

## Parasites

True parasites are eukaryotic organisms living in/on other eukaryotes

Protozoa are single-cellular parasites that can be intracellular or extracellular

Helminths (parasitic worms) are multicellular and can be up to meters long

## Extracellular Protozoa

Giardia Lamblia

1. Lives in host intestines
2. Inhibit phagocytosis
3. Main adaptive response is IgA
4. Zoonosis from beavers
5. High asymptomatic rate

Trypanosoma Brucei

1. Blood dwelling trypanosomes
2. Transmitted between hosts via a tsetse fly vector
3. Main immune response is IgG to VSGs
4. Human trypanosomiasis is a zoonosis from cows

## Giardia Lamblia

200 million symptomatic (diarrhea) infections

Up to 90% of infection are asymptomatic (Strongly underdiagnosed and underreported)

Almost no mortality

Considered a zoonosis (Transferred between animals w/ only occasional human infections)

Parasites attach to mucosal epithelium and can survive for weeks in host

Trophozoite form (w/ flagella) replicates in intestine

→ A single trophozoite has 2 identical nuclei

Cyst form passed in feces

Beaver (main animal reservoir in North America) but dogs and cats can be reservoirs

## **Trypanosoma Brucei**

Causes sleeping sickness (Inflammation in the brain puts people into a coma / causes brain damage)

Spread by tsetse fly bites

Live extracellularly in the bloodstream

Normally controlled by IgG but can evade IgG through antigenic variation

### **Immune Response to Trypanosomes**

Innate Immunity:

1. Hard to eliminate by phagocytosis because of size

Adaptive Immunity:

1. IgG elimination of parasites by neutralization and ADCC
2. Parasite can change the primary antigen through antigenic variation

Variante surface glycoproteins (VSGs) help evade IgG

## **Intracellular Protozoa**

1. Malaria (Plasmodium) infects liver cells and RBCs

Immune Response: CTLs to liver form, IgG to RBC form

2. Protozoa that replicates in vacuole

Leishmania chagasi infects macrophages

Transmitted by sandflies

Main immune response is Thelper cytokines activating macrophages

Toxoplasma gondii lives in muscle and neurons as cysts

## **Leishmania**

1. Infects macrophages
2. Sites of chronic inflammation
3. Infected macrophages need to be activated by cytokines from Thelper cells to kill parasites in vesicles

Infected macrophages also cause non-specific damage and immunopathology causing tissue damage

Areas:

1. Mucocutaneous: Mucosal Tract (Too much immune response (Destruction of tissue))

2. Cutaneous: Skin (Balanced)
3. Visceral: Body (Too little immune response)

Disease manifestation:

1. Different species cause different diseases
2. Too little immune response is bad
3. Too much immune response is worse

## **Toxoplasma Gondii**

Felines are the ONLY definitive host (Mice are on intermediate host)

Humans are considered a dead-end host

Oocysts are ingested by mice or humans and form tissue cysts primarily in muscle or nerve cells

Humans can be infected by ingesting undercooked meat from animals that have cysts in tissue

Incredibly high prevalence of antibodies to toxoplasma antigens in humans