinclined to move, standing with the elbows out, the back arched and head extended

# Epidemiology ...

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## Risk factors

### *Animal risk factors*

- ☞ CBPP occurs **only in cattle**; rare natural cases have been observed in buffalo, yak, bison, reindeer and antelopes

### *Pathogen risk factors*

- ☞ *M. mycoides* subsp. *mycoides* is **sensitive** to all **environmental influences**, including disinfectants, heat and drying, and do not ordinarily survive outside the animal body for more than a few hours
- ☞ **Low incidence** can be anticipated in **arid regions** because of the **rapid destruction of the organism** in exhaled droplets

# Clinical presentation ...

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## Acute form ...

- ☞ Severe depression and the animals stand apart or lag behind a traveling group
- ☞ Respirations are shallow, rapid and accompanied by expiratory grunting
- ☞ Edematous swellings of the throat and dewlap may occur and swelling of the large movable joints may be present

## Hyperacute form

- ☞ Affected cattle may die within 1 week after the onset of respiratory distress

# Clinical presentation ...

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## Chronic and subacute forms

- ➡ **Recovered animals** may be clinically normal but in some an **inactive sequestrum** forms in the **lung**, with a necrotic center of sufficient size to produce a **toxemia** causing *unthriftiness*, a *chronic cough*, and *mild respiratory distress* on exercise

## Necropsy findings

- ➡ The **interlobular septae** are prominently distended with *amber-colored fluid* surrounding distended lymphatics
- ➡ This fluid distinctly outlines the **lobules** which vary in color with *red*, *gray*, or *yellow hepatization*
- ➡ **Consolidation** of the lungs with a typically *marbled appearance* is characteristic



# Clinical presentation ...



*Extended neck and head  
is due to respiratory  
distress and coughing*



*Prominent interlobular  
septal thickening or  
"marbling" in a section  
of lung affected with  
CBPP*

# Control and prevention

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## Vaccination

- ➡ **Modified live vaccine** is available for use in *enzootic* areas, often given in the *tail tip*
- ➡ Immunity subsequent to vaccination is generally good and lasts at least 12 months

## Prevention

- ➡ Sufficient **regulatory restrictions** to *prevent its introduction* in apparently healthy animals because CBPP is a *chronic disease* that may exist subclinically in carrier animals
- ➡ **Serologic testing** of susceptible animals for *importation* is a recommended safeguard

# Control and prevention ...

## Eradication

- ☞ Successful control of the spread rests on **removing susceptible animals** from any possible contact with CBPP-infected animals, whether they are clinically affected or subclinical carriers only
- ☞ In an **outbreak situation**: *testing*, *slaughter*, and *quarantine* would be the methods of choice
  - ✓ *Slaughter of all sick and in-contact cattle*
  - ✓ *Slaughter of all sick cattle and vaccination of in-contact cattle*
  - ✓ *Vaccination of healthy cattle with slaughter of sick cattle in an epidemic and revaccination of cattle at risk*



# 7.1. Contagious caprine pleuropneumonia

- ☞ Contagious caprine pleuropneumonia (CCPP) is an *acute highly contagious* disease of **goats** caused by *M. mycoides* subsp. *mycoides large colony* and *M. mycoides* subsp. *capri*
- ☞ Characterized by *fever, coughing, severe respiratory distress*, and *high mortality*
- ☞ The **principal lesion** at necropsy is *fibrinous pleuropneumonia*

# Epidemiology

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## Occurrence

- ☞ CCPP is one of the **most serious fatal diseases** of goats
- ☞ CCPP has many similarities clinically and at necropsy to CBPP, but it is **not transmissible to cattle**, and the **illness** is **acute** and **severe**

## Host range

- ☞ Contagious caprine pleuropneumonia is a disease of **goats**
  - ✓ *Only goats were involved in spite of the presence of sheep and cattle*

# Epidemiology ...

## Transmission

- ☞ CCPP is transmitted by **direct contact** through *inhalation* of infective aerosols
- ☞ The organism does **not survive for long outside** the animal body and the infection is brought into the flock by a *carrier* or *infected animal*
- ☞ **Outbreaks** of the disease often occur *after heavy rains* and *after cold spells*
  - ✓ *Because recovered carrier animals start shedding the mycoplasmas after the stress of sudden climatic change*

# Clinical presentation

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- ➡ Clinical findings in CCPP are **restricted to the respiratory system** and include *cough, dyspnea, lagging, lying down a lot* (but the animal can stand and walk) and *fever*
- ➡ In the **terminal stages**, *mouth-breathing, tongue protrusion* and *frothy salivation* with death in two or more days
- ➡ **Under adverse climatic conditions** the disease may occur in a *septicemic form* with little clinical or postmortem evidence of pneumonia

# Control and prevention

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- 👉 **Herd biosecurity** to **prevent contact** with infected animals is important
- 👉 **Vaccination** with an ***inactivated mycoplasma F38 vaccine***
  - ✓ *Induces an immune response which is effective in **reducing morbidity and mortality rates**, and a booster dose 1 month after the first vaccination provides additional protection*
  - ✓ ***Immunity*** is generally ***short-lived***

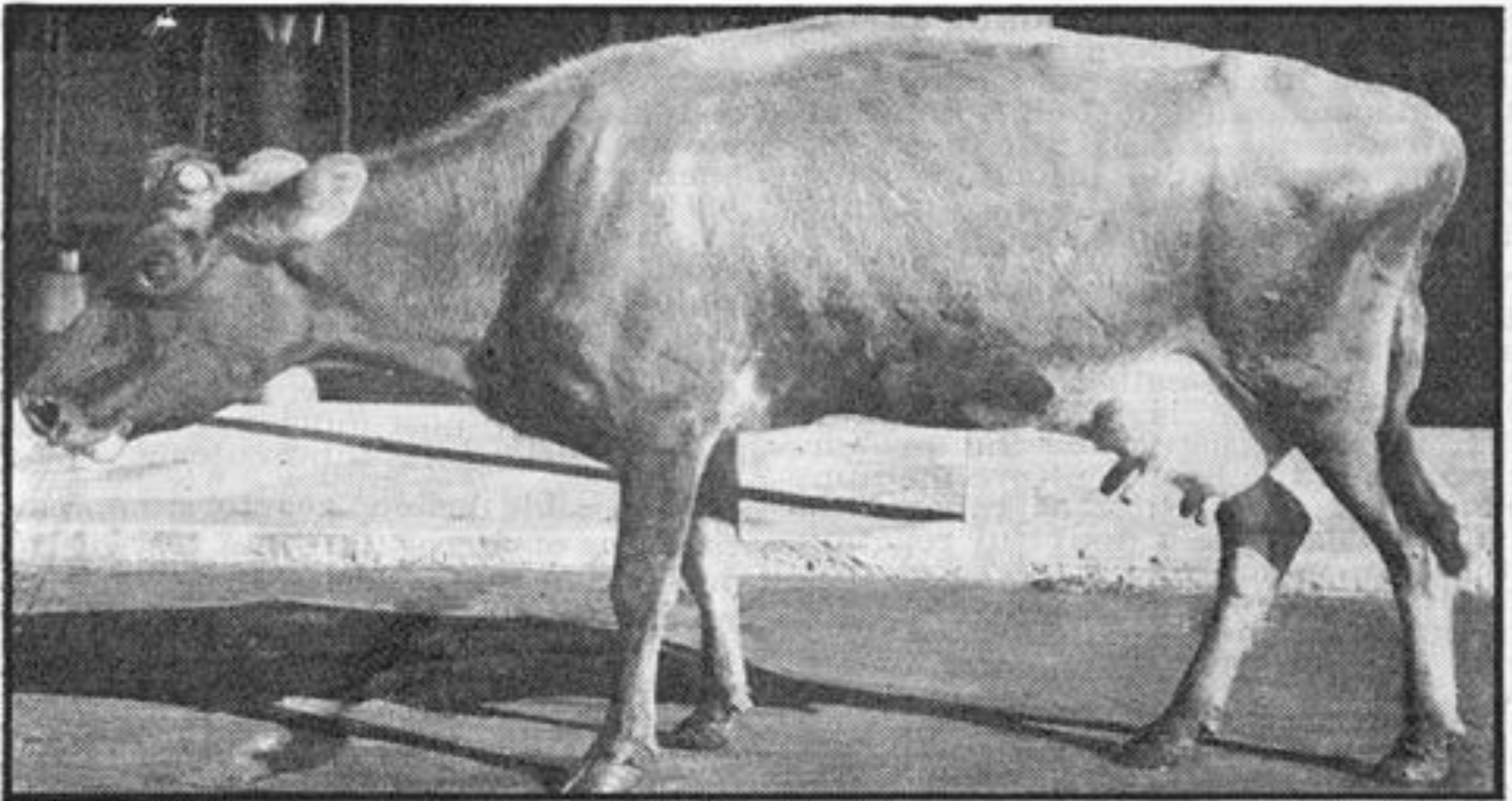
# Control and prevention ...

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## Eradication

- ☞ Sufficient **regulatory restrictions** should be maintained to ***prevent introduction of CCPP*** into apparently healthy animals
- ☞ **Serologic testing** of susceptible animals for ***importation*** is a recommended safeguard
- ☞ Successful **control of the spread** rests on ***removing susceptible animals from any possible contact*** with CCPP-infected animals, whether they are clinically affected or subclinical carriers only
- ☞ In an **outbreak situation**: ***testing, slaughter, and quarantine*** would be the methods of choice

# What do you know about this disease



Cows in the last stages of tuberculosis become weak and emaciated.



## 8. Tuberculosis

Definition: Tuberculosis (TB) is an infectious, granulomatous disease caused by acid-fast bacilli of the genus *Mycobacterium*.

- impact

- loss of body condition
- discarded milk
- culling of diseased cows and bulls
- transmission to humans



# Bovine Tuberculosis (BTB)

☞ It is an infectious disease of cattle caused by *M. bovis* and characterized by progressive development of tubercles in any organs of the body

## ☞ Etiology

☞ *Mycobacterium bovis* is the specific cause of tuberculosis in **cattle**

☞ In addition, a new species, *Mycobacterium bovis* subsp. *caprae* previously classified as *Mycobacterium tuberculosis* subsp. *caprae* has been identified as a cause of infection in **goats** and **humans**

# Epidemiology

## Occurrence

- 👉 **All species**, including humans, and **age groups** are **susceptible** to *M. bovis*, with cattle, goats, and pigs **most susceptible** and sheep and horses showing a **high natural resistance**

## Source of infection

- 👉 **Infected cattle** are the **main source** of infection
- 👉 Organisms are **excreted** in the **exhaled air**, in **sputum**, **feces**, **milk**, **urine**, **vaginal** and **uterine discharges**, and discharges from **open peripheral lymph nodes**
- 👉 Cattle in the **early stages** of the disease, before any lesions are visible, may also **excrete viable mycobacteria** in **nasal** and **tracheal mucus**

# Epidemiology ...

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## Methods of transmission

- ☞ Commonly entry is effected by **inhalation** or **ingestion** of *M. bovis* shed by other infected herd-mates or wildlife reservoirs
- ☞ **Inhalation** is the almost invariable portal of entry in *housed cattle*
- ☞ **Infection by ingestion** is possible at *pasture* when **feces contaminate** the *feed* and *communal drinking water* and *feed troughs* but a **large infective dose** is required
- ☞ **Drinking of infected milk** by **young animals** is a common method of transmission where the disease is *endemic*

# Epidemiology ...

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## Methods of transmission ...

- ➡ Other **uncommon routes** of infection include **intrauterine infection** at coitus, by the use of *infected semen* or of *infected insemination* or *uterine pipettes*
- ➡ **Intramammary infection** by the use of *contaminated teat siphons* or by way of *infected cups* of milking machines
- ➡ The feeding of **tuberculous cattle carcasses** to pigs has also caused a *severe outbreak of the disease*
- ➡ **Stockmen with genito-urinary infections** have transmitted infection to cattle through *urinating in the cattle environment*

# Epidemiology ...

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## Risk factors

### *Environment risk factors*

☞ **Housing predisposes** to the disease (*high stocking intensity*)

✓ *The closer the animals are in **contact** the greater is the chance that the disease will be transmitted*

☞ Amongst **beef cattle** the degree of infection is usually much **lower** because of the *open range conditions under which they are kept*

# Epidemiology ...

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## Risk factors ....

### *Host risk factors*

- ☞ **Zebu** (*Bos indicus*) type cattle are thought to be much **more resistant** to tuberculosis than **European cattle**, and the **effects** on these cattle are much **less severe**

### *Pathogen risk factors*

- ☞ The causative organism is **moderately resistant** to **heat**, **desiccation**, and many **disinfectants**
- ☞ It is **readily destroyed** by **direct sunlight** unless it is in a moist environment
  - ✓ In **warm, moist, protected positions**, it may remain **viable for weeks**

# Epidemiology ...

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## Zoonotic importance

- ☞ TB caused by *M. bovis* is an **important zoonosis**, particularly in ***immunocompromised individuals***, in an uncontrolled environment
- ☞ **Infection** in **humans** occurs largely through ***consumption of infected raw meat*** and ***raw milk products*** by children but **spread** can also occur by ***inhalation***
- ☞ **Transmission** to humans can be significantly **reduced** by ***pasteurization*** of milk but **only complete eradication** of the disease can ***protect the farmer*** and ***his family***

# Clinical presentation

- ➡ **Clinical cases** will present with *progressive emaciation, capricious appetite* and *fluctuating body temperature*
- ➡ **More specific clinical signs** depend on the **organ system** primarily involved, but can include *coughing, chronic respiratory disease, dysphagia, diarrhoea* and *mastitis*
- ➡ The **hair coat** may be *rough* or *sleek*
- ➡ Affected animals tend to become *more docile* and *sluggish*
- ➡ These **general signs** often become *more pronounced after calving*



# Clinical presentation ...

- ☞ The **cough** is *never loud* or *paroxysmal*, occurring only once or twice at a time and is *low, suppressed*, and *moist*
  - ✓ It is *easily stimulated* by *squeezing the pharynx* or *by exercise*
  - ✓ *Most common* in the *morning* or in *cold weather*
- ☞ In the **advanced stages** when much lung has been destroyed, *dyspnea* with *increased rate* and *depth* of *respiration* becomes apparent
- ☞ Rarely **tuberculous ulcers** of the small intestine cause *diarrhea*
- ☞ **Enlargement of retropharyngeal lymph node** which causes *dysphagia* and *noisy breathing* due to *pharyngeal obstruction*

# Control and prevention

- ➡ **Control in a herd** rests on *removal of the infected animals*, *prevention of spread* of infection, and *avoidance of further introduction* of the disease
- ➡ The method used to **eradicate BTB from large areas** will depend on the *incidence of the disease*, *methods of husbandry*, *attitude of the farming community*, and the *economic capacity* of the country to stand losses from a test and slaughter program

## Education

- ➡ An essential **first step** is the *prior education* of the farming community
- ➡ **Adequate compensation** must be paid to *encourage full cooperation for animals destroyed*, or **bonuses** for *disease-free herds*

# Control and prevention ...

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## Staging

- ☞ It is essential at the **beginning of a program** to *determine the incidence* and *distribution* of the disease by **tuberculin testing** of samples of the cattle population and a **meat inspection** service

## Eradication

- ☞ **Test and slaughter policy** has been the only one by which *effective eradication had been achieved*
- ☞ Eradication can **commence in herds** and **areas** which have a *low incidence* of the disease

# Control and prevention ...

## Test and slaughter

- ☞ When the **overall incidence** of tuberculosis is **5% or less**, **compulsory testing** and the **slaughter** of **reactors** is the **only satisfactory method** of eradication
  - ✓ *Accredited areas* are set up by legislation, and all cattle within these areas are tested and reactors removed
- ☞ When an area or country has been **freed from the disease**, **quarantine barriers** must be set up to **avoid its reintroduction**

# Control and prevention ...

## Vaccination

- ➡ Used as a **temporary measure**
  - ✓ When the **incidence** of tuberculosis is **high** and a **routine test and slaughter program** may be **economically impossible** until it is lowered, or
  - ✓ When an eradication program cannot be instituted for some time but it is desired to **reduce the incidence of the disease** in **preparation for eradication**
- ➡ **BCG vaccination** is the only method available for use
  - ✓ Vaccination must be **repeated annually** and the vaccinated animal **remains positive** to the tuberculin test



# 9. BRUCELLOSIS



# BRUCELLOSIS.....

1. Definition: Brucellosis is primarily a reproductive disease characterized by abortion, retained placenta and impaired fertility in the principal animal host caused by the genus brucella.
2. It affects man so it is a zoonotic disease.

The species of *Brucella* and their principal farm animal hosts are:

- *Brucella abortus* (cattle),
- *Brucella melitensis* (goats)
- *Brucella suis* (pigs), and
- *Brucella ovis* (sheep)
- *Brucella canis* (dog)

- Except *B. ovis* all affect man,
- They are intracellular cocco-baccilli
- *B. abortus* and *B. ovis* require 5%CO<sub>2</sub> for growth
- In general, the principal manifestations of brucellosis are reproductive failure, such as abortion or birth of unthrifty newborn in the female, and orchitis and epididymitis with frequent sterility in the male.
- Persistent (lifelong) infection is a characteristic of this facultative intracellular organism, with shedding in reproductive and mammary secretions.



# BRUCELLOSIS ASSOCIATED WITH *BRUCELLA ABORTUS* (BANG'S DISEASE)

2. Etiology : *Brucella abortus* is the causative organism and at least nine biotypes have been recognized including a number of strain variants.
- *B. abortus* is a facultative intracellular parasite capable of multiplication and survival within host phagocytes.
  - The organism can survive on grass for variable periods depending on environmental conditions.
  - The organism is susceptible to heat, sunlight, and standard disinfectants but freezing permits almost indefinite survival.

## 3. EPIDEM IOLOGY

### 3.1 Occurrence

- Many countries have made considerable progress with their eradication programs and some have eradicated the disease.
- In developing countries brucellosis is still a serious disease problem facing the veterinary and medical professions.
- Infection occurs in cattle of **all ages** but is most common in **sexually mature animals**, particularly dairy cattle.
- In horses the organism is often found in **chronic bursal** enlargements as a secondary invader rather than a primary pathogen. It is commonly present with *Actinomyces bovis* in fistulous withers and poll evil.

- The organism can be recovered from **pigs** and **sheep** and **dogs**.
- The infection has occurs in **wild life**, bison (*Bison bison*), elk (*Cervus elaphus canadensis*), deer, coyotes, wild opossums and raccoons, moose, and other wild ruminants.

### 3.2 Source of Infection

- The organism is found in the contents of the pregnant uterus, the fetus and the fetal membranes.
- Many cows that have recovered from infection act as permanent **carriers**.

## 3.3 Transmission

- **Ingestion**: grazing on infected pasture, or consuming other contaminated feedstuffs and water supplies.
- **Contact** with conjunctiva or the intact skin of other animals with aborted fetuses and infected newborn calves..
- **Congenital infection** may occur in calves born from infected dams but its frequency is low.
- **Intramammary** spread during milking from a cow whose milk contains the organism to an uninfected cow.
- **Artificial insemination** of semen from infected bull.

## 3.4 Risk factors

### Animal risk factors

- Susceptibility of cattle to *B. abortus* infection is influenced by the age, sex, and reproductive status of the individual animal.
- Sexually mature, pregnant cattle are more susceptible to infection with the organism than sexually immature cattle of either sex.

### Management risk factors

- The spread of the disease from one herd to another and from one area to another is almost always due to the movement of an infected animal.

## 4. Economic importance

- Losses in animal production due to:
- decreased milk production in aborting cows
- infertility which increases the period between lactations.
- Prolonged average intercalving period by several months.
- loss of calves.
- some deaths as a result of acute metritis following retention of the placenta.

## 5. Zoonotic implications

- Brucellosis is an important zoonosis causing undulant fever in humans.
- Most cases in humans are occupational and occur in farmers, veterinarians, and butchers.

## 7. CLINICAL FINDINGS

### Abortion

- Abortion after the 5th month of pregnancy.
- **Retention** of the **placenta** and **metritis**.

### Orchitis and epididymitis

- In the bull, orchitis and epididymitis occur occasionally.
- Affected bulls are usually sterile when the orchitis is acute but may regain normal fertility if one testicle is undamaged.
- Such bulls are **potential spreaders** of the disease if they are used for artificial insemination.

### Synovitis

- **Hygromatous swellings**, especially of the knees, and nonsuppurative arthritis of the stifle joints may occur.

### Fistulous withers

- In horses, chronic bursal enlargements of the neck and withers, or with the navicular bursa, causing intermittent lameness.





# CONTROL AND ERADICATION

- Most countries with brucellosis have programs designed to control and ultimately eradicate the infection in cattle.
- **Test and reduction of reservoir of infection**
- All breeding cattle in the herd are tested and those that are positive are culled and sent for slaughter

## Quarantine

- This is a period of time during which cattle movement is restricted and the cattle are tested. This will prevent interherd transmission by infected cattle.

## Depopulation

- Depopulation is slaughter of all cattle in a herd when all animals have been exposed and are capable of becoming infected and acting as a source of new infection.

## Vaccination

- The strain 19 vaccine of *B. abortus* provides increased resistance against field strain infection following natural exposure.

## Education

# 10. Dermatophilosis

**Synonyms:** Mycotic dermatitis; cutaneous streptothricosis; lumpy wool of sheep; cutaneous actinomycosis. *When it is complicated with demodicosis in cattle we call it senekebo disease*

**Definition:** This is a superficial skin infection of animals and man characterized by exudation and matting of hairs and wools and formation of crusts and scab.

**Etiology:** *Dermatophilus congolensis*. The organism is a gram positive. It has two forms

- filamentous (hyphae)
- Zoospore

**Occurrence:** **Highly** prevalent in the tropical but sporadic in temperate regions of the world. The disease appears to be most common under low moist climatic conditions.

# Cont...

**Species Affected:** The disease is most commonly encountered in cattle, sheep, and horse. But, it has been also reported in goat, donkey, dog, cat and pigs. Man is readily infected with dermatophilosis.

## **Transmission:**

- All ages of animals are susceptible
- Transmitted through direct contact with infected animals or infected materials. Mechanical transmission through contaminated instrument, brush, bedding materials is possible. The disease may be transmitted through arthropod vectors like flies, ticks and sheep kids.
- **Moisture and cold weather** are predisposing factors to transmit the disease and most of the outbreaks have been found to occur during rainy season. **Skin abrasion** is also another predisposing factor of dermatophilosis.

# Cont...

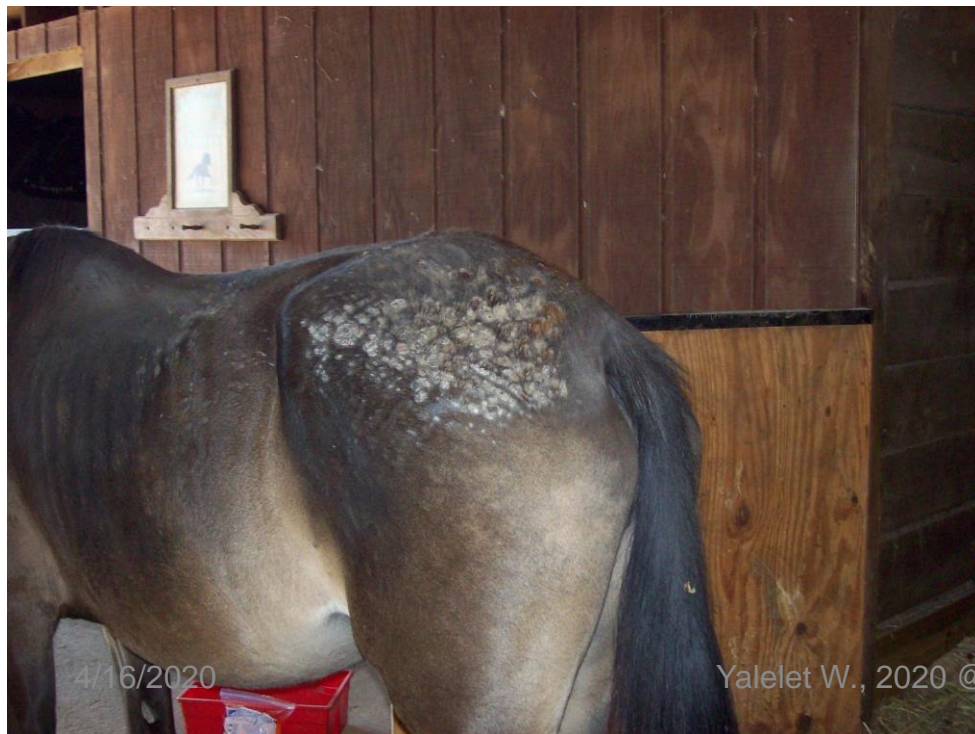
## Clinical Findings:

➤ In cattle, lesions occur on the **neck** or back of the **udder** and may extend over the sides and down the legs and the **ventral surface of the body**.

➤ In adult cattle the characteristic lesions are **thick, horny crusts, varying in color from cream to brown** and they are 2-5 cm in diameters. In the later stages, the dermatitis heals and the crusts separate from the skin but are held in place by penetrating hairs or wool fibres and are easily removed.

➤ In young calves crust formation does not occur. There is extensive hair loss with tufting of the fibres, heavy dandruff and thickening and folding of the skin in later stages. No itching unlike mangemitis.







4/16/2020

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# Cont...

## Diagnosis:

- ❖ Microscopic examinations of stained exudates with Giemsa or Gram's stain by using skin scrapping
- ❖ Culturing on sheep blood agar ( greyish to whitish colony)
- ❖ Serological tests (like ELISA, FAT)

## Differential Diagnosis:

- ☐ Photosensitization
- ☐ Dermatomycosis (Ring worm)
- ☐ LSD

**Treatment:** In general terms, better results are obtained during dry hot weather and in dry climate.

# Cont...

- ✓ Penicillin
- ✓ Pen-streptomycin (1ml/25kg for 5 days)
- ✓ Long acting tetracycline
- ✓ Dipping/spraying by using 0.5%Zn SO<sub>4</sub> or 0.2%CuSO<sub>4</sub>

## Control

- Isolation of infected animals
- Control of tick and fly population are to be made
- No vaccine available so far .

## *Summary of economic impact of microbial diseases*

- loss of body weight (less meat produced)
- loss of milk produced while sick and during convalescence
- reduced reproduction
- loss through treatment
- loss through control and prevention activities
- loss of calf (abortion)

# 11. Foot and Mouth disease (FMD)



4/16/2020

Yale W., 2020 @SVM-WU

# FMD).....

**Definition:-** It is a highly infectious disease cattle, pigs, sheep, goats, wild animals like buffalo are affected

- **Its economic impacts are**

- number one disease why Ethiopia is not exporting cattle to Europe
- Abortion
- mastitis (reduced milk yield)
- death in the young (death in adult animals is rare)

# Etiology

- ➡ Associated with an **aphthovirus** (family **Picomaviridae**)
- ➡ Occurs as **seven major serotypes**: **A**, **O**, **C**, **Southern African Territories (SAT) 1**, **SAT 2**, **SAT 3** and **Asia 1**
- ➡ **No cross-immunity** between serotypes
  - ✓ *Immunity to one type does not confer protection against the others*
  - ✓ *This presents difficulties to vaccination programs*

# Epidemiology

## Occurrence

- ☞ Affects ***all cloven-footed animals*** and is endemic in Africa, Asia, South America and parts of Europe
- ☞ The disease can occur in any country but Japan, New Zealand and Australia are disease free

## Methods of transmission

- ☞ Transmitted by ***inhalation*** or by ***ingestion***
  - ✓ ***Direct*** and ***indirect contact*** with infected animals and their secretions including saliva, blood, urine, faeces, milk and semen, aerosol droplet dispersion, infected animal by-products
- ☞ In cattle, the first site of virus infection and subsequent rapid multiplication in the ***pharynx***



# Clinical findings

- ➡ An incubation period of **3 - 6 d**, but it may vary between 1 and 7 d
- ➡ The **onset** is **heralded** by a very ***rapid loss of condition*** and ***fall in milk yield***, and a ***high fever*** (40 - 41°C), accompanied by ***severe dejection*** (depression) and ***anorexia***, followed by the appearance of an ***acute painful stomatitis***
  - ✓ *At this stage, the temperature reaction is subsiding*
- ➡ Abundant ***salivation*** and ***drooling***, the saliva **hanging in long, ropy strings**
- ➡ ***Smacking*** and ***quivering*** of **lips** and the animal chew carefully
- ➡ ***Vesicles*** and ***bullae*** (1 - 2 cm in diameter) appear on the **buccal mucosa, dental pad and tongue**

# Clinical findings ...

- ➡ Vesicles rupture easily leaving a **raw painful surface** and contain a thin, ***straw-colored fluid***
- ➡ Concurrently with oral lesions, **vesicles** appear on the ***feet***, particularly in the clefts and on the coronet
- ➡ **Rupture of vesicles** causes ***acute discomfort*** and the animal is ***grossly lame***, often recumbent, with a marked, ***painful swelling of the coronet***
- ➡ ***Secondary bacterial invasion*** of **foot lesions** may interfere with healing and lead to **severe involvement of the deep structures of the foot**
- ➡ **Vesicles** may occur on the ***teats*** and when the teat orifice is involved, ***severe mastitis*** often follows
- ➡ **Pregnant** animals may ***abort*** or have ***stillbirths***

# Clinical findings ...

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- ➡ Young animals are **more susceptible** and may suffer **heavy mortality from myocardial damage**, even when typical vesicular lesions are absent in mouth and feet
- ➡ In **sheep, goats** and to a lesser extent **pigs**, the disease is often **mild** and goes **unnoticed**, and is important mainly because of the **danger of transmission to cattle**
- ➡ **Common syndrome** in these species is the appearance of a **few, small lesions**, but with **more severe involvement of all four feet**
- ➡ **Lesions** of FMD consist of **vesicles** and **erosions** in the **mouth** and on the **feet** and **udder**
- ➡ The **erosions** often become **ulcers** especially if **secondary bacterial infection** has occurred

# Clinical findings ...

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*Extensive ulceration in  
a cow approximately 7  
- 10 days after FMD  
first appeared*



*Two unruptured  
vesicles on a bovine  
tongue*





# Clinical findings ...

*Vesicles on the tongue -  
ruptured, leaving  
shallow ulceration with  
shreds of mucosa at the  
periphery*



*Submucosa is markedly  
hyperaemic under  
the ulcer*



# Clinical findings ...

*Vesicles present at the coronary band that have become secondarily infected*



*Vesicles present along the interdigital space that have become secondarily infected*





# Clinical findings ...

*Excessive salivation and  
drooling in acute  
FMD*



*Large erosion on the  
tongue*





# Clinical findings ...

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*Pigs with sore feet -  
note the position of  
the feet*



*Unruptured vesicle on the  
snout and blanching of  
the coronary bands*



# Clinical findings ...

---

*Vesiculation and necrosis of the coronary band in a pig*



*Oral lesions in the pig - areas of epithelial necrosis*





# Prevention and control

## 1. Control by vaccination

- ☞ In countries where the **disease** is **endemic**, or where there are **wildlife reservoirs**, eradication is seldom practicable
  - ✓ *Recommended* for countries where the *disease is enzootic*, or where the *threat of introduction is very great*
- ☞ **Killed trivalent** (containing **O**, **A**, and **C strains**) vaccines are in general use
- ☞ **Produced** in **oil-adjuvant** offer promise of providing **longer immunity**, and require only **annual revaccination** in adult and **biannual revaccination** for young stock

# Prevention and control...

## 2. Control by eradication

- ☞ In areas with only **occasional epidemics**, slaughter of all infected and in-contact animals is usually carried out
- ☞ As soon as the diagnosis is established, **all cloven-footed animals in the exposed groups** should be immediately slaughtered and burned or buried on site
- ☞ Eradication method of control is favored when the **incidence is low**, it imposes severe losses on the animal industry in affected areas and is **economically impracticable** in many countries
- ☞ Regarded as the **final stage** in any control program

# Synopsis on FMD

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- ➡ ***Etiology*** - Foot-and-mouth disease virus, an aphthovirus
- ➡ ***Epidemiology*** - Affects ruminants and pigs. Highly contagious, usually low mortality but great economic impact worldwide
- ➡ ***Pathogenesis*** - Inhalation/ingestion → oropharyngeal infection → viremia → epidermal cells → signs and lesions enhanced by mechanical trauma
- ➡ ***Clinical signs*** - Fever, profuse salivation, vesicles in mouth and feet, sudden death in young animals
- ➡ ***Lesions*** - Vesicular, erosive/ulcerative stomatitis and esophagitis, vesicular/ulcerative dermatitis (feet and teats) and in neonates, interstitial mononuclear and necrotic myocarditis
- ➡ ***Control*** - Mass vaccination with killed vaccines in endemic areas, eradication by slaughter when feasible, and strict quarantine during outbreaks

## *12. Newcastle disease (NCD)*

- affects poultry
- most important disease in poultry (chicken) in Ethiopia
- impact
  - a disease of major importance and concern worldwide which causes continuous heavy economic loss

# Etiology

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☞ “**Newcastle disease** is defined as an infection of birds caused by a virus of **avian paramyxovirus serotype 1 (APMV-1)**”

☞ Possess **two surface proteins** that are important to the **identification** and **behavior** of the virus

## 1. Hemagglutinin/neuraminidase (HN)

☞ Important in the **attachment** and **release** of the virus from the host cells in addition to its serologic identification



# Etiology ...

## 2. Fusion (F) protein

- ➡ Critical role in the *pathogenesis* of the disease
- ✓ *Nine known types* of avian paramyxoviruses have been recognized based on the *antigenic makeup* of the *hemagglutinin*: *APMV-1* to *APMV-9*
- ✓ Of these, *NDV* (*APMV-1*) remains the most *important pathogen* for *poultry*

# Epidemiology

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## Host range

- ☞ **All bird species** are *susceptible* to infection, but the outcome or **disease signs** of infection vary or *show considerable variation* with different species of poultry infected with virulent NDV

## Zoonotic importance

- ☞ **Human infections** usually resulted from **direct contact** with the *virus, infected birds* or *carcasses* of diseased birds
- ☞ Most frequently and best substantiated **clinical signs in human** infections have been *eye infections*, usually consisting of *unilateral* or *bilateral reddening, excessive lacrymation, oedema of the eyelids, conjunctivitis* and *subconjunctival hemorrhage*

# Epidemiology ...

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## Transmission

- ➡ ND virus is **highly contagious**
- ➡ Infection can take place by **virus inhalation, ingestion** or **contact** with **mucous membranes**, especially the **conjunctiva**
  - ✓ **Direct and indirect contact** with contaminated material (fomites) is associated with **deficiencies in biosecurity**

## Vertical transmission of NDVs is *not clear*

- ➡ **Isolation of vaccinal virus** from **eggs laid by infected birds** and isolate virulent NDV from **cloacal swabs** taken from birds with high antibody titres to NDV and from **eggs lay by those birds** as well as from the **hatched progeny** indicates vertical transmission

# Clinical signs

- ➡ Based on the **occurrence** and **severity of clinical manifestations**, NDV's classified as **three pathotypes**: *lentogenic*, *mesogenic*, and *velogenic*, reflecting increasing levels of virulence
- ➡ The **most virulent (velogenic) isolates** are further subdivided into *neurotropic* and *viscerotropic* types
- 1) **Velogenic-viscerotropic virus** (vvND) infection results in *acute onset, highly lethal* disease
- 2) **Mesogenic virus** causes *acute, moderately lethal* disease with *nervous* and *respiratory signs*
- 3) **Lentogenic virus** is responsible for *mild respiratory infection*

# Clinical signs ...

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- ➡ **Clinical manifestations** of this disease are *highly variable* and there are *no lesions* or *signs* that can be considered **pathognomonic**
- ➡ **Clinical signs** produced by the same virus are *influenced* by:
  - ✓ *Species infected*
  - ✓ *Age and the production status or health of the host, especially presence of co-infections*
  - ✓ *Level of immunity to the virus, which may be passively derived from maternal antibodies or actively induced by vaccination*

# Clinical signs ...

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## 1. Velogenic Newcastle Disease (VND)

- ☞ **Most severe** and **serious** disease of poultry
- ☞ **Acute condition** that affects birds of **all ages** and **categories**
- ☞ **Characterized** by **lesions** in the **brain** or **gastrointestinal** tract, **acute onset** with up to 100% flock morbidity and rapidly ascending high mortality accompanied by **respiratory** and **nervous signs**
  - ✓ **Neurologic signs** or **severe depression** are the most obvious clinical sign

# Clinical signs ...

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## 1. Velogenic Newcastle Disease (VND) ...

- ☞ Some birds **die peracutely**, whereas others show more **general signs** of disease such as **anorexia**, **ruffled feathers** and **dropped wings**
- ☞ In **laying birds**, the most **pronounced sign** is a **marked drop in egg production** or **complete peracute cessation** of production
- ☞ **Eggs** are often **misshapen**, with **thin shells (shell-less eggs)** and **watery albumen** due to **premature oviposition**
- ☞ **Surviving** birds generally display **permanent paralysis** and other **neurologic signs**



# Clinical signs ...

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## i. Velogenic - Viscerotropic NCD (VVND)

- ➡ Clinical signs often **begin** with *listlessness*, *increased respiration* and *weakness* and **end** with *prostration* and *death*
- ➡ Clinical manifestations predominantly occur in the **gastrointestinal tract** leading to severe **enteritis** mainly characterized by *diarrhea*, which is often *green* in color
- ➡ **Edema** of the *head*, especially *around the eyes*, usually does not involve the comb and wattle to the extent of highly pathogenic avian influenza (HPAI)

# Clinical signs ...

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## i. Velogenic - Viscerotropic NCD (VVND) ...

☞ **Respiratory distress** and **signs of neurological disturbances**, such as ***drooping wings***, ***torticollis***, and ***ataxia*** may not be as marked as they are with the **neurotropic forms**

✓ ***Neurologic signs*** are frequently observed in chickens that ***survive infection*** with the viscerotropic strains for 2 or 3 weeks

☞ Prior to death, ***muscular tremors***, ***torticollis***, ***paralysis of legs*** and ***wings*** and ***opisthotonos***

# Clinical signs ...

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## ii. Velogenic - Neurotropic NCD (VNND)

➡ **Clinical manifestations** are marked by *sudden onset of severe respiratory disease* or *distress* followed by *neurological signs* (*central nervous system disorders*), including *muscular tremors*, *paralysis of legs* or *wings*, *torticollis*, and *opisthotonos*

➡ **Egg production** *falls dramatically*

➡ **Diarrhoea** is usually *absent*

# Clinical signs ...

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## 2. Mesogenic Newcastle Disease

- 👉 **Clinical manifestations** are *strongly dependent on the age* of the infected animals
- 👉 **Main clinical signs of infection** are a *drop in egg production, poor egg quality* (shell-less or soft-shelled eggs, off-colored eggs) and *decreased feed consumption*, usually cause *respiratory disease*
- 👉 **Nervous signs** are uncommon
- 👉 **Mesogenic viruses** are **not naturally occurring**; rather, they are velogenic viruses that have been *attenuated by a variety of methods in the laboratory*

# Clinical signs ...

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## 3. Lentogenic Newcastle Disease

- ➡ Usually *not cause disease* in **adult birds**
- ➡ In **young**, fully susceptible birds, serious, often fatal *respiratory disease problems* or *respiratory distress*, characterized by *sneezing* and *snicking* occur following infection with the *more pathogenic La Sota strains*, especially in birds co-infected with other microorganisms
- ➡ **Lentogenic pathotypes** such as **B1** and **La Sota** are usually *apathogenic* in *adult birds* and are *used as live vaccines*



# *NCD clinical signs*



# Clinical findings ...

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*Torticollis - infected with  
velogenic Newcastle  
disease*



*Velogenic neurotropic  
pathotype - serious  
nervous signs with  
torticollis and paresis*





# Control and prevention

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## Vaccination

- ➡ Vaccination with **viable** or **inactivated oil emulsion vaccines**, or both, can *markedly reduce the losses* from VND and *lessen* the *impact* of the disease
- ➡ Vaccination makes the flock *more refractive* to infection when exposed and reduces the *quantity of virus shed* by infected flocks
- ➡ A **variety of vaccination programs** can be followed depending on the *risk of infection, virulence of agent, management system*, and *economic factors*

# Control and prevention ...

## In countries with endemic VND

- ➡ Rigorous programs are implemented, incorporating **day-old subcutaneous emulsion vaccine** together with **attenuated live vaccine by the eye-drop route**
- ➡ **Hitchner** or **La Sota vaccine** is administered to broilers by the **aerosol route** at 10 day intervals thereafter
  - ✓ *Immunized with mesogenic-strain vaccines is only justified if birds have previously received one or more live attenuated lentogenic vaccines*

## Eradication of VND virus from the poultry producing area

- ➡ Establishment of a **strict quarantine** and **destruction** of all infected and exposed birds with **financial indemnification** for losses followed by thorough **cleaning** and **disinfection**

# Questions?



# **ANIMAL HEALTH AND DISEASE CONTROL(Vetm 3103)**

3credit hours

By Belege Tadesse (DVM, MSc, Ass. Prof. of  
veterinary epidemiology and animal health  
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Wollo University College of Agriculture  
**Department of Animal science**

@ 2018/19

# **3. Major Animal Diseases Having Economic Importance In Ethiopia And The Tropics And Their Management**

## **Objective**

- Identify common diseases found in farm animals and their management
- Explain way of transmission and control options

- **Based on cause:** diseases are classified as: **infectious and non-infectious**
- **3.1. Infectious Diseases**

### 3.3. Parasitic Infectious Diseases

- **A parasite** is an organism that lives in or on another and takes its nourishment from that other organism, or “host.”
- Parasites of animals and humans come in many forms, including helminths (worms), arthropods (lice, ticks, mosquitoes, etc.), and protozoa.
- **External parasites** often annoy their hosts by biting, embedding
- **Internal parasites** live in the blood or tissues inside an animal’s body.
- In severe cases, these diseases can be deadly



# Parasit disease....

- Parasites have been responsible for **economic losses**
- Below is a brief overview of the key terms related to pathogens, parasites, and diseases.

**Parasitism** – an interaction of species populations in which one (typically smaller) organism (known as the parasite) lives in or on another (known as the host).

- **Host** a plant or animal or arthropod that is capable of being infected with and therefore giving sustenance to an infectious agent.

....

- **Definitive host:** Host in which an organism undergoes its sexual phase of reproduction (*Echinococcus granulosus* in dogs; *Plasmodium* spp. in mosquitoes)
- **Intermediate host:** an animal in which an infection undergoes some development, frequently with asexual reproduction (*Cysticercus bovis* cyst in cattle).
- ❑ **Pathogen** – any parasite (e.g. virus, bacteria, nematode, platyhelminth, etc.) or prion that causes disease
- ❑ **Disease** – an abnormal condition which affects the body of an organism.

- ❑ The effects of the parasite on the host may range from **nothing** to **severe illness** and eventual death, the effects of the parasite may vary by species or even individual.
- ❑ Parasites can be obligate (only live as a parasite) or facultative (may live as a parasite or independently)
- ❑ **Zoonosis** – A pathogen that can be transmitted from animals to humans and vice versa



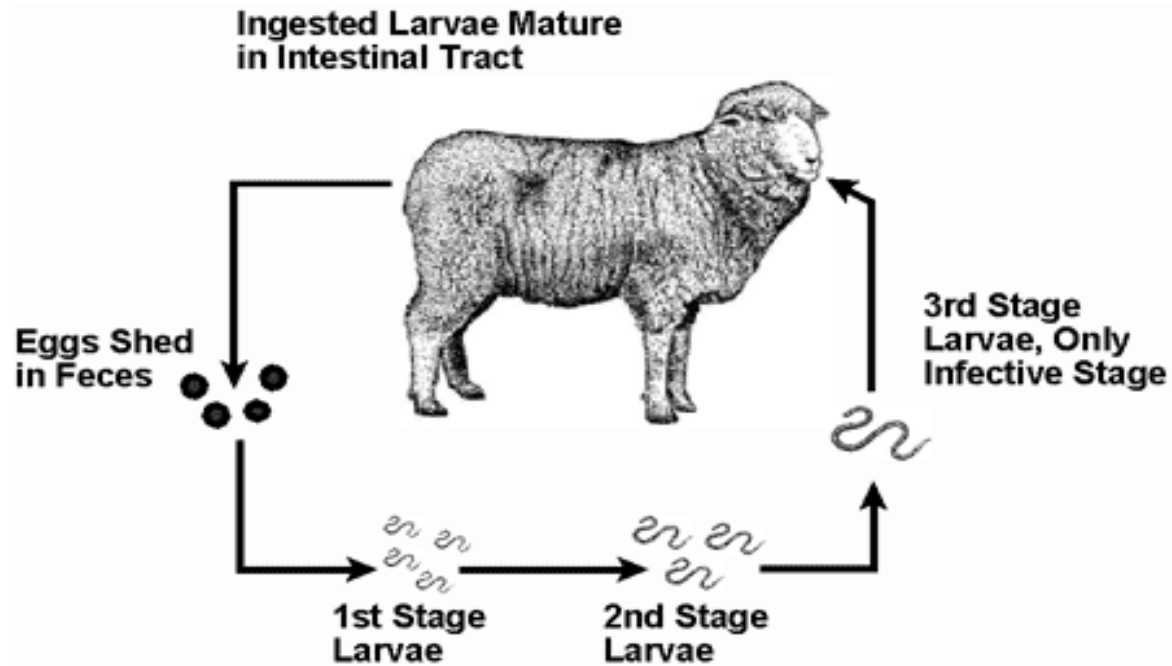
- ❑ **Parasites** can be broken into two major categories:
- ❑ External parasites (**ectoparasites**) – parasites that live externally on the host
- ❑ Internal parasites (**endoparasites**) – parasites that live within the host
- ❑ Each parasite is then further classified into additional groups according to their **structure, growth, and life cycles**.
- ❑ The parasite obtains **food, shelter, or other requirements** from its host.

# I. Internal parasites

- ❑ **Parasites (helminths)** important in veterinary medicine are grouped in **four distinct** taxonomic groups:
  1. **Nematodes** (commonly known as roundworms);
  2. **Cestodes** (commonly known as tapeworms);
  3. **Trematodes** (commonly known as **flukes**); and
  4. Acanthocephalans (commonly known as thorny-headed worms).
- 5. **Protozoa - (E.g. Coccidia, Trypanosoma, Babesia.....)**
- ❖ **Nematode** : Each nematode species has a larval stage that is infective for its definitive hosts.
- ❖ These infective stages include first- and third-stage larvae free in the environment, first and second stage larvae within eggs, and larval stages in intermediate hosts.

## Internal Parasite Life Cycles:

### Roundworm





- ❖ For almost all nematodes important in veterinary medicine, one egg or larva becomes only a single adult of the next generation.
- ❑ **Common signs of roundworms in the stomach or intestines are:**
  - **loss of appetite**
  - **weight loss**
  - **diarrhoea and/or constipation**
  - **anaemia (pale mucous membranes)**
  - **swellings under the lower jaw ("Bottle Jaw") or along the belly**
  - **rough haircoat**
  - **general unthriftiness.**



# Cestodes:

- ❖ Adult cestodes are **hermaphrodite**, have the appearance of a segmented ribbon, and vary with species from a few mm to a meter or more in length.
- ❑ All adult cestodes are parasitic, and the adults of most species live only in the **intestinal tract** of their definitive hosts.
- ❑ Adults have a distinct anterior holdfast organ (the scolex) which anchors the parasite to intestinal mucosa. The body of a tapeworm consists of a ribbon of connected segments that are produced behind the scolex.
- ❑ **E.g. In cattle the cysts of tapeworms can be seen in the meat after slaughtering.**
- ❑ **They look like small bladders in the muscles of the head, the heart and in other places.**

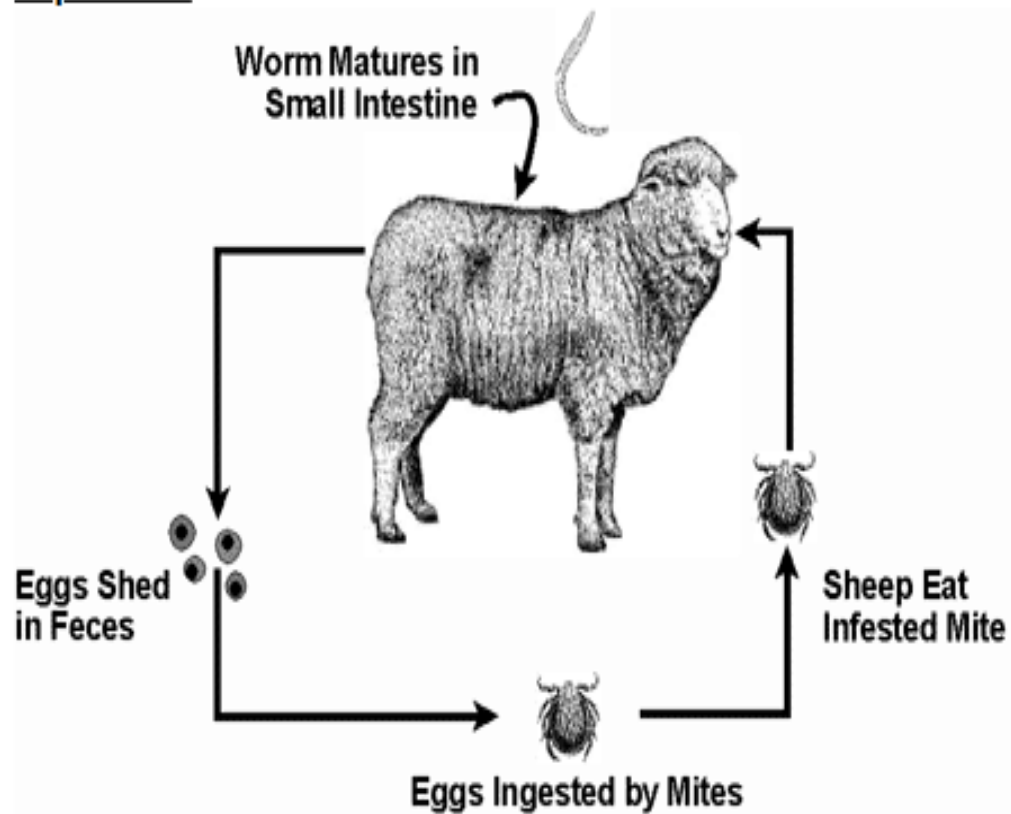


- ❑ Cestodes lack an **anatomical gut**, and nutrients are absorbed through the body covering.
- ❑ All cestodes important in veterinary helminthology have indirect life cycles with a single intermediate host.
- ❑ Each cestode species has a specific larval stage that is infective for the definitive host.



Figure 3. An adult cestode – *Diphylobothrium* spp from Dog

## Tapeworm





- ❑ **Trematodes:** Adults of most **trematodes** live in the gastrointestinal system, including the liver, gall bladder and bile ducts. Other species parasitize the lungs, the vascular system or the urinary tract.
- ❑ All trematodes have an indirect life cycle. Depending on species, there may be one or more intermediate hosts. The first intermediate host is always a snail.
- ❑ For the larval stages of trematodes in snails there is a consistent sequence of development through the various larval stages to the infective stage, and each stage is morphologically distinct.

- ❑ Asexual reproduction in the snail intermediate hosts is a feature of all trematodes, and thus one egg can become several adults of the next generation
- ❑ **Signs include:**
  - **poor appetite and resulting loss of weight and production**
  - **rough haircoat**
  - **pot-belly.**
- ❑ **Rumen fluke larvae** can sometimes cause **diarrhoea and unthriftiness**
- ❑ **Effective drug-** triclabendazol for liver fluke, Albendazol and ivermectin, tetraclozan, levamisol, ... **GIT parasitiess including nematodes and cestodes**

# Fasciolosis

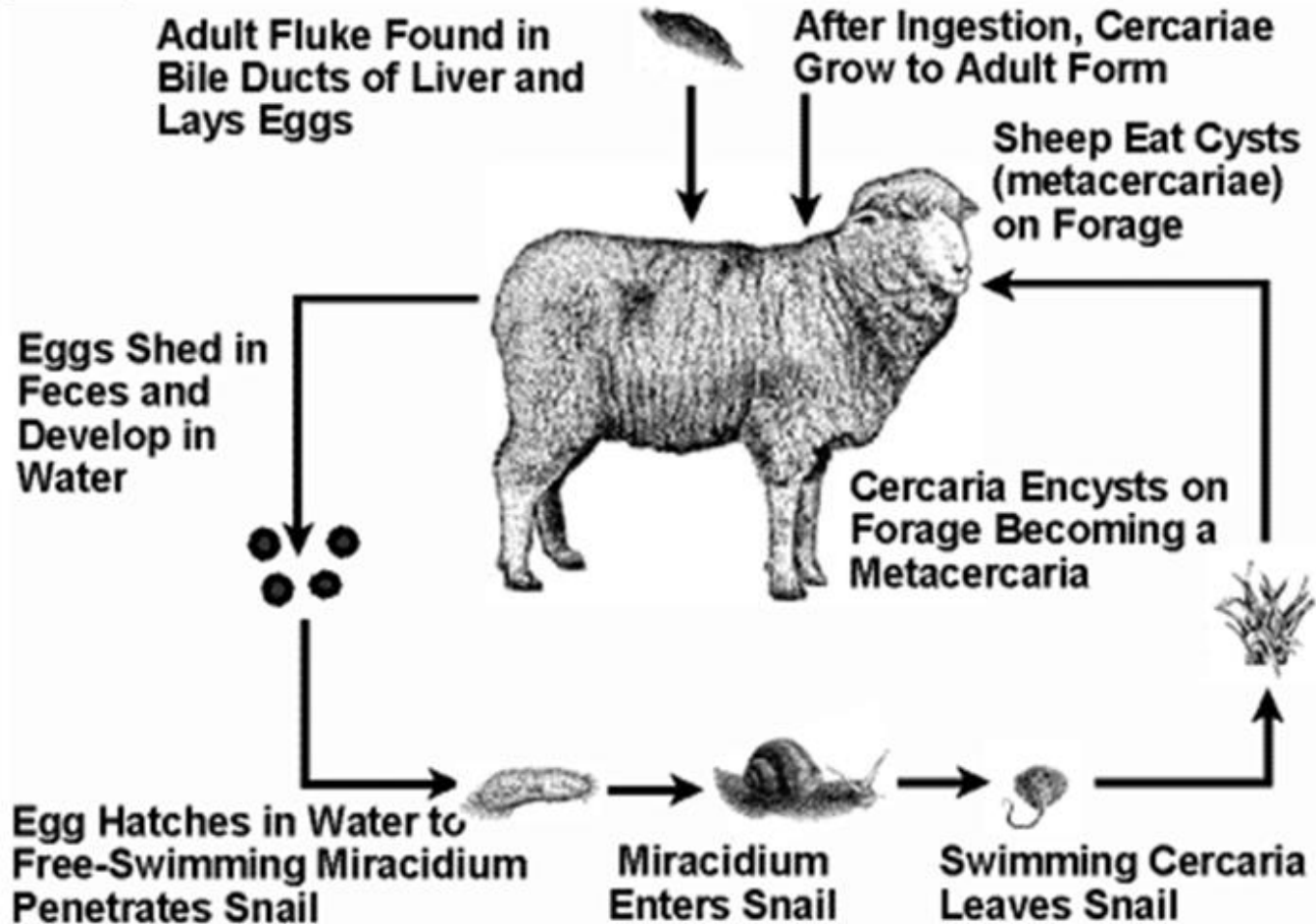
- ❑ *Caused by Fasciola gigantica and Fasciola hepatica*
- ❑ *The life cycle of these trematodes involves snail as an intermediate host*
- ❑ *The disease is found in vast water lodged and marshy grazing field condition*
- ❑ *This disease is widely distributed in areas where cattle are raised and there is a niche for Lymnaeid snail.*
- ❑ *The disease is usually characterized by a chronic, sometimes acute or sub-acute inflammation of the liver and bile ducts, accompanied by sub-mandibular oedema, anaemia, anorexia, general intoxication and death. It is an important limiting factor for bovine production.*

- ❑ It causes several economic losses. The losses may be direct or indirect.
- ❑ The flukes cause severe liver damage and result in total condemnation of liver.
- ❑ Diagnosis of bovine fasciolosis is based on:
  - clinical sign, grazing history, seasonal occurrence, examination of faeces by laboratory tests and post-mortem examination.



- ❑ The disease can be controlled by reducing the population of the intermediate host or by using anthelmintics.
- ❑ Drugs like rafoxanide and nitroxynil other than triclabendazole are more effective.

## Fluke



- Lifecycle of fasciola



- ❑ Eg. of helminth species (e.g. *Haemonchus contortus* in sheep, *Fasciola hepatica* in ruminants, *Oxyuris equi* in horses...) are capable of producing distinct disease syndromes in their hosts.
- ❑ Among the many factors **precipitating disease** and death due to parasites are:
  - 1) **parasite** species that are particularly pathogenic;
  - 2) **large numbers** of parasites;
  - 3) hosts that are unable to **resist**, mitigate the infections: and
  - 4) absence of adequate **preventative**, antiparasite and host-supportive interventions.

# Impact on production

- ❑ Heavy infections with **GI** nematodes result in clinical disease and this consequently leads to **inappetence, impaired gastrointestinal function and changes in protein, energy, mineral metabolism and water balance**
- ❑ Characterized by watery diarrhea, weight loss or reduced weight gain, dull hair coat, anorexia and a general loss of condition

## ❑ **Diagnosis:**

- A. **Internal parasites** - Most of these infections can be detected using a fecal egg count.
  - This is done by collecting a fecal sample and sending it to a local veterinarian for fecal flotation, **direct smear and sedimentation** .
  
- B. **External Parasites** - Parasites or the signs associated with infestations can be observed upon routine examination of the animal.

# Parasite Treatment, Control and Prevention

- When considering the prevention of internal parasite infections, it is important to focus on two major areas:

1. **Avoid grazing** on pastures with large populations of worm larvae.
  - If the pasture is infected, the parasites are then spread to other animals when they ingest the infective stage of the parasite.
  - To prevent eggs from contaminating pasture and infecting other animals, **de-worming** is an essential part of management.

## 2. **Prevent pasture contamination**



- ❑ With the exception of the vaccine against **D. viviparus**, no vaccines are currently available commercially for the control of helminthes infections in ruminants
  
- ❑ Methods available for the control of GI nematode infections are mainly based on:
  - **Chemical treatment**(anthelmintic drugs),
  - **Non-chemical management** practices(pasture management),
  - **Immune modulation**(prophylaxis treatment) and
  - **Biological control** (release predators or other parasites on IH).



# Treatment/Prevention....

- **The following practices are recommend in all areas for better control:**
- Do not use the same pastures for lambing or kidding every year.
- Rotate pastures used for grazing every 3-6 months.
- If clean grazing such as stubble is available, sheep or goats should be given an effective broad spectrum de-wormer before they are moved on to it.
- If possible, all animals that are de-wormed should be held in a dry lot for at least 3 days. This is because most de-wormers do not kill the parasite eggs, just the adults worms. Waiting 3 days will help the animal eliminate most of the parasite eggs in the dry lot and not on pasture where other animals may ingest the eggs.

- Have a veterinarian perform a fecal egg count to check the effectiveness of any de-worming or parasite control programs. This should be done 10-14 days after de-worming.
- Avoid resistance problems by not using the same products year after year.

# 5. Protozoal parasitic diseases

## 1. Trypanosomiasis

- ✓ It is a blood- protozoal disease caused by the flagellated protozoa, known as *Trypanosome*
- ✓ *Trypanosomes* are responsible for serious disease in humans (sleeping sickness in Africa and Chagas disease in parts of Latin America).
- ✓ They also **impose severe constraints** on agricultural production throughout large areas of **sub-Saharan Africa**, **inflicting death** and **chronic disease** on both food-providing ruminants and the draught animals needed to cultivate crops and to carry product to market.

# Con't

- ✓ Infections are widespread in wild and domestic animals; cattle are more susceptible to infection with several species
- ✓ *In the livestock industry, it is a devastating problem & one of the major economic impediments in Africa*
- ✓ precludes the **rearing of livestock**, in particular cattle in many areas
- ✓ Transmitted by *Glossina* species and **biting** flies: *Tabanus*, *Stomoxys*

# Distribution

- ✓ It has world wide distribution ( Africa, Asia and S. America)
  - ✓ **Tsetse** transmitted trypanosomosis can be occurred only in Africa; Tsetse is found in 38 African countries
  - ✓ Some 10 million Km<sup>2</sup> (equivalent to the size of USA), of Africa is infected with tsetse.
  - ✓ In Ethiopia, trypanosomosis is one of the major hindrances to cattle production with **direct & indirect economic losses**
  - ✓ About 220,000 km<sup>2</sup> (1/3 of the country) agriculturally suitable land in the West, Southwest & Northwest Ethiopia is infested with tsetse flies (*Glossina* spp), vector of cyclically transmitted trypanosomosis.
  - ✓ Almost all regions of the country are infected with **mechanically** transmitted trypanosomosis.
-

# Impact of animal African trypanosomiasis

- ✓ serious impact on agricultural development & public health:
  - cattle breeding (increase of mortality & morbidity)
  - reduction of meat and milk production → lower income, reduction of nutritional proteins
  - Losses in animal traction power → reduction of yields & the surface area that can be cultivated
  - restricted land usage
- ✓ Trypanosomosis is one of the major impediments to the livestock development in Ethiopia contributing negatively to the overall **development** in general and to **food self-reliance efforts** of the nation in particular

# Etiology

- Trypanosomes are **protozoan** parasites in the family Trypanosomatidae.
- African animal trypanosomiasis is caused by those organisms that are transmitted by tsetse flies but do not ordinarily affect humans.
- The three most important species are *Trypanosoma congolense* (subgenus *Nannomonas*), *T. vivax* (subgenus *Duttonella*) and *T. brucei* subsp. *brucei* (subgenus *Trypanozoon*).



- The organisms that cause African animal trypanosomiasis have been found in many species of mammals, including all domesticated animals and some free-living or captive wildlife.
- Humans are normally not susceptible to the trypanosomes that cause African animal trypanosomiasis. A very small number of human infections caused by *T. brucei*, *T. vivax* and *T. congolense* have been reported

# Transmission

- **Tsetse flies (*Glossina spp.*)** are biological vectors for the trypanosomes that cause African animal trypanosomiasis and transmit these organisms in their saliva.
- Trypanosomes must develop for **one to a few** weeks in the fly before they reach the infective stage. *T. vivax* has the shortest cycle.
- Trypanosomes can also be transmitted by mechanical vectors including surgical instruments, needles, syringes and other biting flies. Mechanical transmission is thought to be most significant for *T. vivax*,

- In sub-Saharan Africa, *Trypanosoma brucei* causes **sleeping sickness** or **human African trypanosomiasis**, and in America *Trypanosoma cruzi* causes Chagas' disease
- Incubation periods from 4 days to approximately 8 weeks

## Clinical Signs

- Cattle, sheep and goats can be infected with or without clinical signs. Most clinical cases in ruminants are chronic, but acute disease, which may be fatal within weeks, can also be seen. The first sign may be a **localized swelling (chancre)** at the site of the fly bite, but this usually remains unnoticed.
- The primary clinical signs are an intermittent fever, signs of **anemia** (e.g., pale mucous membranes, lethargy), *lymphadenopathy* and weight loss. **Hypoglycemia** may be seen in the acute stage.

- Over time, the animals can lose condition and become progressively **emaciated**, often with concurrent signs such as decreases in milk yield.
- They can have a decreased appetite, and may develop neurological signs, dependent **edema** (including submandibular edema), cardiac lesions, diarrhea and keratitis/ corneal opacity, abortions, premature births, perinatal losses and damage to the male reproductive organs (e.g., orchitis, epididymitis), with reduced semen quality, immunosuppression

- The **lymph nodes and spleen** are enlarged in the acute stage, and petechiae are frequently found on serosal surfaces, particularly in the peritoneal cavity.

## Diagnostic Tests

- A presumptive diagnosis can be made if trypanosomes are observed by **direct microscopic examination of blood, lymph nodes** (e.g., smears of needle biopsies), edema fluid or tissues collected at necropsy.



## Treatment

- Diminazene aceturate and isometamidium chloride
- **Prevention**
- Use of trypanotolerance breeds
- Quarantines, movement controls combined with vector controls(targets, traps, insecticides)

- **B. Coccidiosis-**

- The condition is very commonly observed, especially in young growing animals
- Characteristic symptoms are enteritis with **liquid faeces mixed with blood, emaciation.**
- **Causes: different species of Eimeria**
- **Treatment with antiprotozoal**
- **Protect the hygiene of the housing and prevent contamination**
- Sulfonamides in the feed 25-35mg/kg for  $\geq 15$  days
- Monensin is an effective coccidiostat
- Lasalocid in milk replacer
- Decoquinate in the feed
- Toltrazuril 15mg/kg , po, single dose when animals are moved in to group housing
- Diclazuril 5mg/kg, oral

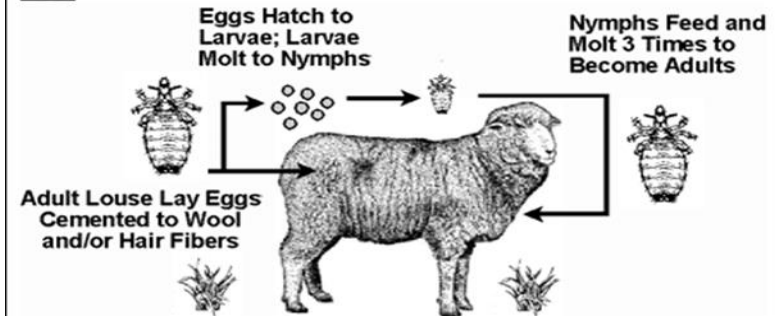
## II. External Parasites

### ❖ Mange(Demodex, psoroptes, sarcoptes...)

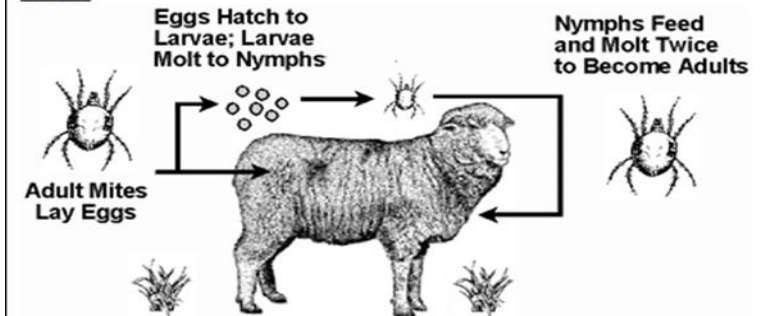
- The typical signs of disease are:
  - loss of hair
  - formation of scabs and crusts
  - thick and folded skin
  - itching.

External Parasite Life Cycles:

#### Lice



#### Mites



- Animals which are not in good condition will show more serious signs of disease than healthy, well-fed animals.

# Con' t

- **Ticks:** it is easy to see ticks on animals. Common places to find ticks are on the head, ears, the base of the tail, the udder and the dewlap. Ticks can cause different kinds of disease in animals:
  - tick-borne diseases
  - loss of condition
  - anaemia
  - inflammation and damage to the skin.
  - Irritating the skin. They cause serious diseases, such as mange and scabies, which affect animals' health and growth.
- **Lice**-are species specific, **2 types sucking and biting**
- Ecto parasites can be treated by external application of chemicals: acaricides, pesticides by spraying, dipping (eg. **Diazinon**) or systemically (E.g. **Ivermectin**)

# Con' t

## 3.2. Non- Infectious disease

- Non- Infectious diseases are a group of disease that are not caused by micro-organisms, rather they are caused by **physical, chemical and toxic materials or elements**
- There are a number of such diseases and we will see some common non- Infectious diseases

# A. Nutritional Deficiencies

- Deficiency of nutrient in a feed leads a diseases.
- To prevent these especially in **poultry** **complete feeds** can be purchased that are formulated to meet all the nutritional requirements (energy, protein and amino acids, fat, vitamins, macro- and micro-minerals, etc.).

# Con' t

- E.g. **Vitamin A** is required for the health of the membranes of the **digestive, urinary, reproductive and respiratory systems**.
- Vitamin A deficiency can result when the level in the diet is inadequate or the vitamin added to the diet is oxidized by rancid fat in the diet.
- Additionally, **neomycin**, a common antibiotic, decreases the absorption of vitamin A.
- Vitamin A is a fat-soluble vitamin



# Con' t

- A **vitamin D** deficiency in poultry results for an inadequate level of vitamin D3 in the diet
  - Rickets** occurs in young birds while cage layer fatigue (osteomalacia) occurs in mature females
- A **vitamin E** deficiency results in a condition known as '**crazy chick disease**' or **encephalomalacia** (softening of the brain).
  - In chicks it usually occurs between 15-30 days of age. Vitamin E is required for **reproduction** as well as the **normal integrity of the central nervous and muscular systems**.

## Con't

- Vitamin E is also an effective antioxidant and is an important protector of essential fatty acids.
- Symptoms of a vitamin E deficiency include:
  - **Uncoordination, Tremors**
  - Rapid contractions and relaxation of the legs resulting in what is known as 'crazy chick disease'
  - Testicular degeneration in adult males resulting to decreased fertility
  - Increased embryonic mortality
- **So supplementation of poultry with vitamins is essential to prevent these effects and improve health production**

## B. Metabolic disease

- **Metabolic disease** refers to a group of conditions caused by **deficiencies of certain essential nutrients** resulting in disturbance of the animal's normal metabolic processes.
- These conditions are multifactorial and commonly occur at times of **high physiological stress or demand** for these nutrients
- **Eg.** late pregnancy and early lactation/lamping/kidding
- The signs of these conditions can overlap and look similar and it is not uncommon for more than one disease to occur at the same time
- For this reason it is important to understand the causes of these diseases because the prevention and treatment are different.

## E.g. Milk Fever

- Also called **hypocalcaemia**, milk fever is due to low blood calcium, which is important for contraction of muscles.
- Deficiency of calcium is associated with excess secretion of calcium in colostrums, decreased absorption and mobilization of calcium from intestine and bones, respectively.
- During calving **within 72hours**
- Affected animals can show signs such as a stiff or staggy gait, muscle tremors, subnormal body temperature, weakness, circulatory collapse, sternal recumbency with curvature of the neck or their side, difficulty in getting up, depression, bloating and ultimately death.

# Con' t

- **Prevention and control**
- Supply more phosphorus and low calcium during late stage of pregnancy (1:3 ratio).
- Administration of calcium chloride 120-150 ml orally 24 hours before calving.
- Supply the cow with balanced diet during pregnancy.(refer nutrition manual).
- ***Treatment:*** Calcium borogluconate 25-30 % solution = 100-200gm calcium borogluconate in 400-800 ml solution respectively

# Con' t



## ❑ **Ketosis or pregnancy toxaemia**

- Is essentially a **deficit in energy** manifested as a fall in blood glucose at a time when the animal has an increased energy demand such as late pregnancy and early lactation.
- Occurs during peak milk production when more energy is needed
- **Treatment of sick animals**
  - Glucose 50% solution; 500ml intravenous followed by 20% solution subcutaneous.
  - Propylene glycol 125-250gm mixed with equal volume of water



# Con' t.....

## ➤ Prevention and control

- Cows at calving should not be too fat or in very poor condition
- Avoid sudden change of feed
- Add sufficient protein to the ration/**Supply high energy feeds**

➤ **Grass tetany** is also called **grass staggers** or **hypomagnesaemia** and as this name indicates, is due to low blood levels of magnesium.

## C. Gastro-intestinal disorder

- Gastro-intestinal disorders are diseases which leads **pain in the GIT** and affect the health of an animal,
- **Colic signs are** associated with tympanic intestinal colic, intussusception, intestinal torsion, prolapse of intestines through the mesentry, and caecal dilatation and torsion —————> GI disorders .
- Signs of colic include:
  - Reduced appetite or inappetance; Kicking at the ventral abdomen;
  - Licking at the wall of the flank or chest;
  - Restlessness, including shifting weight from one hind foot to the other, and frequent lying down and standing up again.

## ➤ **Bloat**

- Is over distension of the rumen and reticulum with the gases of fermentation,
- There are two types of bloat:
  - i. Free gas bloat:** is interference of gas eructation due to esophageal obstruction, reduced exercise and prolonged recumbence.
  - ii. Frothy bloat:** is caused due to accumulation of feed material in the rumen containing bubbles.

# Clinical signs

- Distension of the left flank (Rumen), enlarged abdomen, discomfort, difficulty of breathing, mouth breathing, extension of the head, protrusion of the tongue and loss of rumen motility
- **Prevention and control**
  - Highly leguminous plants should wilt before being fed for cattle
  - Feed cattle with hay before turning on to leguminous pasture
  - Adapt to high performance ration gradually
- **Treatment of bloat: in frothy bloat:**
  - Vegetable oil 250-300 ml orally for large cows or equal amount of detergents by emulsifying in water orally.

## Con' t

- Polyxalanes 25-50 gm orally.
- Emergency rumenotomy or use trocar and cannula at the left flank behind last rib.
- Prompt **relief** of the **excess pressure**, via **stomach tube, rumen trocar and cannula**, or in peracute cases emergency **rumenotomy**

## ➤ **Rumen Acidosis/Grain overload :**

- ✓ Occurs when animals accidentally gain access to large quantities of readily digestible carbohydrate, particularly **grains**.
- ✓ Feeding a lot of concentrates at once affects the normal rumen microflora resulting in rumen acidosis.
- ✓ This disturbs rumen contraction absorption of valuable feed ingredients.
- ✓ Characterized by indigestion, rumen stasis, dehydration, acidosis, toxemia

## ■ **Prevention and control**

- Adapt to high performance ration gradually
- Restricting animals from accessing grains and the feed should at least contain 10% roughage
- Treatments like surgical procedures to remove the contents, fluid therapy should commence if the case is not severe; otherwise slaughter is the animal.
- Treated by indigestion powder, mineral oil

## ➤ **Traumatic reticulitis**

## ➤ **Intestinal obstruction:** cause of acute pain in cattle

-Surgical correction of the obstruction or slaughter



## D. Toxicosis

- There are many things that are potentially toxic
- E.g. herbicides, insecticides, chemicals, poisons, plants, animal(eg. Snake venom) and drugs
- The signs of plant poisoning depend on the plant that has been chewed or consumed and includes **drooling, vomiting, diarrhea, twitching, nervousness, coma, and death.**
- So keeping of animals from exposure to toxic agents is very important
- If exposed treat by **antidote**

## E. Trauma or Wound(mechanical injury)

- A trauma wound is a severe break or injury in the soft tissue of the skin.
- Trauma wounds may include abrasions, lacerations, crush wounds, penetration and puncture wounds.
- Trauma wounds can be injuries resulting from accidents or acts of violence and can worsen and become infected quickly if not treated appropriately.
- **Cause:** accidental injury at grazing/house, a car accident or self inflicted.

## Con' t

- Treatment options after incurring a trauma wound can include:
  - Stopping any bleeding
  - Cleaning the wound thoroughly
  - Dressing the wound properly to help prevent infection
- Prevention of exposure of animals to any danger or trauma/ accident is very important

## F. Birth defect

- When properly accomplished, the outcome of conception/pregnancy is a **healthy neonate**.
- Errors in the **sequential steps** of development may be followed by embryonic loss, fetal death, fetal mummification, abortion, stillbirth, birth of nonviable neonates, or birth of viable offspring with defects.
- A number of specific **genetic, environmental, and infectious** agents as etiologic determinants of certain cases of defective fetal development.

## Con' t

- **Teratogens** are agents or factors that cause development of physical defects in the embryo or fetus
- **Inherited defects** resulting from mutant genes present in breeding lines or families have been seen in all breeds.
- **Environmental teratogens** include plant toxins, drugs, trace elements, nutritional deficiencies, and physical agents such as irradiation, hyperthermia, uterine positioning, and perhaps pressure during rectal examination for pregnancy.
- **Infectious:** Prenatal infection can result in congenital defects similar to those seen in cattle infected with BVDV.

## 4. Diagnosis of animal Diseases of economic importance in Ethiopia and the Tropics

- Clinical Signs
- Diagnosis
- **Clinical Sign** : is the manifestation of a disease. The clinical sign are related with the parts of the body that is affected by the pathogenic agent. So by observing the clinical signs we can **tentatively diagnose** a disease in infected animals.

# Diagnosis

- Treatment of infected animals requires diagnosis of the animal.
- Diagnosis of a specific disease will follow a series of procedures.
- Procedures of diagnosis:
- **Record animal information**(sex,spp,breed,age BCS...)
- **Take history**(about the animal-feed, watering, housing, vaccination, previous disease status, breed, physiological state,....)

- **Observe clinically ( we can see the clinical manifestation of the disease)**
- **Measure vital parameters (HR, To, mm, RR...)**
- **Take samples(blood, faeces, milk, urine, nasal secretion....)**
- **Confirm labratorically**
  - Smears, flotation, sedimentation,
  - Culture and isolation
  - ELISA
  - PCR
  - CFT.....,
- **Finally treat the animal by electing the best drug.**



# 5. Laboratory Medicine/science

- Learning objectives
- At the end of this module you will be able to:
- Explain the proper collection, transportation and processing of specimens.

- **Specimen types**

## **I. Respiratory**

- Bronchoalveolar lavage (BAL)
- Bronchial wash/brush
- Transtracheal aspirate

## **II. Non-respiratory**

- **tissue**  
body fluids
- **blood**
- **faeces**
- gastric lavage
- **urine**

# 5.1. Sample Collection, Processing and Storage

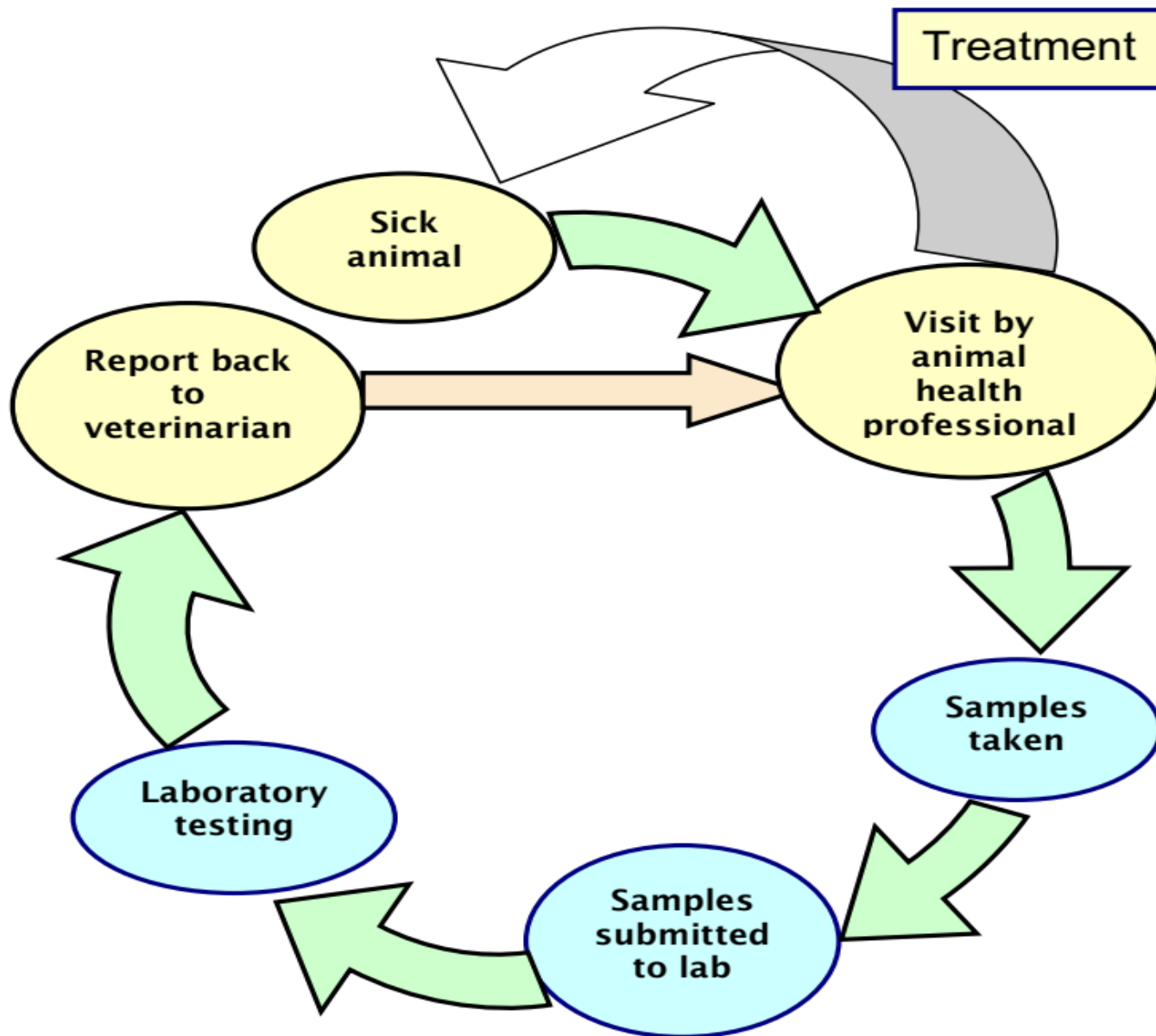
- Sample Collection, such as handling, labeling, processing, aliquoting, storage, and transportation, may affect the results of the study.
- So proper collection, transpiration and processing of a sample is essential

# Cont....

- **Diagnosing** of a disease in the laboratory is necessary to treat the animal by the best drug
- Specimens are submitted to the laboratory to help determine what might be causing illness in the field or to determine the extent of infection in animals in the field.

# Cont...

- Samples should be delivered to the laboratory without any delay.
- When samples cannot be processed on the day of collection, they must be stored in the refrigerator
- If refrigeration is not available, use of preservatives should be considered.



## Process of a laboratory confirmation

# Collection of specimens

- **Urine:** External genitalia should be washed before specimen collection.
- A single early-morning urine specimen (approx. 200 ml) should be collected.
- Specimens should be refrigerated or transported immediately to the laboratory.

- **Blood:** The jugular vein is the preferred location for small ruminants and horses
- **Feces:** Preferably, fecal samples should be taken directly from the rectum or just after defecation.
- **Larger external parasites:** can simply be picked off and placed into a container. Ticks and fleas should be submitted for identification or stored in **70% alcohol**.

.....

- **For smaller parasites**, such as skin mites, scrape with a razor blade to be sure you go deep enough to get the parasite
- Put the collected material onto a slide with some mineral oil. Then you can put the slide under a microscope to see the mites.
- **Impression smears:** Take the tissue and touch gently to a glass slide. Allow to air dry



....

## **Taking environmental & feed samples**

- In cases when a toxin or mineral deficiency is suspected in the environment or in the feed, samples can be collected for laboratory analysis.
- Wear personal protective equipment - gloves, apron, and boots.

# How To Preserve Specimens

- Keep the tissues cool
- Samples should be kept moist
- For swabs, immerse the swab in sterile saline or sterile water and keep at 4°C until it can be sent to the laboratory.
- *For external parasites*, mites, fleas, and ticks can all be kept in 70% alcohol indefinitely.
- *For fecal samples*, keep them cool until they can be sent to the laboratory. Nematode eggs usually survive well at 4°C but can be destroyed by freezing, so DO NOT FREEZE.

# Transportation/shipping

- Package should be well labeled
- Keep the samples **cool** on the way to the laboratory
- Use packaging that will prevent leakage and crushing
- Be sure that all your samples are well-labeled
- Be sure that appropriate paperwork is included with all of the samples
- Alert the laboratory

.....

- Sample shipping requirements depends on the time, distance, climate, season, method of transport, applicable regulations, type of specimen and markers to be assayed.
- Protect specimen from contamination

# Tests Done In The Laboratory

- Histopathology
- Virology: cell culture, ELISA, CFT....
- Bacteriology,: Culture, ELISA, PCR....
- Mycology
- Parasitology: consistency.....
- Toxicology.....

# Parasitology

- *Fecal consistency*
- *Fecal flotation is the best method for nematodes*



- *Direct Smear: Giardia*, trichomonads, and amoebae.
- *Fecal Sedimentation: eggs of flukes, tapeworms*

# Mites

- Skin scrapings smeared in mineral oil are the most common technique used to diagnose mites such as **Sarcoptes** and **Demodex**.
- When submitting/shipping mites to the diagnostic laboratory, these should be stored in 70% alcohol.
- However, scabs from chronic infections, particularly from *Psoroptes ovis* and *P. cuniculi* can be also submitted. These are digested in 10% sodium hydroxide before microscopic evaluation.

# Protozoans

- Blood protozoans are best visualized in blood smears stained with Giemsa or Wright's stains.

# THANK YOU





# **Wollo University**

## **School of Veterinary Medicine**

### **ANIMAL HEALTH AND DISEASE CONTROL COURSE**

to  
2<sup>nd</sup> year Animal Science Students  
By

**Dr. Yalelet Worku & Dr. Belege Tadesse  
Dessei, 2019/2020**

# Objectives (learning outcomes) of the course are

**At the end of this course, students will be able to;**

- ✓ Identify various common diseases found in farm animals
- ✓ Know & describe the major clinical signs of farm animal diseases in order to make clinical diagnosis at farm level
- ✓ Understand how diseases arise and spread among susceptible population
- ✓ Apply the different methods of livestock disease prevention and control strategies.
- ✓ Design and implement an effective herd or flock health program which would include considerations for sanitation, nutritional disorders, and vaccination program so as to give primary health aids to farm animals
- ✓ Evaluate various types of chemotherapy for the treatment of diseases outlined in item one design and implement a cost effective herd or flock health program

# Contents of the course

- Chapter 1:** General concepts of animal health & disease (introduction to epidemiology)
- Chapter 2:** Infectious diseases of farm animals
- Chapter 3:** Parasitic diseases of farm animals
- Chapter 4:** Non-infectious diseases of farm animals
- Chapter 5:** Diagnosis of animal Diseases of economic importance in Ethiopia and the Tropics

# Chapter 1: General concepts of animal health & disease

## Lesson objectives

- Learn about the basic definitions of terms related with disease
- Learn the definition & objectives of epidemiology
- Disease initiating factors & determinants of diseases
- Understand how disease is transmitted
- Maintenance strategies used by pathogens
- Occurrence of disease by time and space
- **Short review disease control & prevention measures**

# Definition of terms

**Animal:** living animal or human or plant that can harbor the agent

**Health:** a state of complete physical, mental, and the well-being and not merely the absence of disease. It is the state of being free from illness

**So disease control** means protecting animals from danger

**Agent:** something that produces or is capable of producing an effect, i.e. infection/diseases

**Vector:** an organism (as an insect) that transmits an agent from one organism or source to another

# Definition of terms ...

**Infection**: the state produced by the establishment of an infective agent in or on a suitable host , host may or may not have signs or symptoms

**Disease**: impairment of normal functioning, manifested by signs and symptoms, it can be defined as a medically definable physiological dysfunction.

**Carrier**: individual that harbors the agent but does not have symptoms. animal can infect others.

**Source of infection (reservoirs)**: habitat (infected animal, meat, milk, feces, urine, soil, egg, cow dung etc.) in which the agent normally lives, grows, and multiplies

## Definition of terms ....

- **Cause** of a disease an event which plays an essential role in producing an occurrence of disease
- **Pathogens:** disease causing organisms
- **Pathogenesis:** Development of disease

Therefore, knowledge about cause & effect relationships to give appropriate Rx in clinical medicine.

# Diseases are classified by Severity and Duration:

Acute – disorder with sudden onset, relatively severe, and short duration of symptoms (e.g. anthrax, PPR, )

Subacute disease- intermediate between acute and chronic (e.g. subclinical mastitis)

Chronic – develops slowly, lasting over long periods if not a lifetime (e.g. tuberculosis, parasitic diseases)

Latent disease- agent remains inactive for a period of time, but then activates to cause disease (e.g. CBPP)



# Four Common Disease Stages

1. Stage of susceptibility (precedes disease; risk for acquiring disease)
2. Stage of pre-symptomatic disease (begins with exposure & subsequent pathologic changes before symptom onset)

# Common Disease Stages.....

3. Stage of clinical disease: when disease signs and symptoms appear
4. Stage of recovery, disability, or death (influenced by multiple factors including time of detection and treatment)

## 2. Definitions & objectives of Epidemiology

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- ➡ Epidemiology is the study of disease in a population and of factors that determine its occurrence
- ➡ Veterinary epidemiology additionally includes investigation and assessment of other health - related events like productivity
- ➡ A literal translation of the word “epidemiology”, based on its Greek roots *epi* = upon, *demo* = people, and *logo* = *discoursing*, is “the study of that upon the animal or people, “the study of disease in a population”

## 2. Definitions & objectives of Epidemiology

The term *epidemiology* is derived from three Greek words;

Epi = about or upon,

demos = population, and

logy = study of knowledge

According to Thrusfield (2005);

*“Epidemiology is defined as the study of disease in populations and of factors that determine its occurrence”.*

# What is epidemiology?....

According to (Last 1988)

“Epidemiology is the study of the distribution and determinants of health-related states or events in specified populations, and the application of this study to the control of health problems.”

According to Schwabe et al., (1977),

He defines epidemiology as the study of the *frequency*, *distribution* and *determinants* of diseases in populations.

Others define epidemiology as; Epidemiology is the collection and interpretation of data on diseases and disease determinants in a population and the making of biological inference from that data

# Main terms in the definition of epidemiology

**Population.** The main focus of epidemiology is on the effect of disease on the population rather than individuals. For example CBPP affects many cattle in Ethiopia but Blackleg is rare. So, epidemiology gives more emphasis to CBPP since it affects many cattle.

**Disease frequency: -**

- The core characteristics of epidemiology are;
  - to measure the frequency of diseases, or death in a specified population.
  - it is always as the rate, ratio and proportion.

## **Distribution**

Distributions of disease events are based on **time, place, and animal.**

## Main terms .....

### Distribution of diseases:

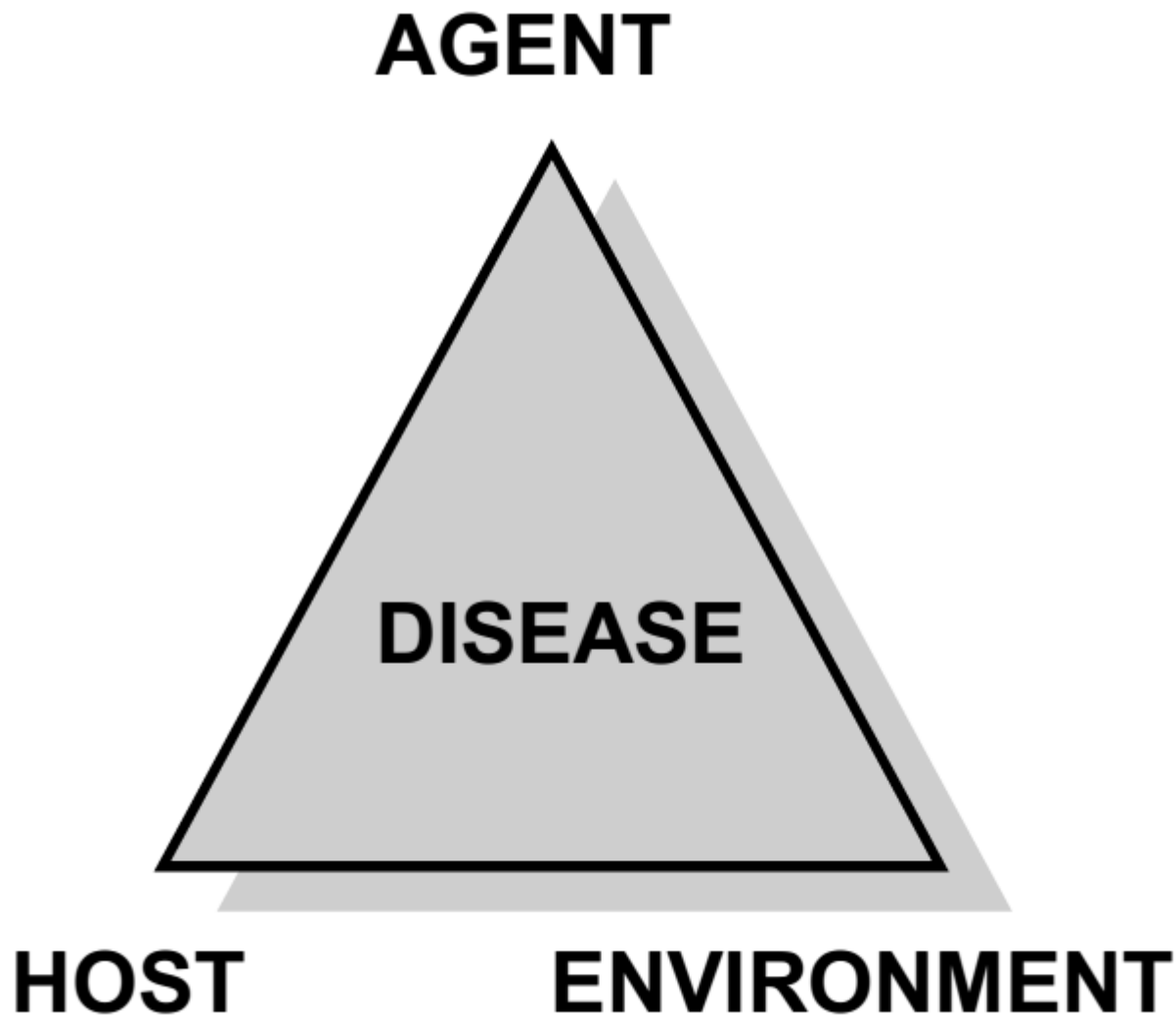
- Health events occur in pattern in a population and this pattern varies from herd to herd.
- Also health events or diseases condition affect population at various age groups, different sexes, different species/breeds of animals.

# Basic Concepts of epidemiology

## Disease causation concept (epidemiological triad concept)

- ❖ Epidemiology assumes as disease does not occur randomly it requires factors
- ❖ So the concepts of epidemiology were first suggested by Hippocrates in the fifth century B.C. that the development of disease might be related to environment and external of an individual.
- ❖ Epidemiology is defined as the study of the distribution and determinants of health related status or events in specified populations and the application of this study to control the health problems





# disease causation concept...

- Identifying causes of disease and the mechanisms by which they spread remains a primary focus of epidemiology
- **Etiology:** Science and study of the causes of disease and their mode of operation

## disease causation concept...

- **Agent**: the cause of the disease
- **Host**: an organism, usually a human or an animal, that harbors a disease
- **Environment**: is a surrounding and conditions external to the human or animal that cause or allow disease transmission
- **Time**: accounts for incubation periods, life expectancy of host or pathogen, and duration of the course of the illness or condition.

# How can epidemics be stopped?

At least one of elements of triangle must be:

- ✓ interfered with or
- ✓ altered
- ✓ changed, or
- ✓ removed from existence, so that disease no longer continues in mode of transmission and routes of infection

**How?** Clean up environment, change behavior, vaccinate, medicine, etc.

# Objectives of epidemiology

- To identify the *etiology* (cause) of a disease & the relevant *risk factors*.
- To determine the *extent of disease* found in the animal population.
- Collection of information on the etiology & natural history of disease (host ecosystem).
- Planning, monitoring & assessment of disease control programs.
- Assessment of the economic effects of a disease, and analysis of the costs & economic benefits of alternative control programs.

# .....cont....

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- ☞ The occurrence of disease is explained by a **complex web of interacting factors** involving *host*, *agent*, and *environment*
- ☞ The web of causation is often used to **describe modern disease problems** where the presence or absence of disease is not just a matter of the agent being present or absent
- ☞ **Host** is the **animal** (or **human**) that may **contract a disease**
  - ✓ *Age, sex, species, breed, level of exposure, and state of health* all influence a host's *susceptibility to developing disease*

## .....cont....

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- ➡ **Agent** is the factor that causes the disease (bacteria, virus, parasite, fungus, chemical poison, nutritional deficiency etc) - one or more agents may be involved
- ➡ **Environment** includes surroundings and conditions either within the host or external to it, which cause or allow disease transmission to occur
  - ✓ *May weaken the host and increase its susceptibility to disease or provide conditions that favor the survival of the agent*

### 3. Determinants of disease

- ✓ The factors that are involved in a multifactorial disease causation
- ✓ **Determinants:** factors that when altered produce a change in the frequency or character of a disease and affect the health of a population
- ✓ They are any factor, variable or characteristic which influence health and productivity
- ✓ **Determinants** of disease can also be **risk factors** that influence or alter the frequency of disease occurrence in a population.



# Importance of studying determinants

- ✓ Knowledge of determinants help to know which group of hosts are at risk under what circumstance and hence to prevent occurrence of disease in population
- ✓ For prevention or control of a disease, not all determinants has to be eliminated, removing only one or some of them could lead to prevention or control of the disease
- ✓ Helping in the diagnosis of disease by narrowing the diagnosis

# Classification of determinants

## Primary and secondary determinants

- ❖ Primary determinants: are factors whose variations exert a major effect in inducing disease.
- ❖ They are usually **necessary causes** of disease.  
Eg. **Pasteurella** is the primary cause of pasteurellosis
- ❖ Secondary determinants: they are **predisposing, enabling, precipitating and reinforcing factors**.

E.g. Sex is a secondary determinant for **canine heart incompetence** where male dogs are more likely to develop valve incompetence than female dogs

# Cont...

- Predisposing factors, which increase the level of susceptibility in the host (e.g. **age and immune status**);
- Enabling factors, which facilitate manifestation of a disease ( e.g.. **housing and nutrition**);
- Precipitating factors. Which are associated with the definitive onset of disease ( **e.g., many toxic and infectious agents** = (necessary causes);
- Reinforcing factors, which tend to aggravate an already existing disease (**e.g., stress, under nutrition, overwork etc**) repeated exposure to an infectious agent

# Intrinsic and extrinsic determinants

## Intrinsic:

They are determinants which could be **primary** or **secondary** that are internal to the **host or agent**

e.g. Genetic constitution (Sex, Species, breed), Age, size & conformation, Hormonal status, Nutritional status, immunological status, Functional status (Pregnant, lactating...), Behavior

Extrinsic: are determinants which could be **primary** or **secondary** that are external to host or agent

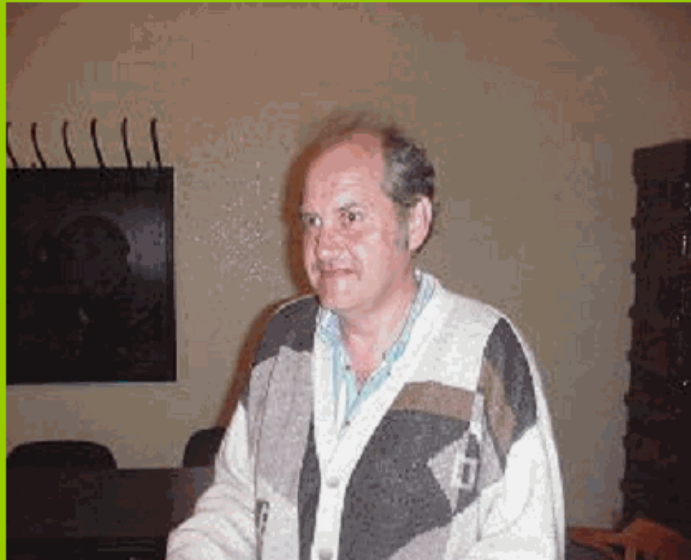
**Examples;** Poisons, location, climate, management, radiation , Stressors etc..

# Host-agent-environment (H-A-E)

- ✓ During the past centuries, after microbial revolution, the study of disease has primarily concentrated on the pathogens of disease ignoring features like the **host, agent and environment**
- ✓ But modern understanding of disease is as multifactorial; caused by interaction of several factors
- ✓ **Multifactoriality varies from disease to disease**
- ✓ It is less apparent in some disease like rinderpest or FMD (called **simple diseases**) but more clear in **complex disease** of intensive farming like environmental mastitis or hypoclacemia

Cont..

## MULTIFACTORIAL CAUSATION THEORY



PETTENKOFFER

- PETTENKOFFER STATED THAT AGENT, HOST AND ENVIRONMENTAL FACTORS WILL ACT AND INTERACT SYNERGISTICALLY AND ACT AS JOINT INDEPENDENT PARTNERS IN CAUSING THE DISEASE.

# disease Initiators & potentials



HOST Characteristics	Types of AGENTS	ENVIRONMENTAL Factors
Age	Biologic – bacteria, virus, molds	Housing – crowding, noise
Gender	Chemical – poison, alcohol	Air – temperature, humidity
species	Physical - trauma, fire	Water , food
Breed		
Physiological		
Genetic profile		

# Host-agent-environment (H-A-E).....

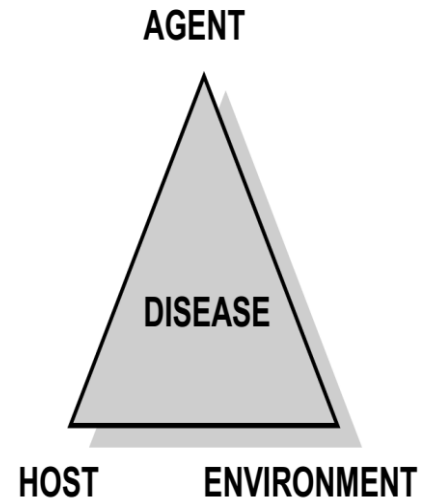
- ✓ In this classification determinants associated with host, agent & environment **do not exert their effects in isolation**, they interplay (interact) one over the other to induce and influence the frequency of disease occurrence.
- ✓ Disease occurs as result of interaction of **agent, host, environment factor**
- ✓ A number of models of disease causation with multifactorial paradigm/model have been propose
- ✓ One of the model that indicates the association of the three factors frequently called "**Epidemiological triad**".
- ✓ It is the interaction of the agent, the host, and the environment which determines whether or not a disease develops, and this can be illustrated using the **epidemiological triangle**.
- ✓ **Less useful for non infectious disease**



# H-A-E

## *What is Epidemiologic Triangle?*

The Epidemiological Triangle is a model that scientists have developed for studying health problems (mainly infectious disease).



It can help students to understand infectious diseases and how the spread.

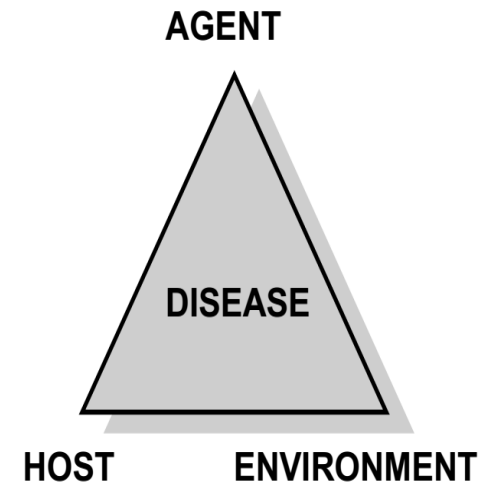
# H-A-E.....

The Triangle has three corners (called *vertices*):

Agent, or microbe that causes the disease (the “**what**” of the Triangle)

Host, that may be animal /human harboring the disease (the “**which**” of the Triangle)

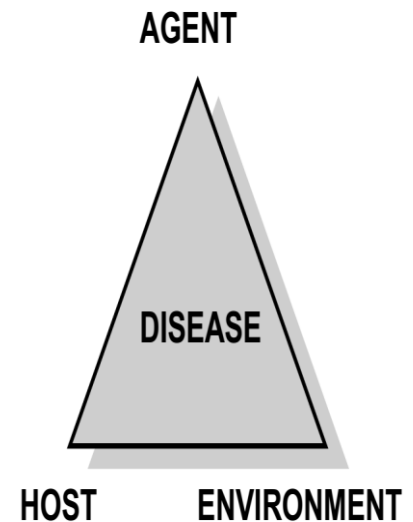
Environment, or those external factors that cause or allow disease transmission (the “**where**” of the Triangle)



# H-A-E.....

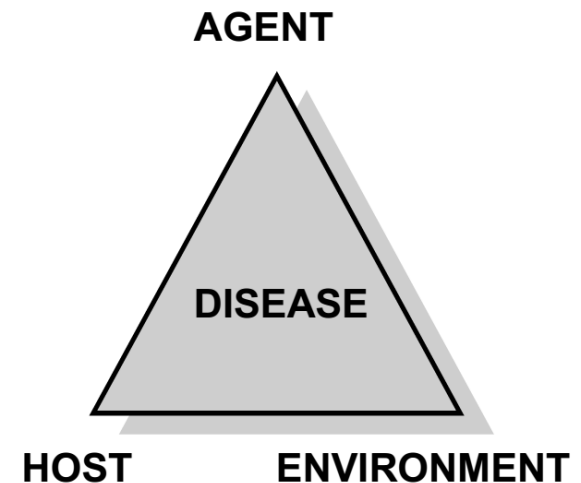
The mission of an epidemiologist is to **break at least one** of the sides of the Triangle, disrupting the connection between the environment, the host, and the agent, and **stopping the continuation of disease**

Because, the three components of the epidemiological triads are potential risk factors that influence the probability of disease occurrence in a population.



# A. Host determinants

**The Host—“Which”** Hosts are organisms, usually humans or animals, which are exposed to and harbor a disease



# Species of the host as determinant to a disease dev't

- Species vary in their susceptibility and responses to different infectious agents, and therefore in the role they play in disease transmission.

## Example

- cattle are the species most likely to be infected by between-farm spread of airborne virus, because of their extreme susceptibility to airborne infection and higher respiratory tidal volume.

## Example;

- Dogs, for example, do not develop heart water
- Pigs are harder to infect with foot-and-mouth disease virus via the respiratory tract than cattle and sheep.
- Pigs are not only less susceptible to airborne virus but also, because of their lower tidal volume

# Age of the host as determinant to a disease dev't

- The occurrence of many diseases shows a distinct association with **age**.
- **Many bacterial and virus diseases**, for instance, are more likely to occur, and to be fatal, in **young than in old animals**, either because of an **absence of acquired immunity** or because of a low non-immunological host resistance.
- **Many protozoan and rickettsial infections**, in contrast, induce milder responses in the young than in the old.

# Sex of the host as determinant to a disease dev't

- **Anatomical d/c** e.g. urolithiasis in bulls than cows
- **Hormonal** e.g. mammary tumors in bitches
- **Occupational** e.g. canine heart worm disease is common in male dogs due to exposure to vector mosquito during hunting
- **Social:** bite wounds in male cats
- **Genetic:** may be inherited either by being sex-linked (gene located in the sex chromosome), sex-limited (occurred only in one sex), or sex-influenced (occurs more on one sex) eg **mastitis**

# B. Agent determinants

Agents associated with disease can be categorized into two broad groups:

- "Living" agents, such as viruses, bacteria, rickettsia, protozoa, helminths, arthropods etc.
- "Non-living" agents, such as heat and cold, nutrients, toxic substance, physical injuries etc.
- Since infectious diseases of livestock are generally regarded as being of **prime importance in Africa**, the following discussion is concerned principally with the determinants associated with the so-called **living disease agents**.



# Agent determinants...

- In instances of infectious disease, the presence or absence of the **etiological agent is the main determining factor in the epidemiology of the disease.**
- Obviously, disease cannot occur in the absence of the agent, but, conversely, disease need not always result from the presence of the agent.
- This leads us to the important epidemiological distinction between infection and disease.

## Cont...

- *Infection* can be defined as the invasion of a living organism/the host, by another living organism/the agent.
- *Disease* can be defined as a derangement in the function of the whole body of the host or any of its parts.

# Properties of infectious agents includes the following

## Infectivity:

- ❖ It is a measure of the ability of a disease agent to establish itself in the host.
- ❖ This term can be used **qualitatively**, when an agent is referred to as being of **low, medium or high infectivity**, or **quantitatively**. Attempts to quantify infectivity normally involve the use of a statistic known as **ID<sub>50</sub>**.
- ❖ This refers to the numbers of infectious agent required to infect **50% of a specified population of susceptible animals** under controlled environmental condition.
- ❖ Having become infected, the host may or may not become diseased, and this is again determined by a range of intrinsic and extrinsic determinants affecting the agent and the host.
- ❖ **Two terms - virulence and pathogenicity** - are often used to describe the ability of the agent to cause disease.

# Cont...

## What is virulence?

- ✓ can be defined as a measure of the **severity** of a disease caused by a specified agent.
- ✓ In its strict sense, virulence is a **laboratory term** and is used to measure the **varying ability of disease agents** to produce disease under controlled conditions.
- ✓ It is often quantified by a statistic known as  $LD_{50}$  which refers to the numbers of the infectious agent which will kill 50% of a specified population of susceptible animals under controlled environmental conditions.

# Cont...

## What is pathogenicity?

is an epidemiological term used to describe the ability of a particular disease agent of known virulence to produce disease in a range of hosts under a range of environmental conditions.

# Cont...

## Plurability:

- The antigenic diversity property of infectious agents
- Eg. FMD, pastuerella, salmonella, NCDV etc....

## Transmiablity:

- ✓ it is the transsimibility property of an infectious agent
- ✓ Based on this diseases can be classified as **contagious disease** (transmit through contact)
- ✓ **Non-contagious disease** diseases which can be transmitted by vector

# Cont...

## Tissue tropism:

- ✓ After the overcoming of the defence mechanism of the host agent has the affinity to certain tissue (organs \*(predilection site)
- ✓ Example Pneumotropic, enterotropic, neurotrpic, dermatropic etc..

## **Stability (tenacity):**

- it is the ability of the agent to survive in the environment
- Example bacillus spore survive in the soil but the agent of FMD is not.

**Adaptabiliy:** the ability of the agent to cope up the host defence mechanism

## Cont...

# Toxigenicity:

- ✓ It is the ability of the agent to produce toxin
- ✓ The toxin may be **phytotoxin** (fungus) or **zootoxin** (venom)
- ✓ Or it may be **endotoxin** (e.coli, salmonella)
- ✓ Or it may be **exotoxin** by clostrial bacteria.

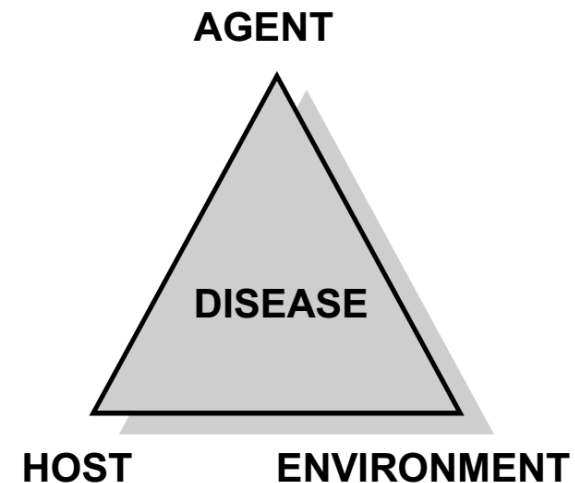


# C.Environment determinants

## The Environment—“Where”

The environment is the favorable surroundings and conditions *external* to the host that cause or allow the disease to be transmitted.

Some diseases live best in dirty water



# Environment determinants

- The **extrinsic determinants** of disease are important in epidemiology in that they can have effects **on the host, on the agent, and on the interactions** between the host and the agent.
- They can also affect any **intermediate hosts or vectors** involved in the transmission of a disease, and thus determine the type and extent of the disease transmission taking place.

# Major Environment determinants

- The first two are **climate and soils**, which, by interacting in a variety of ways, affect the environment of the host, the agent, and the intermediate host or vector, if they are present.
- The third major factor is **man**, who, uniquely among animals, has the ability to modify both the environment in which he lives and the environment in which he keeps his livestock.

# 1. Climate

- ✓ When considering climate as a determinant of disease, a distinction is normally made between the **macroclimate** ( weather), and the **microclimate**.
- ✓ The term **macroclimate** refers to the actual climatic conditions prevailing in the specific, restricted environment where the host, agent, vector or intermediate host actually live.
- ✓ While **man is as yet largely incapable of** deliberately manipulating **macroclimates**, he can control and manipulate **microclimates** to some extent.



## Macroclimates

- A large number of different factors combine to make up the macroclimate.
- Some of these factors (**heat, cold, rainfall, wind, humidity etc**) can act as disease agents in their own right, either individually or in combinations.
- As such they can cause **disease in young and newborn animals** which are particularly sensitive to heat, cold and dehydration.
- In older animals they tend to act more as indirect determinants of disease in that they can produce either alone or in combinations with other managemental and nutritional determinants - **"stress" conditions in the host**, which may lower its resistance both to infection and, if infection takes place, to disease.

# Environment determinants....

## Macroclimates

- ✓ Macroclimates can also affect the ability of a disease agent, or its intermediate host or vector, to survive in the environment.
- ✓ If the effects of weather on disease agents and their intermediate hosts or vectors are known, it may be possible to predict when host populations are at a particular risk of contracting disease and thereby to implement appropriate control measures at strategic times.
- ✓ This approach has been used with success in the control of such diseases as helminthiasis, ticks and tick-borne diseases, trypanosomiasis, foot-and-mouth disease, and in mineral and other nutritional deficiencies.

# Environment determinants....

## Microclimates:

- ✓ While macroclimates can have a direct effect on microclimates, the study of macroclimates alone can frequently be misleading in achieving an understanding of the epidemiology of a disease.
- ✓ Regions where existing macroclimatic conditions might be thought unsuitable for the transmission of a disease may, in fact, contain limited areas where the microclimatic conditions are suitable for the survival of the disease agent and its vector or intermediate host.
- ✓ (An example may be a water hole or an irrigated pasture in an arid environment).

# Environment determinants

## Microclimates:

- ✓ Such areas often provide enhanced conditions for disease transmission, since they may prove attractive to livestock, particularly at those times of the year when the macroclimate is at its most severe.
- ✓ If the host and the agent (and the vector or intermediate host, if they exist) are in close contact, the transmission of disease can be effected rapidly and easily.
- ✓ Thus, in arid areas, the transmission of such diseases as helminthiasis and trypanosomiasis may in fact take place during the dry season when the hosts, the agent and the vector are all concentrated around permanent water sources.
- ✓ High contact rates in these areas also favour the introduction and transmission of rinderpest, foot-and-mouth disease and contagious bovine pleuropneumonia.



# Environment determinants....

## Soils

- By interacting with climate, soils determine vegetation and the environment in which the livestock are kept.
- The main effect of vegetation is on nutrition. Soils therefore **act indirectly as** determinants of disease by causing **starvation**, if there is little or no vegetation, or nutritiorial imbalances such as protein, energy, vitamin or mineral deficiencies.
- **Malnutrition** can be the **direct cause of disease**, or it can **stress** the host and thus increase its **susceptibility** to infection and disease from other sources. Soils can also have an effect on the ability of the **agent** to **survive in** the environment, through such factors as waterlogging, pH etc.

# Environment determinants....

## Man

- Man is often able to create favourable, artificial microclimates for livestock rearing by providing such inputs as housing, water supplies, irrigation etc.
- Unfortunately, this often results in the creation of conditions favourable for the survival of disease agents and their intermediate hosts or vectors.
- This means that, by altering the environment, man can alter the determinants of the diseases present in that environment.
- The changes in determinants will favoriable some diseases and be detrimental to others.

# Environment determinants.....

## Man

- Thus **changes in systems** and methods of production will result in changes in the relative importance of the diseases present, with perhaps some new diseases being **introduced** and others disappearing.
- The epidemiologist should be alert to such changes and should attempt to predict the likely effect that these will have on the overall disease picture, so that potentially dangerous situations can be averted or controlled.
- Man is also able to interfere directly in the **disease process** through the use of drugs, vaccines, movement controls, quarantines etc.
- Among the main tasks of the epidemiologist is the investigation of the efficacy such measures, as well as to design ways in which they can be used most efficiently and to monitor the effects of their introduction on disease incidence.

# 4. Method of Transmission of Disease

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- ➡ **Infectious disease** is the result of the **invasion of a host** by a pathogenic organism
- ➡ The **continued survival of infectious agents**, with or without the induction of disease, depends on their **successful transmission to a susceptible host**
- ➡ The complete cycle of an infectious agent is its **life history** (**life cycle**) and **knowledge** of this is essential when **selecting the most applicable control technique**, including knowledge of:
  - ✓ *Modes of transmission and maintenance of infection*
  - ✓ *Ecological conditions that favor the survival and transmission of infectious agents*

# .....con't.....

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- ☞ Transmission may be either **horizontal (lateral)** or **vertical**
- ☞ **Horizontally** transmitted infections are those transmitted from any **segment of a population to another**
- ☞ **Vertically** transmitted infections are transmitted from **one generation to the next** by infection of the **embryo** or **fetus** while in utero (in mammals) or in **ovo** (in birds) by **transovarian route** or transmission on the **egg shell**
  - ✓ *Transmission by **milk to offspring** is also considered, by some, to be **vertical***

# .....con't.....

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## Horizontal Transmission

- ☞ It can be either *directly* or *indirectly*

## Direct Transmission

- ☞ Occurs when a susceptible host contracts an infection, either by **physical contact** with an **infected host** or by contact with the latter's **infected discharges** or by **inhaling** or by **ingesting** or through coitus

## Indirect Transmission

- ☞ Involves an *intermediate vehicle*, **living** or **inanimate**, that transmits infection between infected and susceptible hosts

- ☞ This vehicle generally may be termed a **vector**

# .....con't.....

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## *Classification of vectors*

### **A. Mechanical Vector**

- ☞ An animal (usually an arthropod) that **physically carries an infectious agent** to its primary or secondary host
- ☞ Infectious agent **neither multiplies nor develops** in the mechanical vector
- ☞ **Airborne** transmission of infectious agents, frequently **over long distances**, is often defined as **indirect**, although it is **more correctly classified as direct** because **no intermediate vehicle is involved**

# .....con't.....

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## *Classification of vectors ...*

### **B. Biological Vector**

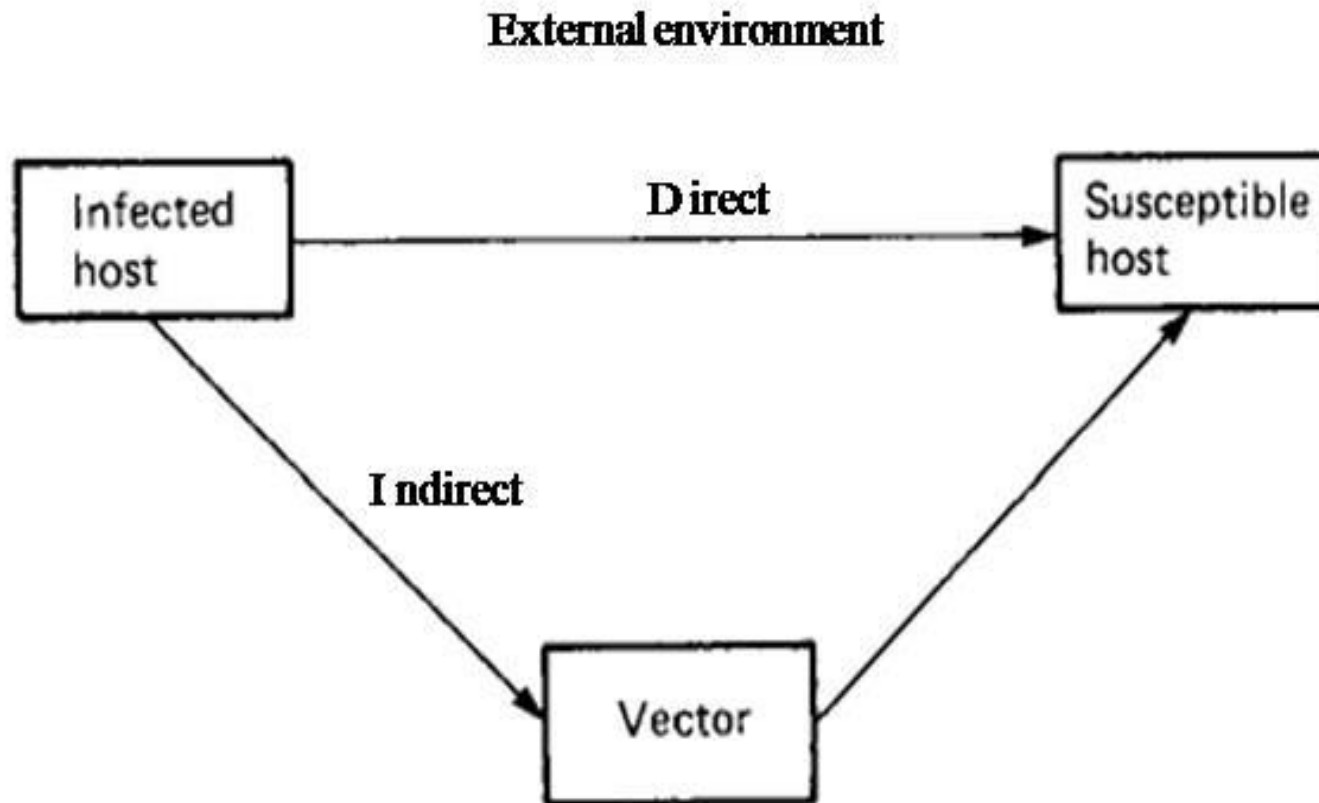
- ☞ An infectious agent undergoes either a **necessary part of its life - cycle**, or **multiplication**, before transmission to the natural or secondary host

### *Three types of biological transmission*

- 1. Developmental transmission:** with an essential **phase of development** occurring in the vector
- 2. Propagative transmission:** when the agent **multiplies** in the vector
- 3. Cyclopropagative transmission:** a **combination** of 1 and 2



.....con't.....



*Basic mechanisms of transmission of infectious agents*

# Summary on Mode of Transmission

Route	Example	Disease
Direct contact	sexual contact, skin-to-skin contact	Brucellosis, Epizootic lymphangitis manage
Droplet	Organism on large respiratory droplets that animal sneeze, cough, drip, or exhale. Disease spread when people are close to each other (usually <3 feet) and inhale droplet.	CBPP, BTB, CCPP, Pasteurellosis etc..
Indirect contact	Contact with contaminated surfaces, clothing, etc	Skin infections, diarrheal disease
Vector	Bite from disease-carrying ticks, fleas, mosquitoes	Trypanosomosis, Fasciolosis
Vehicle	Eat/drink contaminated food/beverage, transfuse infected blood, fomites (bedding, infected tatoo needle)	Mastitis, salmonellosis etc..
Airborne	Organism on dust particles or small respiratory droplets that may become aerosolized when people sneeze, cough, laugh, or exhale	Tuberculosis, Shoats pox, LSD, Anthrax (inhalational)

# 6. Maintenance strategies of infectious agent

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**Definition:** The ways in which infectious agents are maintained can be considered as strategies for maintenance. Five main

1. Avoidance of a stage in the external environment;
2. The development of resistant forms;
3. A rapidly in, rapidly out' strategy;
4. Persistence within the host;
5. Extension of host range.

## Avoidance of a stage in the external environment

- Some agents avoid transfer via the environment. There are four main methods:
  1. by vertical transmission;

# strategies....

## Avoidance of a stage in the external environment

Some agents avoid transfer via the environment. There are four main methods:

- ✓ by vertical transmission;
- ✓ by venereal transmission;
- ✓ by vector transmission;
- ✓ By transmission by sarcophagia (flesh eating); for example, the helminth *Trichinella spiralis* occurs in cysts in the muscle of pigs, rats and other animals, and is only transmitted when these animals are eaten by predators and scavengers, including man.

# strategies....

## Resistant forms

- The harshness of the external environment can be buffered by surrounding the infectious agent with a shell that is resistant to heat and desiccation.
- Some bacteria form such shells (spores).
- Examples include members of the genera *Clostridium* and *Bacillus*, which can survive boiling water, even flames, for short periods of time, and may survive in the external environment for decades. Fungi may also produce spores.
- Some helminths and protozoa form resistant shells (cysts).
- Thick-shelled helminth eggs can resist the external environment and may overwinter on pasture.

# strategies....

## 'Rapidly in, rapidly out' strategy

- Some agents enter the host, replicate and leave very quickly, before the host has time to mount an immune response or die.
- Many viruses of the upper respiratory tract can do this within 24 hours.
- The strategy requires a continuous supply of susceptible hosts.
- This may be one reason why respiratory and enteric infections, such as the common cold virus in man, are not present in primitive societies of low population density, and may not have occurred in small prehistoric societies.

# strategies....

## Persistence within the host

- ~~• Infectious agents may persist within the host, sometimes for life.~~
- Persistence occurs because the host's defense mechanisms fail to eliminate agents.
- This failure may arise because microorganisms adapt to the host's phagocytic cells, or develop strategies for avoiding the host's immune response.
- The latter include immune-suppression and tolerance.

# 7. Distribution (occurrence) of Disease Events in Time and Space

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- ☞ The level of disease in a **population** depends often on the interplay of **three factors**
- 1) **Individual factors**: what **types of individuals** tend to develop disease and which tends to be spared?
  - 2) **Spatial factors**: where is the disease especially **common** or **rare**, and what is **different** about those places?
  - 3) **Temporal factors**: how does disease **frequency change over time**, and what other **factors** are associated with those **changes**?



# .....con't.....

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## 1) Individual

- 👉 Individuals can be grouped or distinguished on a number of characteristics: **age, sex, breed, coat-color**
- 👉 An important component of epidemiological research is aimed at **determining the influence of individual characteristics on the risk of disease**

## 2) Place

- 👉 The **spatial pattern** of disease is typically a **consequence of environmental factors**
- 👉 Environmental factors include aspects of **climate** (**temperature, humidity, rainfall**) as well as aspects of **animal management**

### 3) Time

- 👉 **Temporal patterns** of disease in populations are presented graphically by using **epidemic curves**, which consists of bar charts showing **time on the horizontal axis** and the **number of new cases on the vertical axis**
- 👉 **Shape** of an epidemic curve can provide important information about the **nature of the disease** under investigation
- 👉 **Times of occurrence** of cases of a disease constitute its **temporal** distribution, whereas **places of occurrence** comprise its **spatial** distribution
- 👉 The amount of disease is the **morbidity**; the number of deaths is the **mortality**

# .....con't.....

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☞ According to **morbidity** and **mortality rate**, **temporal** and **spatial distribution**, and **demography** of diseases, occurrence can be classified as

1. Sporadic occurrence
2. Endemic occurrence
3. Epidemic occurrence
  - a) *Common source epidemic*
  - b) *Propagated epidemic*
3. Pandemic occurrence

# Sporadic Occurrence

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Occurs *irregularly* and *haphazardly*

- ☞ This implies that appropriate circumstances have occurred locally, producing small localized outbreaks
- ☞ Thus 'sporadic' can indicate either a single case or a cluster of cases of a disease or infection (without obvious disease) that is *not normally present in an area*

# Endemic Occurrence

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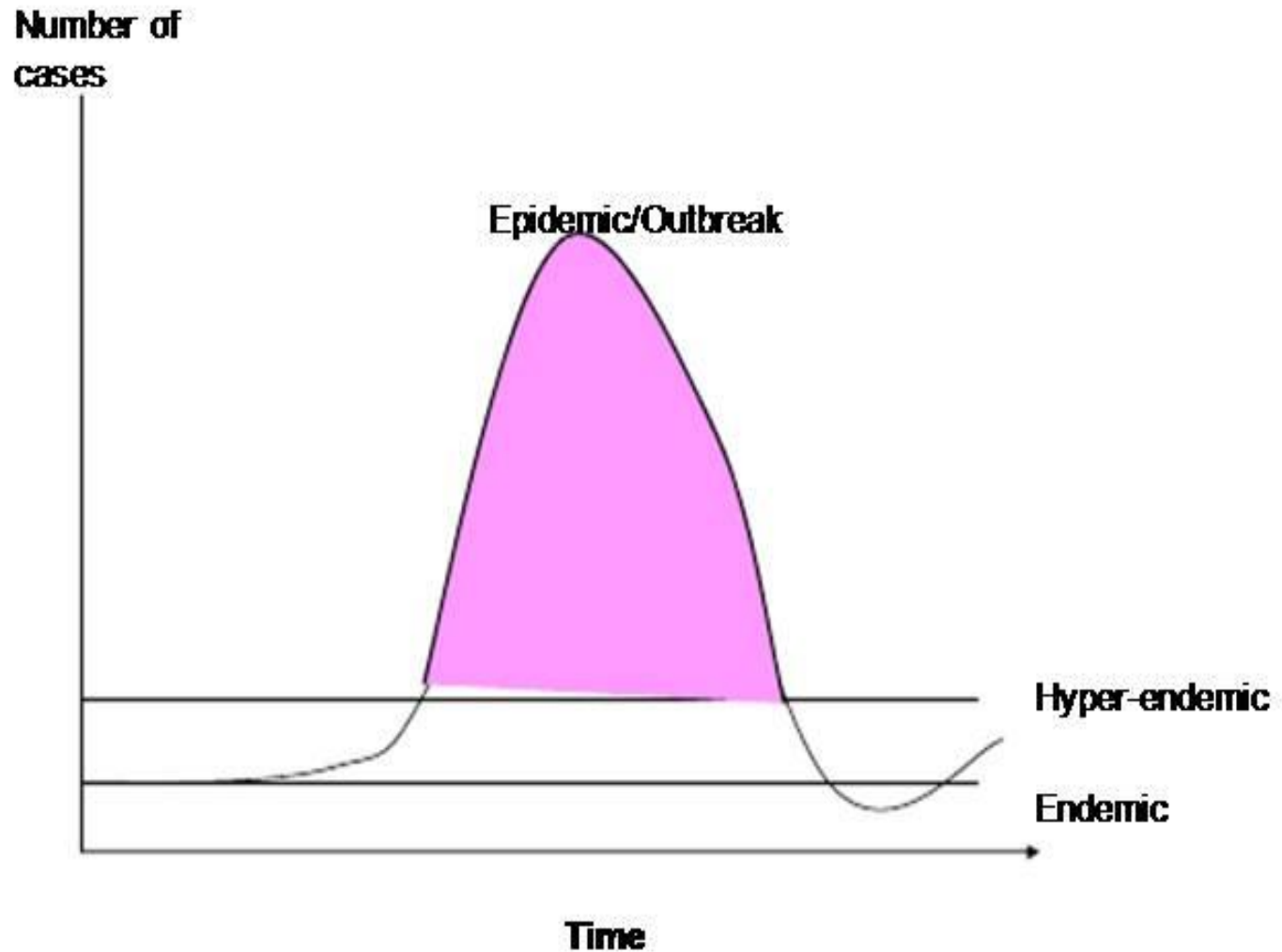
- ☞ “**Endemic**” is used in **two senses** to describe:
  - i. *Usual frequency of occurrence of a disease in a population*
  - ii. *Constant presence of a disease in a population*
- ☞ “Endemic” implies a **stable state**, i.e., describes levels of disease which do **not exhibit wide fluctuations over time**
- ☞ If a disease is well understood, then its endemic level is often **predictable**

# Epidemic Occurrence

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- ☞ “**Epidemic**” originally was used only to describe a sudden, usually unpredictable, increase in the number of cases of an infectious disease in a population
- ☞ In modern epidemiology, an epidemic is an *occurrence of an infectious or non-infectious disease to a level in excess of the expected* (i.e., endemic) level
- ☞ When an epidemic occurs, the *population* must have been subjected to one or more factors that were not present previously
- ☞ The endemic level of disease in a population has to be *known before an epidemic can be recognized*

.....con't.....



.....con't.....

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Epidemics may be described as being either **common source** or **propagated**

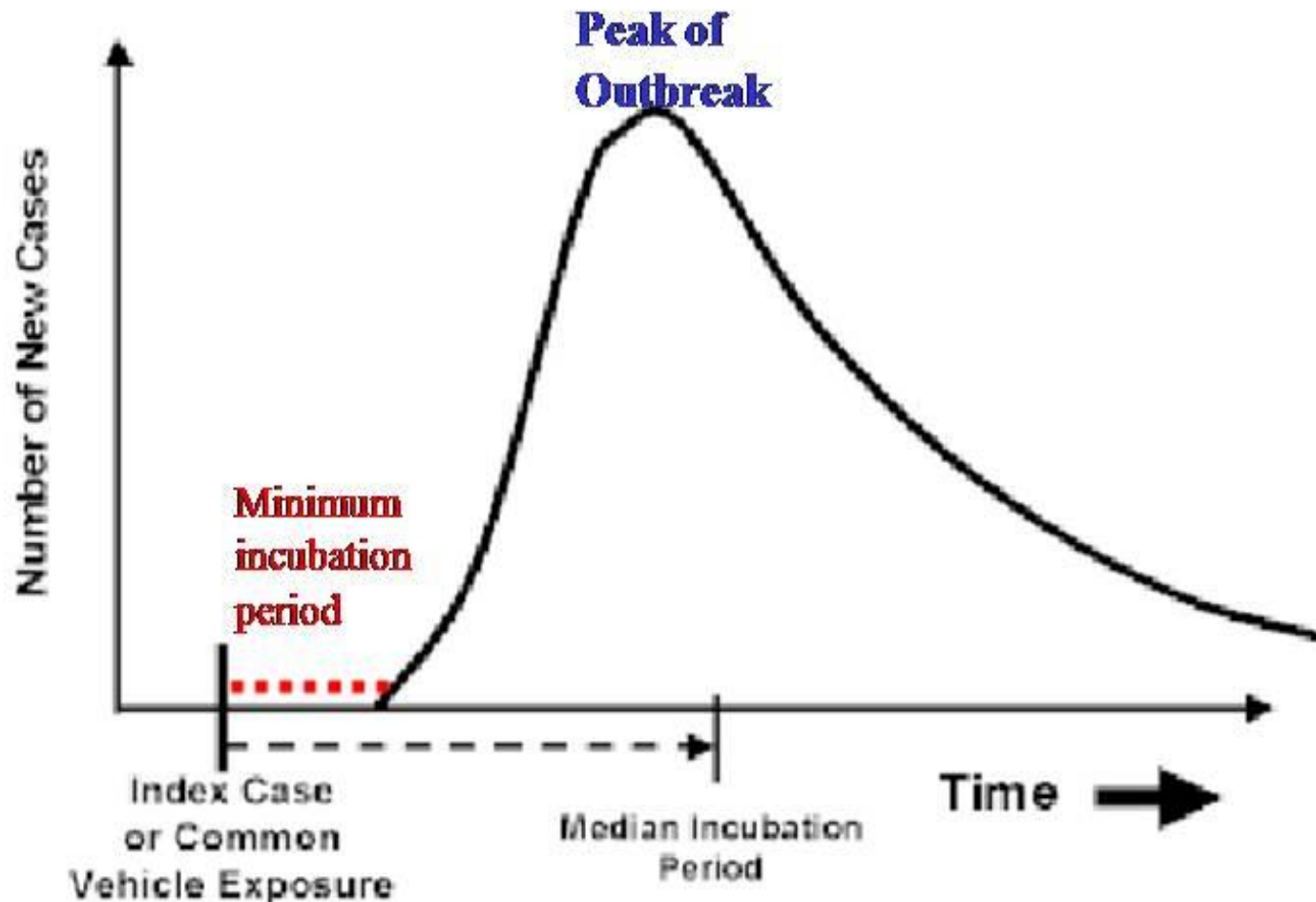
### *a) Common Source Epidemic*

- 👉 Subjects are exposed to a **common noxious influence**
- 👉 If the group is **exposed** over a **relatively short period** then disease cases will **emerge over one incubation period**
- 👉 **Shape** of the **curve** **rises rapidly** and contains a **definite peak** at the top, followed by a **gradual decline**
- 👉 **Down slope** of the curve may be **very sharp** if the **common source is removed** or **gradual** if the **outbreak is exhausted itself**



.....con't.....

## Epidemic Curve of Point Source Epidemic

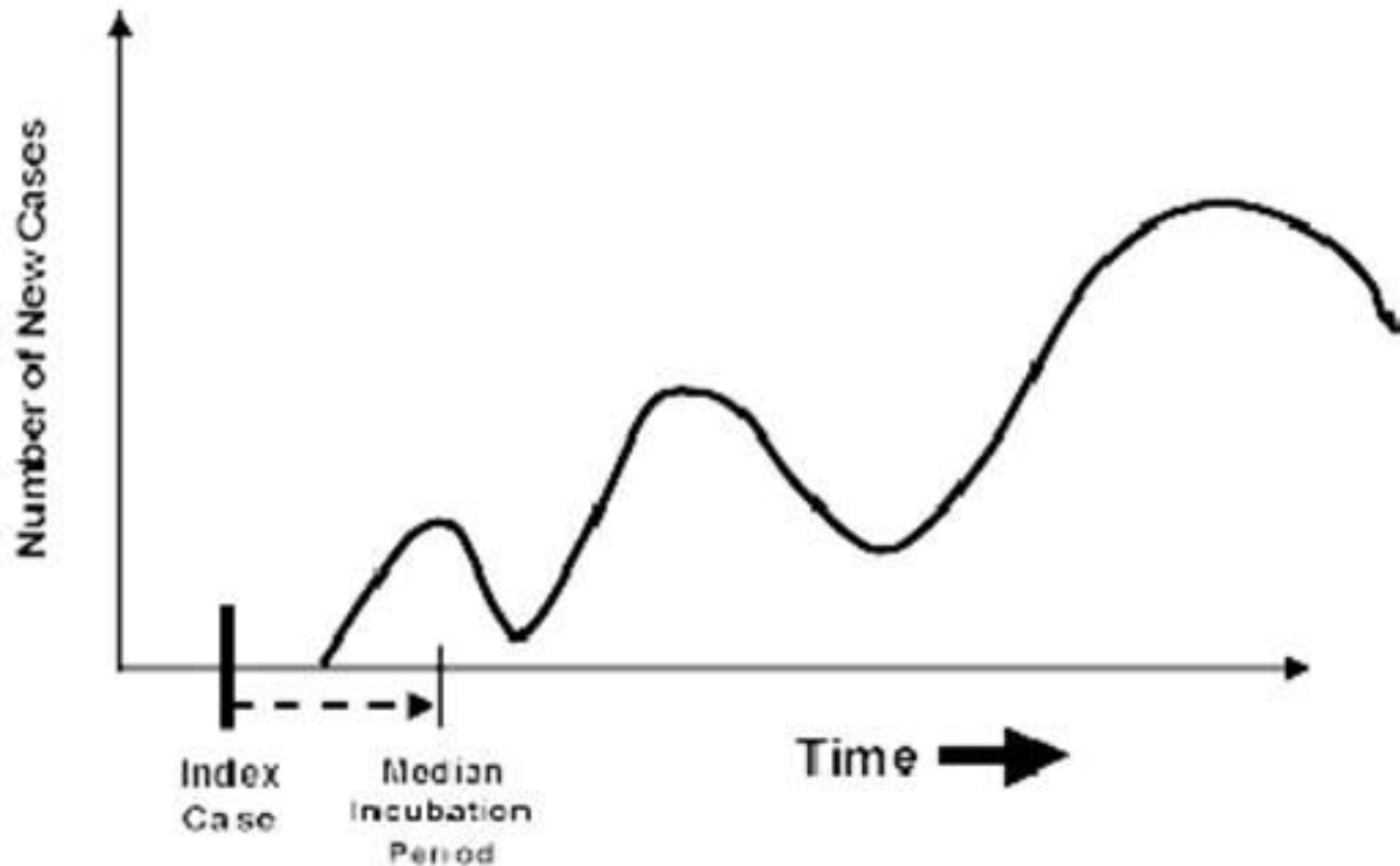


## *b) Propagated Epidemic*

- ➡ Occurs when a ***case of disease serves as a source of infection for subsequent cases*** and those **subsequent cases**, in turn, serve as ***sources for later cases***
- ➡ Epidemic curve of a propagated epidemic has a ***successive series of peaks*** reflecting **increasing numbers of cases in each generation**
- ➡ The epidemic usually ***wanes after a few generations***, either because the **number of susceptible falls** below a critical level, or because **intervention measures become effective**

.....cont.....

## Epidemic Curve of Propagating Epidemic



# Pandemic Occurrence

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➤ A *widespread epidemic* that usually affects a large proportion of the population

☞ Many countries may be affected

Example HIV/AIDS, FMD, PPR, AI etc....

# 8. Disease control & prevention measures

## Preventive Medicine Concepts

- There are three levels of prevention :

**1. Primary prevention:** Eliminate causes of disease or increasing resistance to disease.

- ***Health promotion***

*(eg. housing )*

- ***Prevention of exposure***

*(eg. vector control)*

- ***Prevention of disease***

*( eg. vaccine )*

# Cont'd...

**1. Secondary prevention:** stop or slow the progression of disease

Eg. Early detection and treatment

**2. Tertiary prevention:** *prevent further disability or death*

‘Better than cure on humanitarian and economic grounds’

# Cont'd...

## Disease Control & prevention Concepts

- Good sanitation and vaccination programs are often the best means to lower the risk of D+,
- Identification and removal of animals harboring pathogens
- Treatment of infected animals
- Isolation of sick animals does little to stop the spread of infection (in-apparent case)
- All-in all-out operations are a good control strategy
- Reduce both prevalence and incidence

## Cont'd...

# Strategies of control and eradication

1. **Doing nothing:** incidence of D+ may be reduced by natural changes in host/parasite r/s without the intervention of man, eg. Bluetongue in Cyprus
2. **Quarantine:** isolation of animals that are either infected,
  - eg. During importing animals from endemic area
- Similarly, when an infectious agent is not spreading within a herd or flock, **quarantine** may be adopted as part of a control campaign- removal of **Seropositive**
- The period of quarantine depends on:
  - on the incubation period ,
  - time taken for the infection to be confirmed, and
  - the time taken for an infected animal to become non-infectious



# Cont'd...

**3. Slaughter:** in chronic infectious D+, in eradication campaigns ('test-and-removal' strategy),

- **Pre-emptive slaughter:** culling of infected animals during epidemics is accompanied by the slaughter of animals exposed to infection and at risk of developing D+
- **Blanket culling** (contiguous culling) is pre-emptive culling that also aims to 'get ahead' of the D+ before clinical signs occur
- **'stamping out'** : Slaughter of animals is accompanied by (e.g., disinfection, and carcasses burning or burial); to reduce the risk of transmission,

# Cont'd...

**4. Vaccination :-** Strategies in not routinely vaccinating countries,

- **Ring vaccination:** animals in an area surrounding an infected region are vaccinated to provide a circumjacent barrier
- **Barrier vaccination:** not completely circumscribing an infected region,
- **suppressive or dampening-down:** both within and around outbreak region

NB: Emergency vaccines are manufactured to a higher potency than routine vaccines

## Cont'd...

### 5. Therapeutic and prophylactic chemotherapy

- Warble fly was eradicated from the UK through the use of 'warblecides'
- Preoperative and postoperative use of antibiotics
- Addition of antibiotics to livestock feed (a declining practice)

NB: **Resistance as disadvantage**

### 6. Restriction of movement of hosts

- Around 'Protection Zone' (3km radius)
  - Including slurry spreading and hunting
- Restriction of international animal movements (banning)
  - Including animal product and byproduct

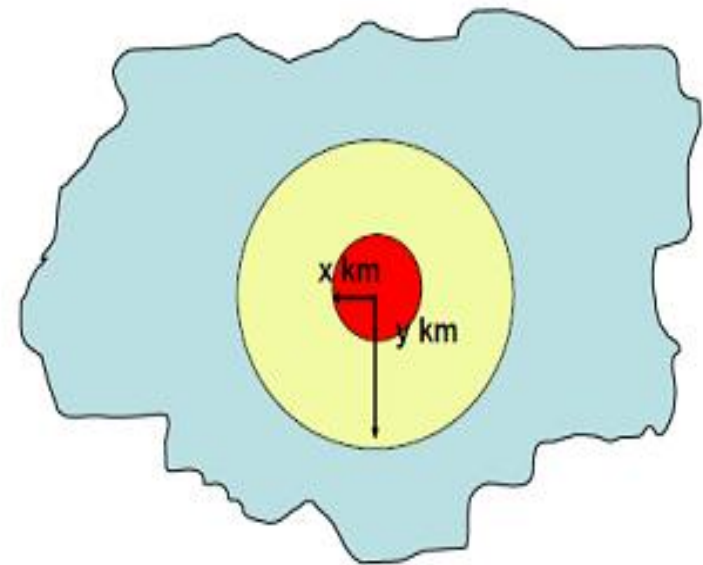


Figure 5 – Illustration of movement control areas centred on a disease outbreak

indicating an infected zone around an outbreak

# Cont'd...

## 7. Mixed, alternate and sequential grazing

- **Mixed:**

- Adult cattle (immune) with calves (susceptible).
- Cattle (resistant to *Ostertagia*) with sheep (susceptible)

- **Alternative:**

- Annual alternation of sheep and cattle

- **Sequential:** at different times of resistant and susceptible animals of the same species

NB: Reduce anthelmintic resistance

## 8. Control of biological vectors

- Insecticides
- Destroying habitat
- Competitive exclusion (Niche filling)
- Manipulation gene SIT

# Cont'd...

## 9. Genetic improvement

- Many diseases of animals have a variable heritable component
- A valuable aid to the identification of genetic conditions and predispositions is **genetic screening and selective breeding**
- The requirements for a genetic screening programme are :
  - Problem is at family, a herd or a breed level,
  - A simple and inexpensive test should be available
  - Control by culling of heterozygote should not affect genetic makeup
  - Logistic should be acceptable, safe and integrated with other control program,
  - Genetic counseling to ensure that control is instigated on the basis of information provided by the screening tests,

# Summary on disease Control & prevention measures

## Portal of enters

- Oral route
- Respiratory route
- Skin
- Coitus etc..

Route	Example	Control Measures
Direct contact	Coitus, ingestion skin-to-skin contact	Use of barrier
Droplet	Organism on large respiratory droplets that animal sneeze, cough, drip, or exhale.	Respiratory etiquette
Indirect contact	Contact with contaminated surfaces, etc	Hand-hygiene, sanitizing infected surfaces
Vector	Bite from disease-carrying ticks, fleas, mosquitoes	Vector control
Vehicle	Eat/drink contaminated feed/drink, transfuse infected blood, fomites (bedding, infected treatment needle)	Proper hygiene and sanitation, cook food/boil water, etc.
Airborne	Organism on dust particles or small respiratory droplets	Respiratory etiquette, isolation (if necessary)

# Summary on disease Control & prevention measures.....

## Education and Training

- Hygiene
- Sanitation
- Follow public health recommendations – food preparation, isolation and quarantine

## Vaccination

- Keep up to date

## Medicine

- Prophylactic antibiotics – meningitis, pertussis

# Questions?

