

# Intestinal Parasites

Helminths, Tapeworms, Protozoa,  
and other things with which you'd rather not share your body.

James Gaensbauer, MD  
Fellow, Pediatric Infectious Diseases  
University of Colorado



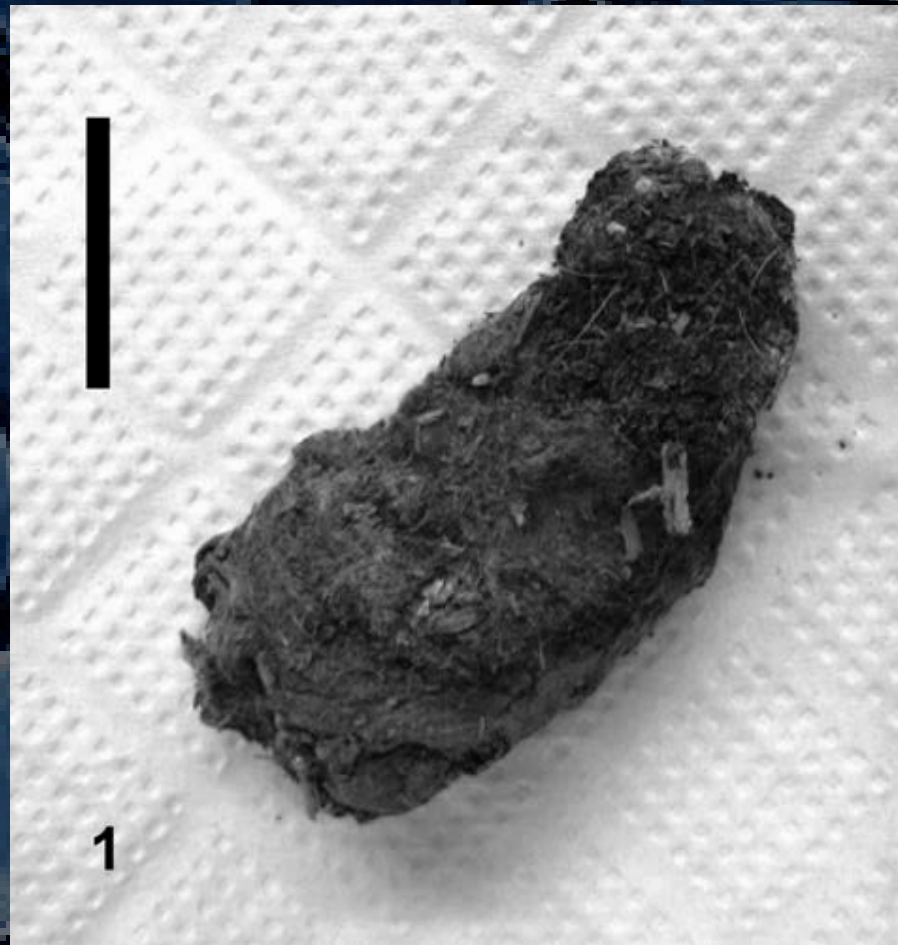
# Parasite Classification

- Protozoa--first animals
- Platyhelminths--flat worms
- Nematodes--round
- Acanthocephala--thorny headed
- Arthropods--jointed feet

	<u>Intestinal</u>	<u>Tissue/Blood</u>
<u>Protozoa</u>	Entamoeba Giardia Cryptosporidium	Malaria Leishmania Naeglaria Toxoplasma
<u>Platyhelminths</u> Cestodes	Taenia (ingested larvae) Diphyllobothrium	Taenia/cystocercosis (ingested eggs) Echinococcus
Trematodes	Alaria	Schistosoma Fasciola Clonorchis
<u>Nematodes</u>	Ascaris Hookworms Strongyloides Trichuris	Trichonella Druncunculus Angiostrongylus

# Intestinal Parasites in Human History

- Ascaris eggs from coprolites from Peru, 2277 BC, Egypt 1600 BC, described in literature 500 BC



# Intestinal Parasites in Human History

- Giardia first microorganism seen by Leeuwenhoek, after invention of microscope in 1681
- Hookworm in South American mummies suggests an oceanic migration from old world to new
- Taenia and trichinella may form basis for Jewish and Islamic traditions of avoiding pork

# Intestinal Parasites in Human History

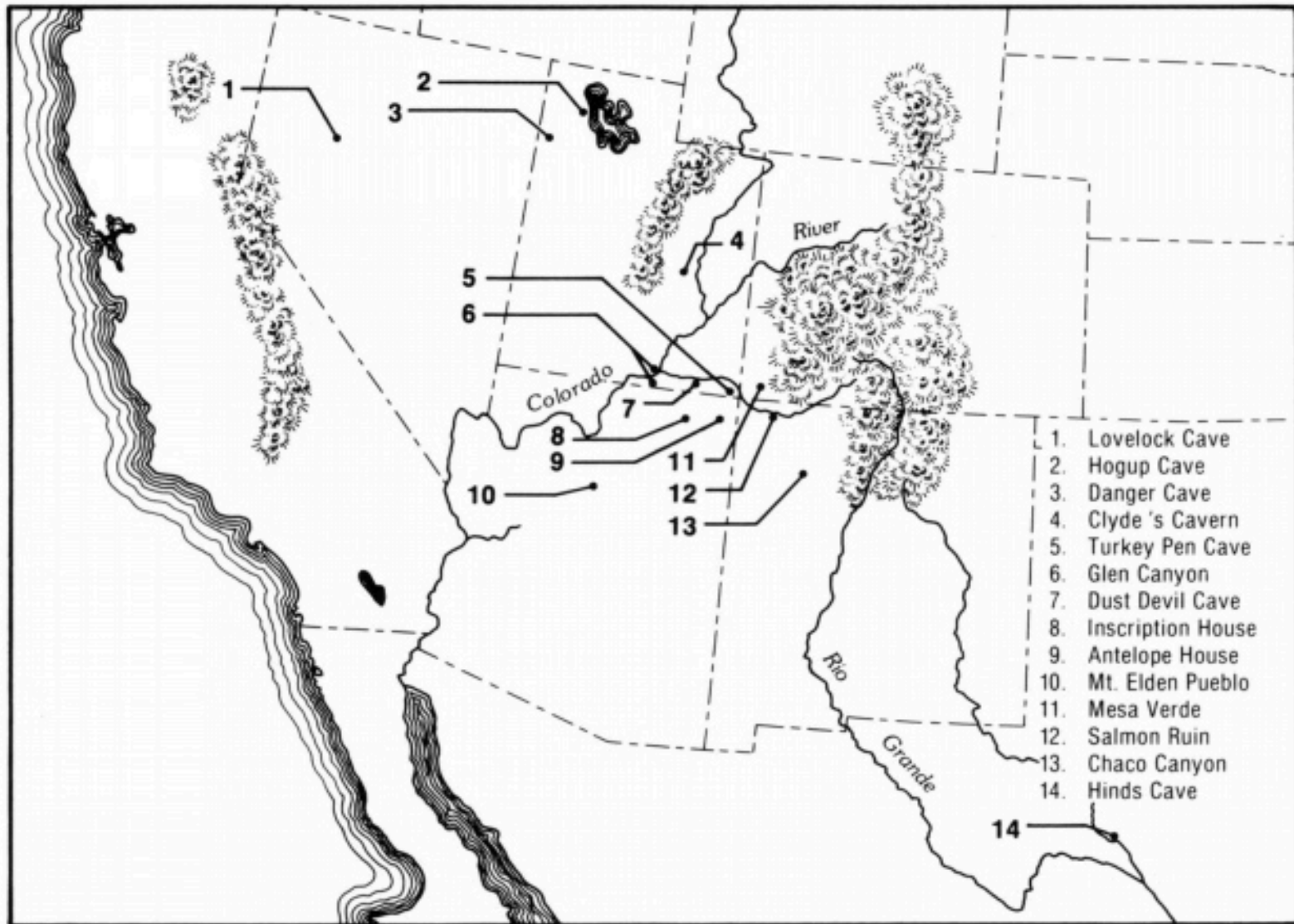


FIGURE 1. Localities in the southwestern United States where helminth remains have been recovered from prehistoric fecal deposits.



# Global Burden of Intestinal Parasites



## The major human helminthiases and their global prevalence and distribution

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<b>Disease</b>	<b>Major etiologic agent</b>	<b>Global prevalence</b>
<b>Soil-transmitted nematodes</b>		
Ascariasis	<i>Ascariasis lumbricoides</i> (roundworm)	807 million
Trichuriasis	<i>Trichuris trichiura</i> (whipworm)	604 million
Hookworm	<i>Necator americanus</i> ; <i>Ancylostoma duodenale</i>	576 million
Strongyloidiasis	<i>Strongyloides stercoralis</i> (thread worm)	30–100 million

# Global Burden of Intestinal Parasites

- *Entamoeba histolytica*: 50 million infected persons
- Giardia: 2% of adults and 6-8% of children in the developing world
- *Taenia solium*: 2.5 million infected with adult tapeworm; 50-100 million harboring cysticerci.



# Global Burden of Intestinal Parasites

## Acute Disease

- **Ascariasis**
  - Intestinal obstruction, tissue migration
- **Hookworms**
  - Pain, severe anemia
- **Trichuriasis**
  - IBD-like syndrome
- **Amoebiasis/Giardia**
  - Dehydration, malnutrition, liver abscess



# Global Burden of Parasitic Disease: Insidious/persistent disease due to STH's

- Anemia
- Growth retardation
- Undernutrition
- Micronutrient deficiency
- Fatigue
- Cognitive disability
- Low birth weight



# Global Burden of Parasitic Disease

## WHO, 2004

DALY's by age and cause (millions)

	Total	0-4 yr	4-15 yr
Tuberculosis	34.2	1.6	1.8
Diarrheal Disease	72.7	61.6	3.5
Malaria	34.0	29.3	3.2
HIV/AIDS	58.5	8.9	1.7
Dengue	0.7	0.1	0.5
Intestinal Nematode infections	4.0	0.5	2.7

The background of the slide is a dense, repeating pattern of dark blue leaves with white outlines, creating a textured, organic appearance. The leaves are arranged in a somewhat regular but slightly offset grid, filling the entire frame.

# Intestinal Parasites: Disease Control

# Intestinal Parasites: Disease Control

- Intestinal protozoa
  - Improved sanitation
  - Prevention of fecal contamination of food and water supply
  - Hygiene
  - Education
  - Economic development

# Intestinal Parasites: Disease Control



- Soil Transmitted Helminths:
  - Anti Helmintic Drug Treatment
  - Improved Sanitation
  - Education

# Deworming Programs for STH's

- Periodic Therapy
  - Universal
  - Targeted
  - Selective
- Frequency
- Medication
  - Benzimidazoles
  - Vitamin A supplementation
- Monitoring



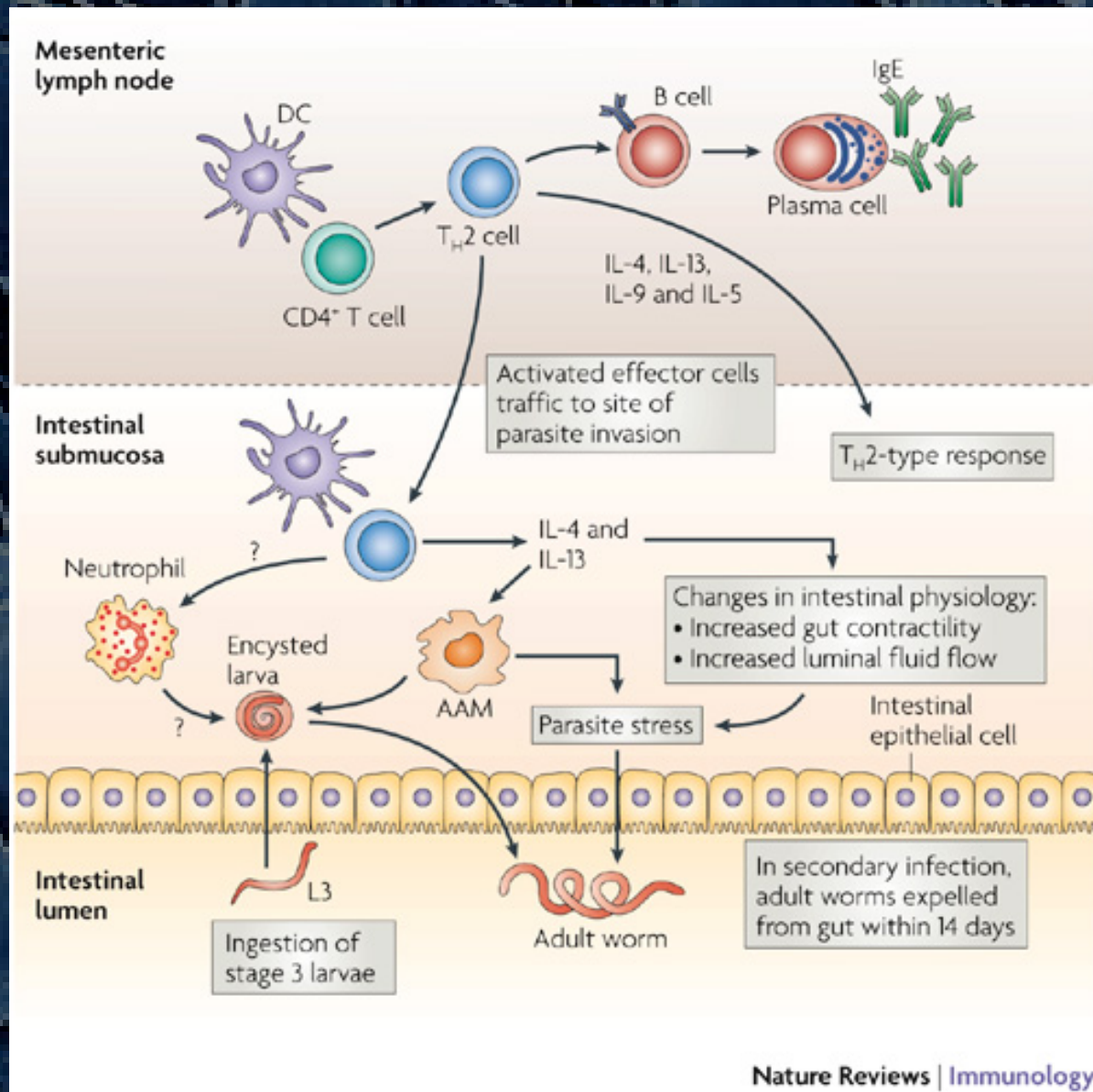
# Deworming Programs: Effectiveness

- Universal impact varies
- Greatest improvements occur when:
  - Hookworm is a predominant parasite and anemia is the primary outcome
  - Iron supplementation complements deworming
  - Treatment begins at early age
  - Doses are given 3 times/year vs. 2 in high prevalence areas
  - Primary intervention is Vitamin A supplementation

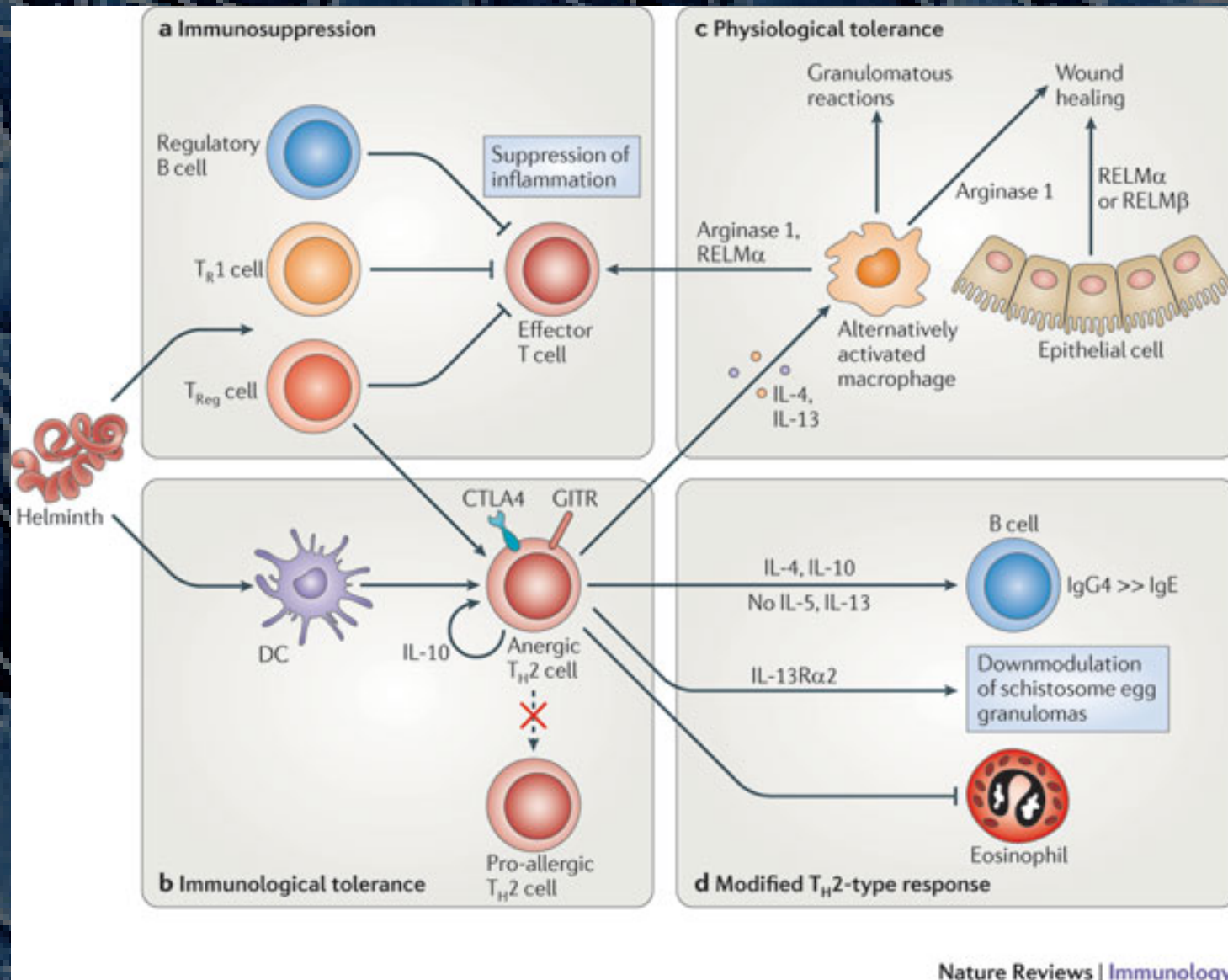
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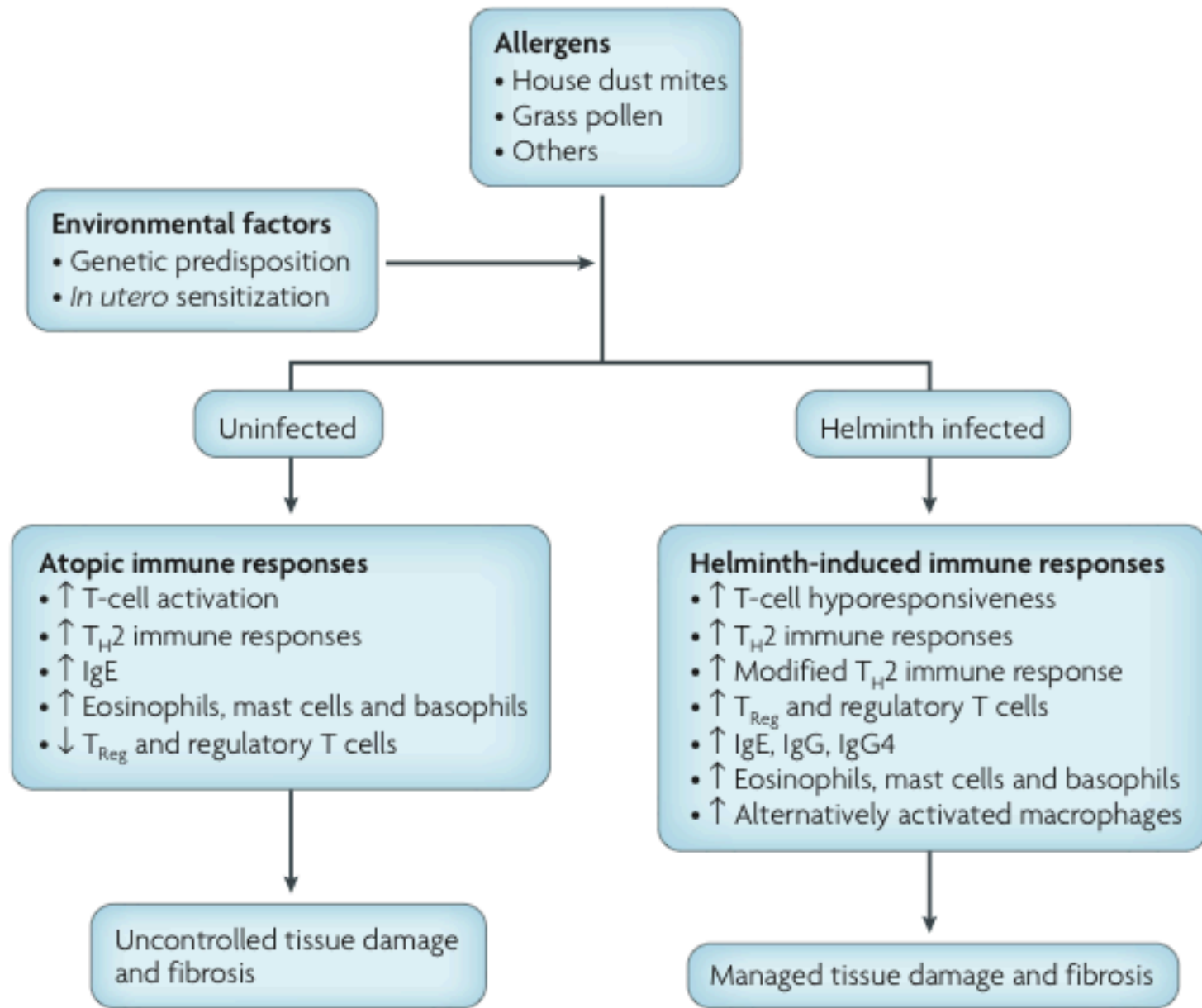
# Immune Response to Intestinal Helminth Infection

# Immune Response to Intestinal Helminth Infection



# Helminth Immunity: A balance between defense and excessive inflammation





# Helminth Immunology: implications for atopic and auto-immune disease?



# Bibliography and Reading List

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Thank you