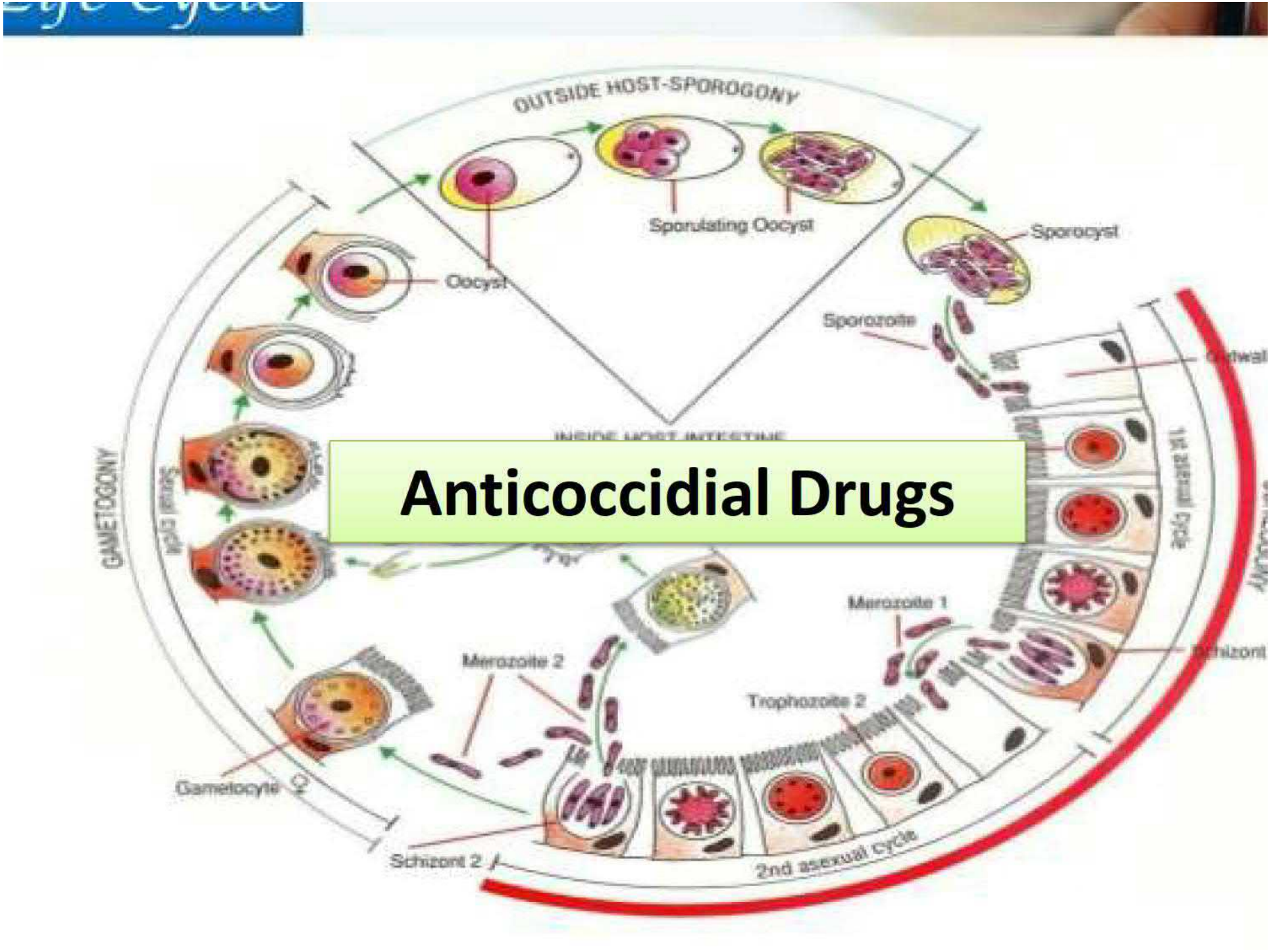
Anticoccidial Drugs

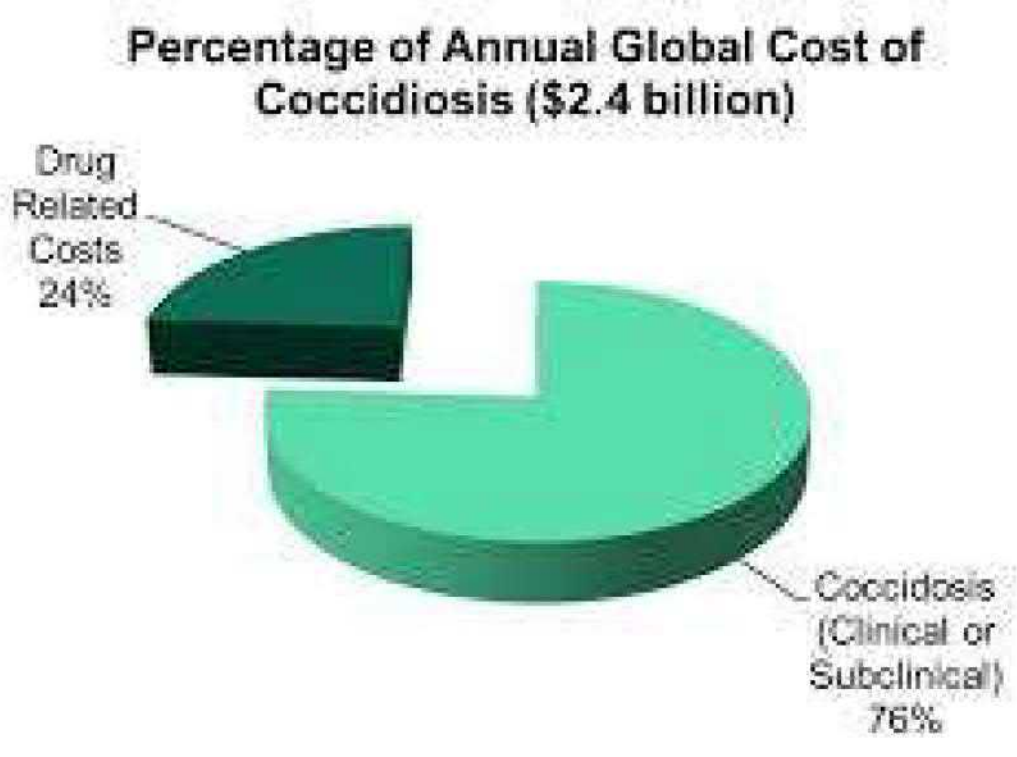
Dr Noha Abdelmageed
Lecturer of Pharmacology
Faculty of Veterinary Medicine
Sohag University



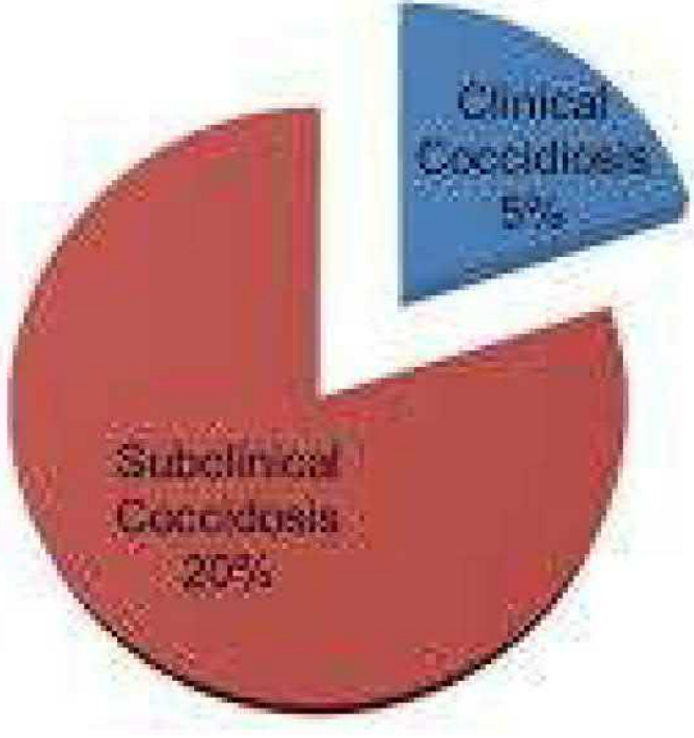
Anticoccidial Drugs

Introduction

- Coccidiosis is a parasitic disease caused by tissue protozoa (Family Eimeridae) or **Emeria** species.
- It induce partial or complete **destruction of mucosal cells** along the intestinal tract (Intestinal coccidiosis) in poultry and animals and also liver cells of rabbits (hepatic coccidiosis).
- Coccidiosis causes great **economic losses** as it decreases body weight gain and immunoresponses.
- Deaths may occur following sever diarrhea associated with haemorrhages (Caecal coccidiosis caused by *E. tenella* in chickens).
- Transmission of the parasite occurs by ingestion of **sporulated oocysts** .


Percentage of Annual Global Cost of Coccidiosis ($2.4 billion)
Drug Related Costs 24%
Coccidiosis (Clinical or Subclinical) 76%

Global Prevalence of Coccidiosis



Types of Coccidiosis

1- Intestinal Coccidiosis:

- It infects the intestinal mucosa of chickens, rabbit and animal

In Chickens, it is caused by6 stains of *Eimeria Spp* . as , *E. necatrix*, *E. maxima, E. acervulina, E. brunetti, E. mitis and E. paracox..*

2- Ceacal Coccidiosis

- It infects ceacum of chickens and rabbits
- It caused by *E. tenella* in poultry

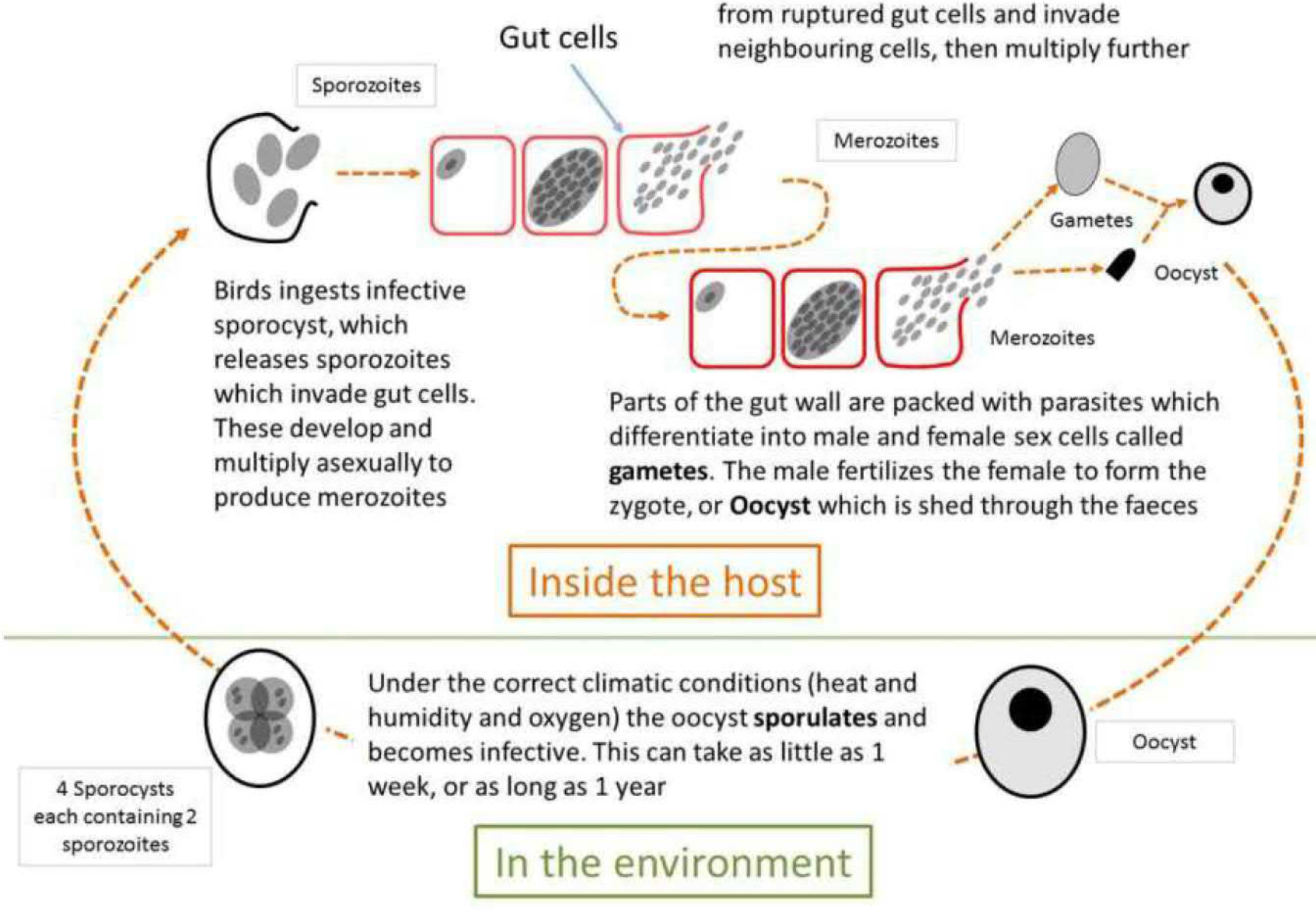
3- Hepatic Coccidiosios :

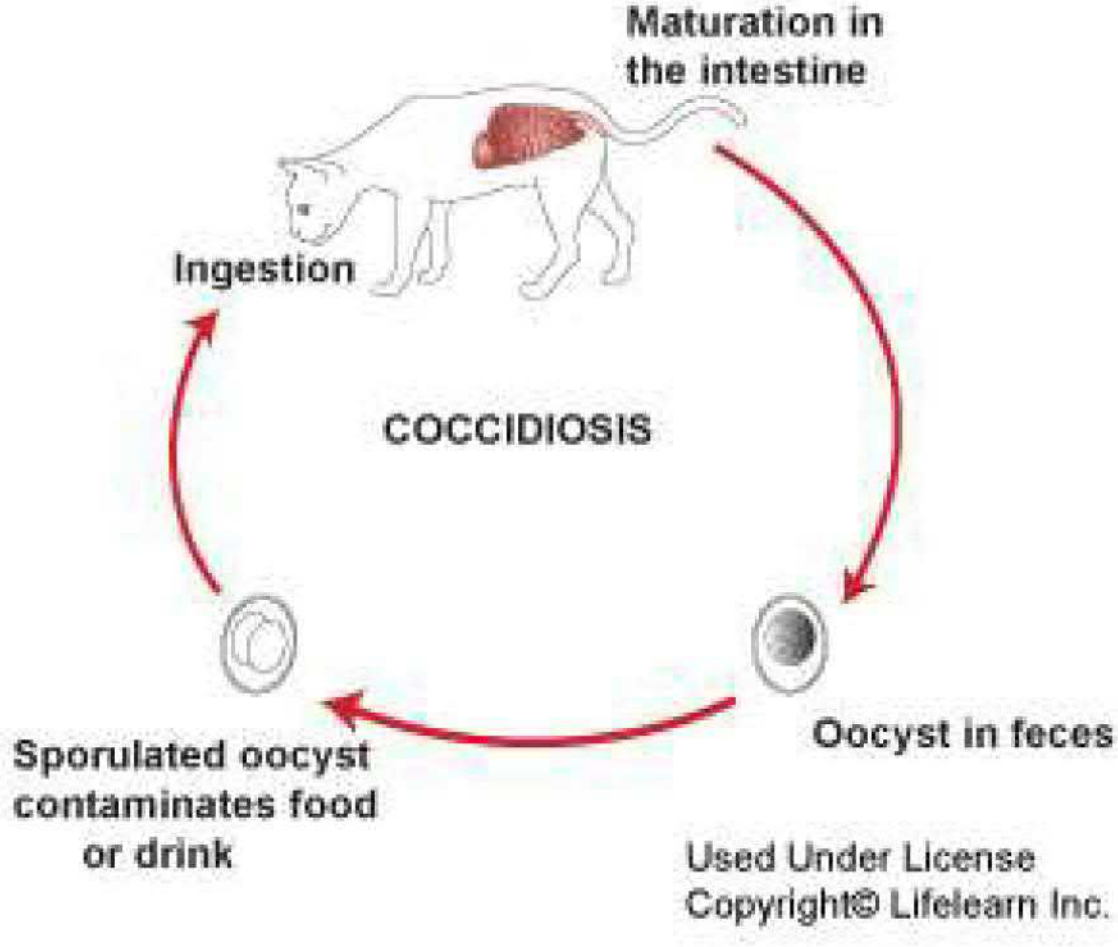
- It infects liver cell of rabbits
- Hepatic Coccidiosis is caused by *E. Staidae.*

Life cycle : of Emeria species

- Coccidia has 2 stages in its life cycle (7 days).
- A- **A sexual stage** (Schizogony stage) during which the protozoan **rapidly multiplies** and a great number of schizonts fill the **mucosal cells leading to its burst** and releasing merozoytes to attack other cells.
- B- **Sexual stage** (Sporogony stage) in which the capsulated zygote is formed by fertilization of macrogametes with microgamete then **oocysts** is formed and shed with feces and changed to sporulated oocystes(**infective stage**) out side in the presence of suitable temperature and humidity

Coccidiosis Lifecycle in Poultry





Control of Coccidiosis

1- **Destruction of oocysts** in poultry and rabbit houses using disinfectants, and other hygienic managements.

2- **Prevention of Coccidiosis**

a) Immunization only in layer

b) Prophylactic drugs :

by using coccidioatat as feed additives.

3-**Treatment** of infected birds by suitable anticoccidial drugs.


Bi-OO-Cyst


Biocyst
DUAL FUNCTION DISINFECTANT
Biolink

STAGE 1
Assess disease status of herd or flock
STAGE 2
Remove all livestock and muck out
STAGE 3
Washing
STAGE 4
Rinse
STAGE 5
Allow to dry
STAGE 6
Disinfecting
STAGE 7
Re-bed the pens
TRIED • TESTED • TRUSTED
K

Common types of disinfectants

- Disinfectants are divided into several groups based on their chemical structure

Like:

- Halogens (iodophors and chlorines, halamid®, dettol®)
- Alcohols
- Oxidizing agents (hydrogen-peroxide, hyperox®, virkon®)
- Phenols (fenix®, Prophyl 75®)
- Aldehydes (glutheraldhyde – TH4®, formalin)
- Quaternary ammonium compound (Timsen® Medisep®)

Choosing the Right Disinfectant

The choice of disinfectant will depend on the following:

Cost

Type of disease agent/s to be destroyed

Amount of contamination by organic matters such as: droppings, blood and manure left in the poultry house

Active ingredient
the chemical compound and concentration that its contained

Characteristics of Selected Disinfectants

This table provides general information for each disinfectant chemical classes.
Antimicrobial activity may vary with formulation and concentration.
Always read and follow the product label for proper preparation and application directions.

				Oxidizing Agents				
Disinfectant Category	**Alcohols**	**Alkalis**	**Aldehydes**	**Halogens: Chlorine**	**Halogens: Iodine**	**Peroxygen Compounds**	**Phenols**	**Quaternary Ammonium Compounds**
Common Active Ingredients	ethanol, isopropanol	calcium hydroxide, sodium carbonate, calcium oxide	formaldehyde, glutaraldehyde, ortho-phthalaldehyde,	sodium hypochlorite (bleach), calcium hypochlorite, chlorine dioxide	povidone-iodine	hydrogen peroxide/ accelerated HP, peracetic acid, potassium peroxymonosulfate	ortho-phenylphenol, orthobenzylpara-chlorophenol	benzalkonium chloride, alkyldimethyl ammonium chloride
Sample Trade Names*			Synergize *	Clorox *, Wysiwash *		Rescue *, Oxy-Sept 333*, Virkon-S *	One-Stroke Environ *, Pheno-Tek II *, Tek-Trol *, Lysol *	Roccal-D *, DiQuat*, D-256 *
Mechanism of Action	Precipitates proteins; denatures lipids	Alters pH through hydroxyl ions; fat saponification	Denatures proteins; alkylates nucleic acids	Denatures proteins	Denatures proteins	Denature proteins and lipids	Denatures proteins; disrupts cell wall	Denatures proteins; binds phospholipids of cell membrane
Characteristics	• Fast acting • Rapid evaporation • Leaves no residue • Can swell or harden rubber and plastics	• Slow acting • Affected by pH • Best at high temps • Corrosive to metals • Severe skin burns; mucous membrane irritation • Environmental hazard	• Slow acting • Affected by pH and temperature • Irritation of skin/ mucous membrane • Only use in well ventilated areas • Pungent odor • Noncorrosive	• Fast acting • Affected by pH • Frequent application • Inactivated by UV radiation • Corrodes metals, rubber, fabrics, • Mucous membrane irritation	• Stable in storage • Affected by pH • Requires frequent application • Corrosive • Stains clothes and treated surfaces	• Fast acting • May damage some metals (e.g., lead, copper, brass, zinc) • Powdered form may cause mucous membrane irritation • Low toxicity at lower concentrations • Environmentally friendly	• Can leave residual film on surfaces • Can damage rubber, plastic; non-corrosive • Stable in storage • Irritation to skin and eyes	• Stable in storage • Best at neutral or alkaline pH • Effective at high temps • High concentrations corrosive to metals • Irritation to skin, eyes, and respiratory tract
Precautions	Flammable	Very caustic	Carcinogenic	Toxic gas released if mixed with strong acids or ammonia			May be toxic to animals, especially cats and pigs	
Bactericidal	+	+	+	+	+	+	+	+
Virucidal	±[a]	+	±	+	+	+	+	+ Enveloped
Fungicidal	+	+	+	+	+	±	+	+
Tuberculocidal	+	±	+	+	+	±	+	—
Sporicidal	—	+	+	+	±	+	—	+
Factors Affecting Effectiveness	Inactivated by organic matter	Variable	Inactivated by organic matter, hard water, soaps and detergents	Rapidly inactivated by organic matter	Rapidly inactivated by organic matter	Effective in presence of organic matter, hard water, soaps, and detergents	Effective in presence of organic matter, hard water, soaps,and detergents	Inactivated by organic matter, hard water, soaps and anionic detergents

+ = effective; ± = variable or limited activity; — = not effective

a - slow acting against nonenveloped viruses (e.g., norovirus)

DISCLAIMER *The use of trade names serves only as examples and does not in any way signify endorsement of a particular product.*

ITE RENCES : Fraise AP, Lambert PA et al. (eds). *Russell, Hugo & Ayliffe's Principles and Practice of Disinfection, Preservation and Sterilization*, 5th ed. 2013. Ames, IA: Wiley-Blackwell; cDonnell GE. *Antisepsis, Disinfection, and Sterilization: Types, Action, and Resistance*. 2007. ASM Press, Washington DC. Rutala WA, Weber DJ, Healthcare Infection Control Practices

the Center for Food Security & Public Health
IOWA STATE UNIVERSITY

Control of Coccidiosis

a- Immunization only in layer by:

Natural infection with partial drug control, where natural infection is reduced to induce immunity but resistant strains are developed.

Vaccination:

- using attenuated oocyst which sprayed direct on the feed or given in water.
- There are two preparation in the market, either 5 or 8 strains but these are not native strains and it may induce sub clinical coccidiosis that has adverse effect on body weight gain.

NB:

- Broilers are not vaccinated against coccidian due to latent infection may retard growth as it developed immunity 30 days after application.
- It is very expensive in comparison with the coast of anticoccidials.

Control of Coccidiosis

I- prophylactic drugs

- They are drugs used mainly as feed additives to prevent coccidiosis.
- They act on the exracellular stages to prevent their penetration of the cells or on the intracellular stages to stop or inhibit their development.

A- Polyether antibiotic ionophores: as Monensin, Salinomycin, Lasalocid, narasin, Maduramicin, Semaduramicin.

B- Chemical coccidiostates: as Nicarbazin, Clopidol, Methybenzquate, Amprolium, Ethopabate, Diclazuril, Arprinocode and halofuginone.

Control of Coccidiosis

II- Drugs for treatment:

- Drugs which destroy intracellular coccidia during their growth. (late stage of second generation schizontes or on the gametocytes.)
- eg. Sulphonamides, Amprolium, Diaveridine, Pyrimethamine, Toltrazuril and Diclazuril.

Characteristics of ideal antiparasitics

- 1. Effective in removing parasites from body
- 2. Wide therapeutic index: Toxic dose > 3× therapeutic dose
- 3. Economically justifiable
- 4. Easy to administer, for example, in feed, injections, and pour-on
- 5. One-dose treatment
- 6. No residue problems, especially in food-producing animals
- 7. Effective against immature form of parasites

Current trends include the use of broad-spectrum drugs and combination therapy to increase efficacy.

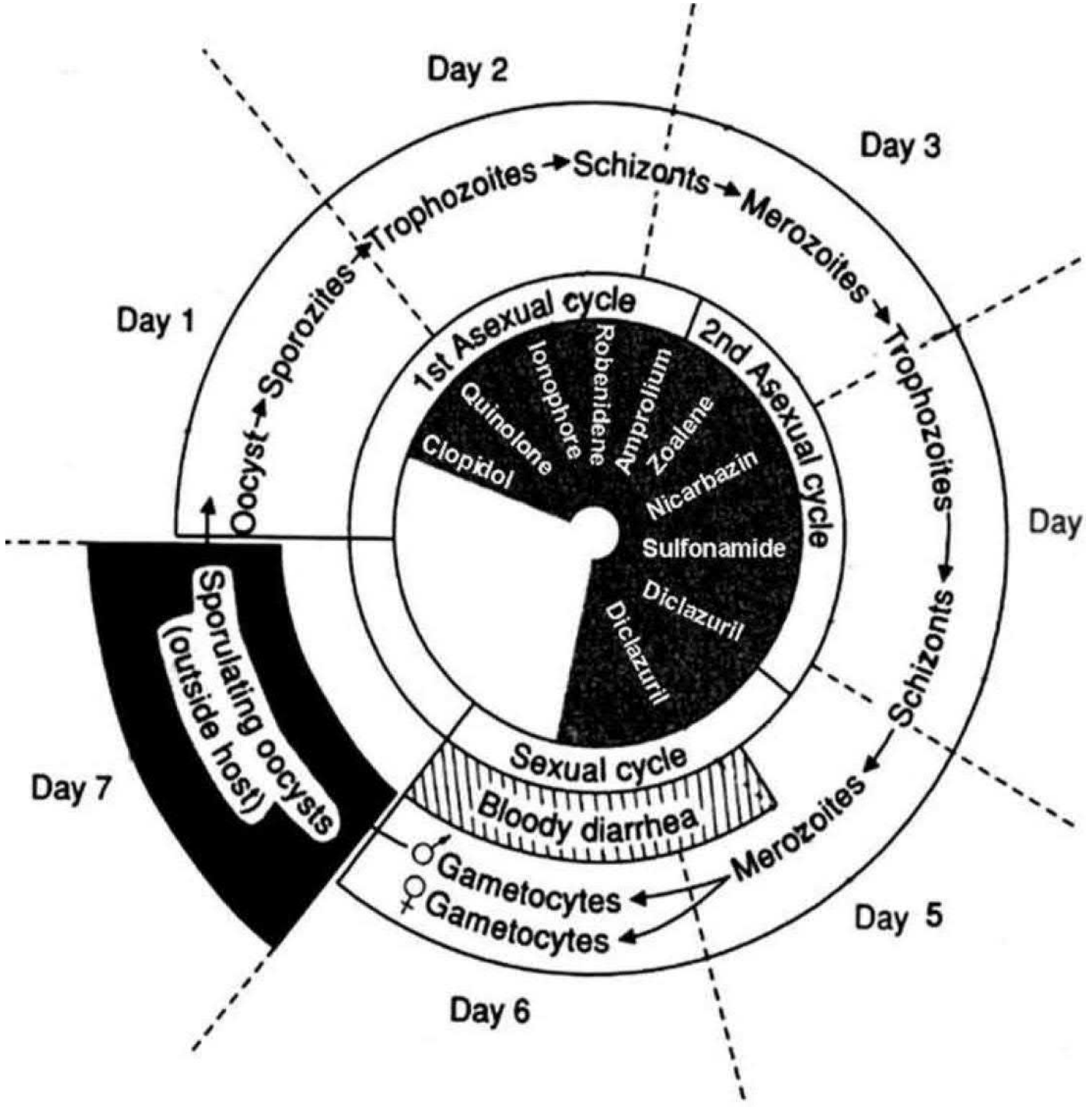


FIGURE 16-8. Life cycle of avian coccidia and the effects of anticoccidial drugs on the life cycle. All drugs are effective during the asexual cycle only, except that diclazuril is also effective during the sexual cycle. Second generation schizonts seem to play an important role in gut damages; drugs affecting this stage can be used to treat outbreak. (Modified from W. M. Reid, *Am. J. Vet. Res., 36:593, 1975.)*

I- Polyether antibiotics (Ionophores):

- They are complex molecules isolated from various **actinomyces**.
- They are used as **preventive or prophylactic** in poultry feed in broilers or replacements.
- Ionophores **have low therapeutic index and higher doses** in feed may cause sides effects, intoxication so they should be mixed well with poultry feed.
- Some of members act **as growth promoters** e.g. Monensin in cattle, salinomycin, maduramicin and semduramicin in poultry.
- Ionophores can classified into:
  - **Monovalent polyether** (Monensin, salinomycin and narsin)
  - **Divalent polyether** (lasalocid)
- Monovalent monoglycoside polyether (maduramicin and semduramicin)

Mechanims of action:

- They act by interfering with the transport of ions of K^+ and Na^+ through membranes of *Emeria*. This leads to an influx of positively charged ions (Cations) and subsequently causes upset of osmotic balance cells as well as disturbances of mitochondrial function of intracellular coccidia.
- They are active against sporozoites and merozoites at the first 2 days of life cycle of *Eimeria.*

Pharmacokinetics

- Ionophores are poorly absorbed from gastrointestinal tract (GIT) following their oral administration.
- They have a short withdrawal time after stopping of administration (3 - 4 days).
- **N.B:**
- Continuous development of ionophores by modification in their chemical structure to decrease the effective dose consequently to minimize their side effects.
- It should be well mixed with poultry feed to subside in proper dose (Therapeutic failure) or toxicity.

- **Action and Uses :**
- They are highly active against **intestinal and ceacal coccidiosis in poultry.**
- They do not interfere with immunity
- they have **growth promoting effect**
- They are used as **coccidiostates** for prevention of ceacal and intestinal coccidiosis in broilers (Continuously in the feed) and replacement layers or breeders up to 16^{th} week of age.

Contra-indications and Toxicity:

- They should be not mixed with other **anticoccidials.**
- They should not given with the antibiotic "Taimulin" to prevent incidence of cardiac toxicity and deaths.
- **Cardiac toxicity** may (myocardial edema).
- Immunosuppersion and failure of vaccination may occur due to administration of toxic doses.
- Ionophores have a narrow safety margin. Therefore, they should be mixed well with poultry or animal feed.
- Lasalocid cases wetting letter
- They are not given **to layer** or breeders.