

MMed and DCH Lectures

Neglected tropical diseases in children – soil transmitted helminths

Monday June 29th 2021

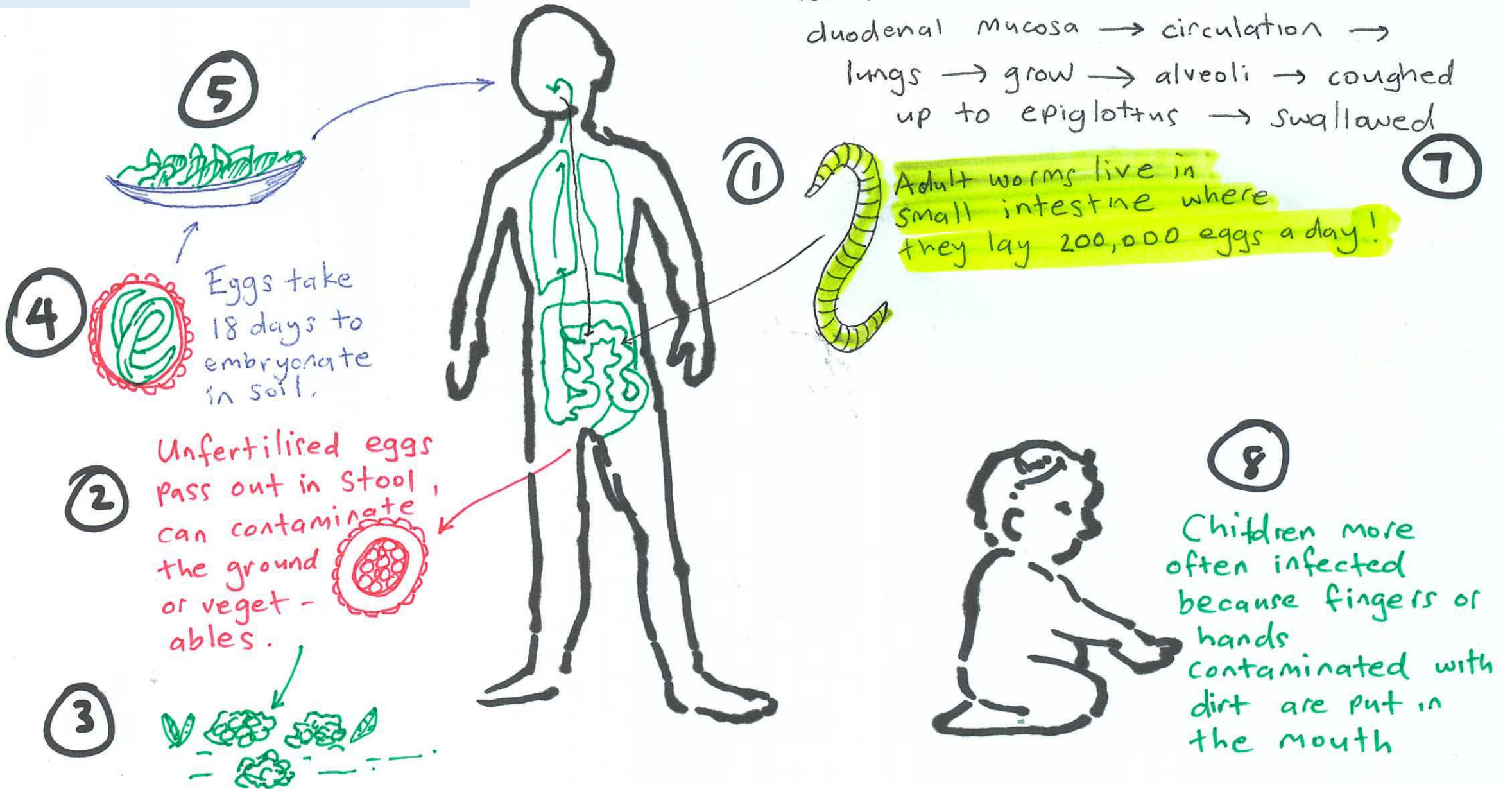
Prof Trevor Duke

WHO list of NTDs

- Buruli ulcer
- Chagas disease
- Dengue and Chikungunya
- Dracunculiasis (guinea-worm disease)
- Echinococcosis
- Foodborne trematodiasis
- Human African trypanosomiasis (sleeping sickness)
- Leishmaniasis
- Leprosy (Hansen's disease)
- Lymphatic filariasis
- Mycetoma, chromoblastomycosis and other deep mycoses
- Onchocerciasis (river blindness)
- Rabies
- Scabies and other ectoparasites
- Schistosomiasis
- Soil-transmitted helminthiasis
- Snakebite envenoming
- Taeniasis/Cysticercosis
- Trachoma
- Yaws (Endemic treponematoses)

Parasite name	Host and cycle	Invades human host	Organs affected	Treatment
Ascaris lubricoides	Humans	Faecal-oral Eating contaminated food	Intestines Airway Lungs	Albendazole Mebendazole
Hookworm – Necator americanus	Humans	Skin penetration	Intestines Blood loss Anaemia	Albendazole Mebendazole
Cutaneous larva migrans –Ankylostoma braziliense	Dog, cat	Skin penetration	Skin irritation	Albendazole Ivermectin
Whip worm – Trichuris trichiura	Humans	Faecal-oral Eating contaminated food	Large intestines / rectal prolapse Blood loss Anaemia	Mebendazole BD x 3 days
Strongyloides stercoralis	Dogs Humans	Skin penetration	Skin Intestines Systemic (lungs / brain / sepsis)	Albendazole daily x 3 days
Strongyloides fuelleborni kellyi	Humans	Vertical transmission to foetus	Intestines (swollen belly syndrome)	Albendazole daily x 3 days

Ascaris lumbricoides



Ascaris lumbricoides

- Large round worm (15-30cm long), migratory
- Mechanical obstruction of small bowel, intussusception
- Appendicitis
- Obstruction of bile duct (jaundice, cholangitis) and pancreatic duct (pancreatitis)
- Laryngeal obstruction
- Lungs - eosinophilic pneumonia, wheeze, “Loffler's syndrome”
type-1 hypersensitivity reaction (IgE mediated)
- **Malnutrition, pot-belly, oedema**

Ascaris lumbricoides

- Risk factors
 - Eggs in soil contaminated by faeces, “night soil” on gardens
 - Young children most affected
 - Fruits and vegetables not properly cooked, washed or peeled
- Eggs in stool
- Eosinophilia
- Treatment
 - Albendazole – broad-spectrum anthelmintic, active against hookworm and Strongyloides (and Tricuris to a lesser extent)
 - Mebendazole



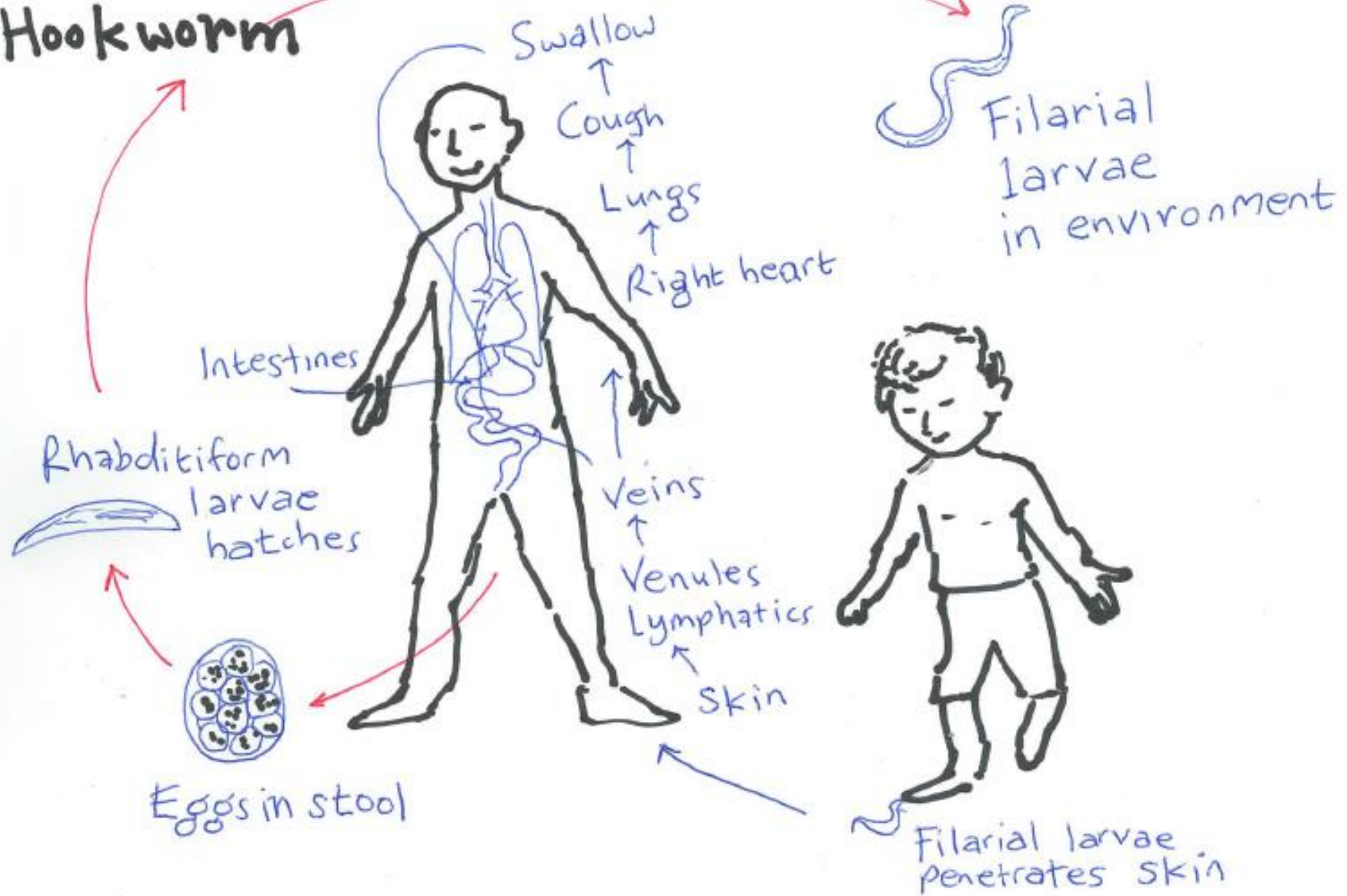
Courtesy of Prof John Vince

Hookworm – necator americanus

- 59-83% of child population infected in PNG
- Mostly *Necator americanus* (*Ankylostoma duodenale* not found in PNG)
- **Skin penetration of larvae** (500 microns long with a pointed tail that can penetrate skin of the feet) → travel through subcutaneous venules and lymphatics → right heart → pulmonary capillaries → alveoli → airways → trachea → pharynx → swallowed → small intestine.

Shield JM. A comparative study of intestinal helminths in pre-school-age urban and rural children in Morobe province, Papua New Guinea. PNG Medical Journal 2013; 56; 14-31

Intestinal Hookworm



Hookworm – clinical manifestations

- Mature hookworm can extract 0.05ml blood per day (necator), ankylostoma (0.2ml)
- Anaemia
- Poor growth
- Hypoalbuminaemia
- Abdominal pain, diarrhoea
- Impaired intellectual, and cognitive development
- Vitamin A deficiency
- Diagnosis
 - Clinical
 - Ova in stools

Hookworm treatment

- Replace iron – ferrous sulphate
- Ascorbic acid (vitamin C) to increase iron absorption
- Albendazole
- Mebendazole – broad spectrum anti-helminth (hookworm, Ascaris, Tricuris).
- Footwear (not flip-flops)

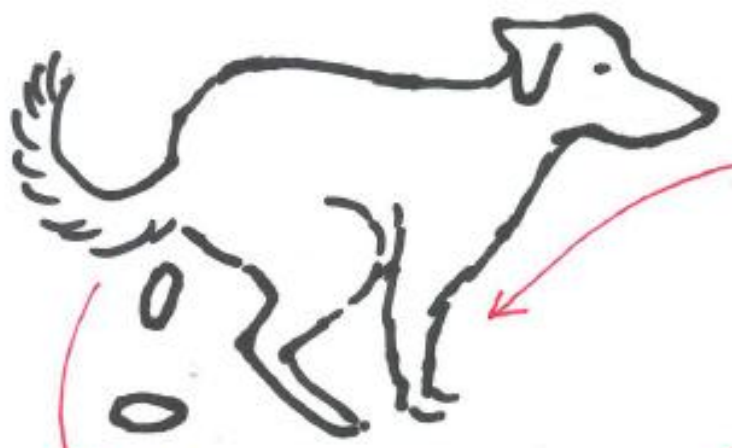
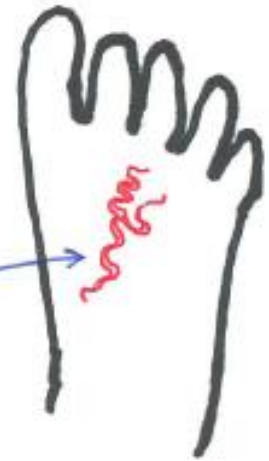
Cutaneous larva migrans

*Dog (or cat) hookworm: Ankylostoma
brazilense*



Cutaneous larva migrans

Larvae penetrates skin → tingling → intense itch as larvae migrate slowly.



Eggs in faeces



Rhabditiform larva hatches

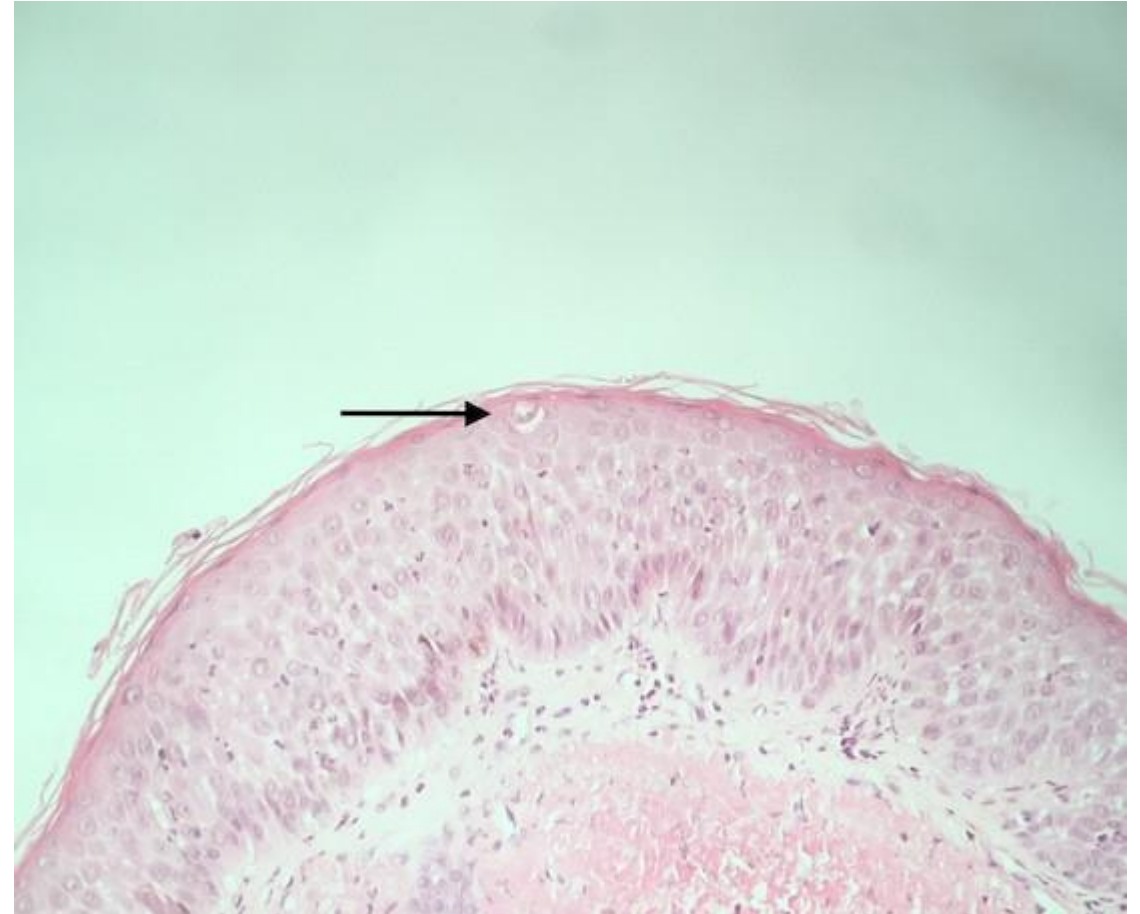


Larvae penetrate through hair follicles in skin, or cracks in skin.

filariform larva skin.

Cutaneous larva migrans (*ankylostoma brasilense*)

- Lesions usually confined to the outer layers of the skin (epidermis), as the larvae cannot penetrate the basement membrane to reach the dermis
- Feet, toes, hands, knees, buttocks
- Treatment:
 - Albendazole (single dose)
 - Ivermectin (single dose)



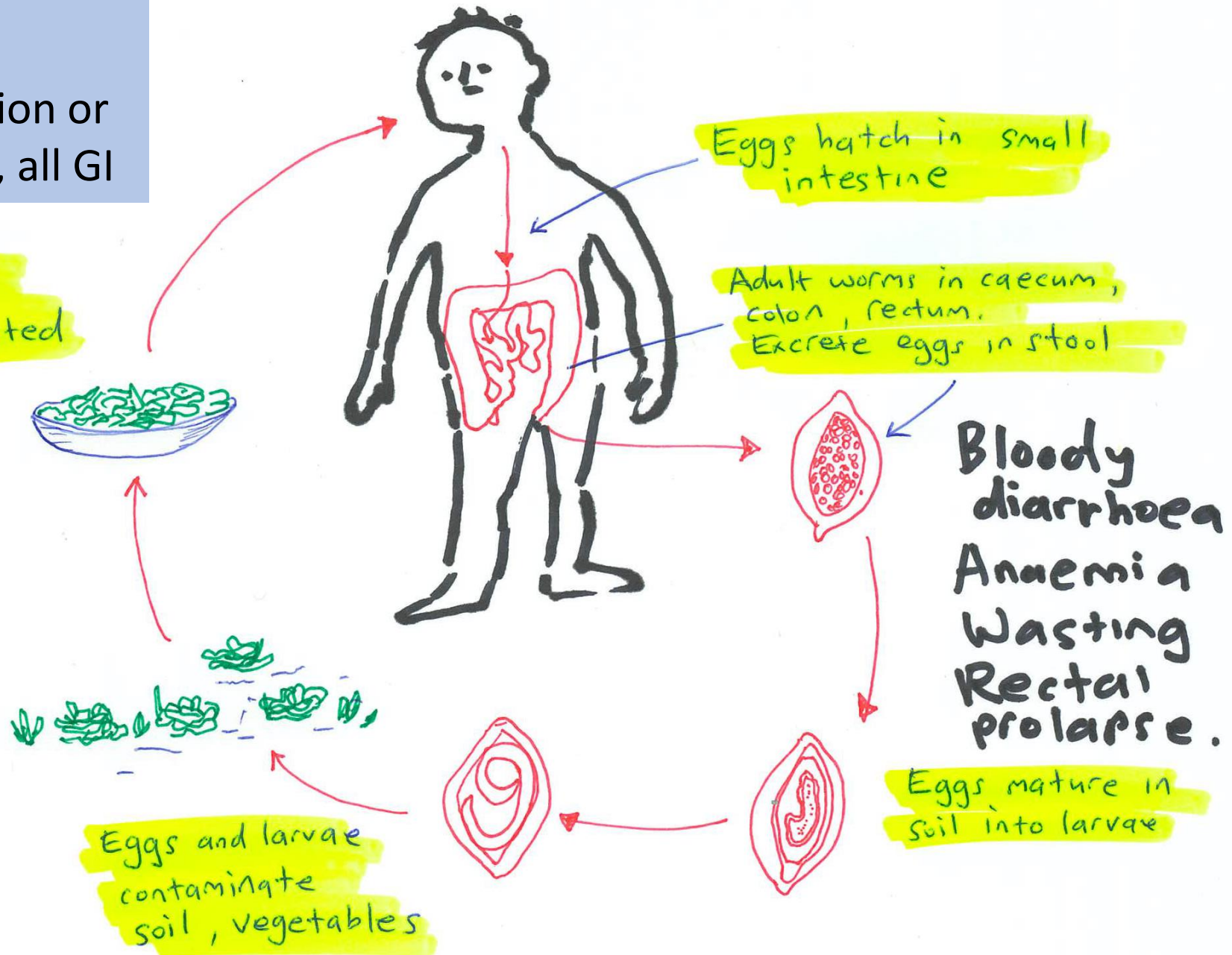
Cutaneous larva migrans (ankyostoma brasilense)

- Treatment:
 - Albendazole (single dose)
 - Ivermectin (single dose)
- Relief of itching within 24-48 hours, most lesions/tracts resolve within a week.

Whip worm

Trichuris trichiura

No cutaneous migration or blood or lung phases, all GI



Human life cycle – also *T. suis* (pigs), does not cause disease in humans

Whip worm (Trichuris trichiura)

- Adult worms in **large bowel (caecum, colon, rectum) – rectal prolapse**
- Dysentery (but no fever)
- Iron deficiency anaemia
- Wasting
- Eosinophilia
- Diagnosis
 - Eggs of direct faecal smear
 - Rectal prolapse
- Mebendazole ideal 100mg BD x 3 days
- Albendazole 400mg adult x 3 days - 50%+ cure



Courtesy of Prof John Vince

Strongyloides

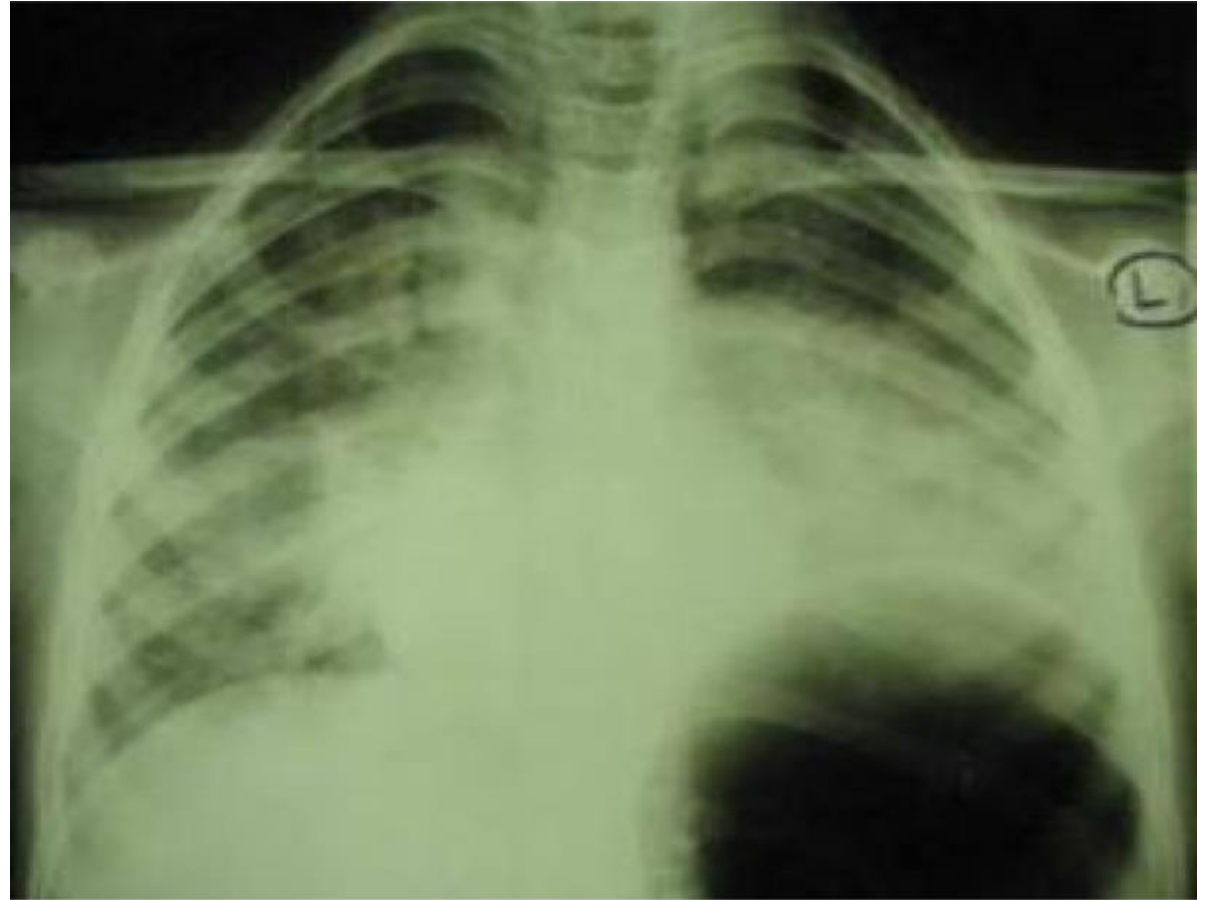
- *Strongyloides stercoralis*
 - 27% of PNG children positive (81% under 1 year of age)
- Complex lifecycle:
 - Extrinsic life-cycle in soil
 - Dogs definitive host
 - Skin penetration of filarial larvae....travel to intestine by veins / lymphatics, skin (“migratory larvae currens”), and...
 - Strongyloides can also complete a life cycle inside the intestine (larva re-enter intestinal mucosa or through perianal skin – “autoinfection”)....
- Especially if immune compromised (HIV). WW II veterans.

Strongyloides

- Most *Strongyloides stercoralis* infections trivial, unless immune compromised
- Itchy eruption migrating lesions in skin “larva currens” (*fast* migrating)
- Cough and wheeze
- Abdominal pain, diarrhoea, steatorrhoea (malabsorption)
- Weight loss

Strongyloides: hyperinfection syndrome

- Diarrhoea
- Paralytic ileus
- Gram negative septicaemia
- Serous effusions
- Bacterial peritonitis
- Cough, wheeze, dyspnea, haemoptysis
- Encephalitis (larva in brain)



Strongyloides – diagnoses and treatment

- Clinical, eosinophilia, fat malabsorption
- Stool microscopy for motile larvae or eggs
- Stool culture – grow larvae
- Treatment
 - **Albendazole 400mg (adult) x 3 doses**



Strongyloides in infants

- *Strongyloides fuelleborni kellyi* – swollen belly syndrome (Kanabea in Gulf Province, and Madang)
- Can be vertically transmitted (mother → baby trans-placental or breast milk) – accounts for young infants infected

Vince JD, Ashford RW, Gratten MJ, Bana-Koiri J. Strongyloides species infestation in young infants of Papua New Guinea: association with generalized oedema. PNG Med J 1979;22:120-127



Anti-helminths agents

- Benzimidazoles: 1960s plant fungicides and then veterinary anthelmintics
- Thiabendazole first human drug, then **mebendazole**, flubendazole, **albendazole**, triclabendazole
- Mechanism of anti-helminth action:
 - Metabolic disruption of parasite at different sites, most of sites of energy production
 - Kills the adult stages of gut-dwelling helminths, kills or sterilises eggs, and kills larvae

Albendazole

- Highly effective broad-spectrum antihelminthic drug
- Many helminths (hookworm, Ascaris) are treated with a single dose
- Recommended dose for *Strongyloides stercoralis* infection is 400 mg daily for 3 days
- Less effective against Trichuris – mebendazole better

Tinidazole and metronidazole

- 5-nitroimidazoles
- **Anti-protozoal**
 - Gastrointestinal: Giardia, Entamoeba histolytica
 - Reproductive system: Trichomonas, gardenerella
- Antibiotic – *only anaerobes* (e.g. *Bacteroides fragilis*)
- No effect on helminths

Poverty and NTDs – a cycle

- Poverty – poor housing, sanitation, water supplies, poor food preparation, no footwear
- Infections – iron deficiency, anaemia, cognitive impairment, poor school performance, micronutrient deficiency, wasting, poor development→
- Poverty

- MDA – Albendazole, ivermectin
- Public health policies, housing, sanitation, water supplies
- Economic development, education

What we've learnt

- Ascaris
- Hookworm (human)
- Cutaneous larva migrans (dog hookworm)
- Whipworm
- Strongyloides