The Flies

Pathology

Adult Flies

1. Biting Flies
   - In the USA, account for 50% of the annual losses in cattle production from all livestock pests
   - Blood feeders (puncture the skin directly) → pain & allergic reactions to saliva
   - Acute blood loss (livestock have been killed by swarms of biting flies)
   - Biological or mechanical vector for disease

2. Non-biting Flies
   - Feed on secretions or scavenge at wounds or body orifices
   - Cause annoyance & disturb host
   - Mechanical vectors for many pathogens

Larval flies

3. Myiasis Flies
   - Lay eggs on tissues or in wounds of the host
   - Larvae invade tissues
   - Can cause significant damage to the host

- All flies can also cause considerable disturbance to the host
- Biting flies & myiasis flies → dramatic escape responses → self-injury
- Large populations of flies can also cause death by suffocation after inhalation
The Flies

Life History
All flies have a *holometabolus* life cycle:
- Egg → Larvae → Pupae → Adult

1. **Eggs**
   - Most flies are oviparous
     - Oval eggs laid in batches
   - A few species are ovoviparous
     - Eggs hatch in oviduct & female deposits larvae

2. **Larvae (maggots)**
   - 3-5 larval stages
   - Soft, legless & segmented
   - In some species are parasitic = **MYIASIS**

3. **Pupae**
   - Visible external appendages
   - Develops within a cocoon or puparium

4. **Adults**
   - Duration of the life cycle & length of time adults live vary between species

Note: The flies of veterinary importance are *ectoparasites* as **adults** or as **larvae**, but are rarely ectoparasites in both stages
The Flies - Myiasis

Myiasis is the infestation of the tissues or organs of animals by the larval stages of dipterous flies (dipteran fly larvae). Fly larvae feed directly on necrotic or living tissue of the host.

Myiasis can be classified as follows:

1. **Obligatory myiasis**
   - A living host is required to complete development (will not survive without a living host)

2. **Facultative myiasis**
   - Living host tissue is **not** required to complete development

3. **Accidental myiasis**
   - Rare chance events of myiasis (i.e. accidental ingestion of fly eggs)

FYI: Myiasis is caused by **cyclorrhaphous dipteran** larvae. Cyclorrhapha means 'circular-seamed flies', which refers to the **circular aperture** through which the **adult escapes the puparium**.
The Flies - Myiasis

Myiasis Flies of Veterinary Importance

I. **Obligatory myiasis** (*screwworms* = a type of blow fly)
   1. *Cochliomyia hominivorax* (Primary screwworm)  
      (Eliminated from North America)
   2. *Chrysomya bezziana*  
      Africa and southern Asia

II. **Facultative myiasis-producing flies of veterinary importance**
   1. *Cochliomyia macellaria* (Secondary screwworm)
   2. *Phormia, Protophormia, Lucilia, and Calliphora* spp. (blow flies or bottle flies)
   3. *Musca domestica* (house flies)
   4. *Sarcophaga* spp. (flesh flies)
   5. *Gasterophilus* spp. in horses and *Oestrus ovis* in sheep (bots)
   6. *Hypoderma* spp. in cattle (warbles)
   7. *Cuterebra* spp. in dogs and cats

III. **Accidental myiasis** (*pseudomyiasis*)
   - Other species of flies
   - Rare chance events of myiasis
     - Accidental ingestion of fly eggs
     - Eating cheese fly maggots (i.e., in casu marzu)
The Flies - Myiasis

Morphology of the larvae

- The larva (maggot) is usually pointed anteriorly, conical & divided into 12 segments
  - Head, 3 thoracic segments, 8 abdominal segments
- Cuticle is soft & unsclerotized, may be covered in scales or spines
- Larva is legless, but may have protuberances that aid in locomotion
- A pair of mouth-hooks protrude from the atrial cavity (atrium) which is a pre-oral cavity anterior to the functional mouth
- A pair of anterior spiracles just behind the head & a pair of posterior spiracles on the 12th segment
  - Posterior spiracles are used in identification (by experts)
Identification Key for agents of wound myiasis

Examine larva for body processes

"Hairy maggot" Typical "smooth" maggot

*Chrysomya albiceps* *Chrysomya rufifacies*

Closed peritreme

Sinus slits

*Musca* species

*Calliphora* species

*Lucilia* species

Open peritreme

Straight slits

Posterior spiracles not in cavity

*Sarcophaga* species

*Wohlfahrtia* species

Posterior spiracles in cavity

Dorsal tracheal trunks pigmented in posterior segments

*Chrysomya* species

*Phormia* species

*Protophormia* species

*Dichopomia* species

Cochliomyia hominivorax

Dorsal tracheal trunks not pigmented

*Cochliomyia* species

*Cochliomyia macellaria*

The Flies - Myiasis

**Life History**

- Eggs of myiasis flies are deposited
  - Directly on an animal
  - On vegetation where they are likely to be picked up by a passing host
- Eggs usually hatch within 24 hours
- 3 larval stages follow
  - Feeding occurs
- After the 3\(^{rd}\) stage larva completes its feeding it leaves the host & finds a suitable place to pupate
  - Usually burrows into the ground
- After pupation, adults emerge
- Adults may or may not feed before mating & depositing eggs
The Flies - Myiasis

Pathology

• Effects vary depending on the numbers of larvae, species of fly, and site of infestation

• General signs
  – Irritation
  – Discomfort
  – Pruritus
  – Weight loss
  – Reduced fertility

• Heavy infestations → severe tissue damage, hemorrhage, anaphylaxis, toxemia, and/or secondary bacterial infections → death (if not treated)
The Flies - Myiasis

Pathology

- The classical description of myiasis is according to the part of the host that is infected.
- For example:
  1. Dermal
  2. Sub-Dermal
  3. Cutaneous
     - Creeping (where larvae burrow through or under the skin)
     - Furuncular (where a larva remains in 1 spot causing a boil-like lesion)
  4. Nasopharyngeal (nose, sinuses or pharynx)
  5. Ophthalmic or ocular
  6. Auricular
  7. Gastric, rectal, or intestinal/enteric
  8. Urogenital
The Flies – Myiasis

I. Blow Flies - Family Calaphororidae
   1. Screwworms
      • *Cochliomyia hominivorax*
      • *Chrysomyia bezziana*
   2. Strike flies
      • *Lucilla, Phormia, Protophormia, Calliphora*

II. Bots & Warbles - Family Oestridae
   1. *Oestris*
   2. *Gasterophilus*
   3. *Hypoderma*
   4. *Cuterebra*
The Flies – Myiasis

1. Blow Flies – Family Caliphoridae

General characteristics

• Shiny metallic colour
  – Black, blue, green or copper

• Lay eggs in wounded, infected or fecal-soiled skin

• Larvae pass through 3 instars while feeding on host tissues → myiasis

• When mature, larvae migrate away from the site of myiasis & drop to the ground where they pupate then emerge as adults

• Infested animals suffer intense irritation, anorexia, loss in fleece value & death will occur if untreated
The Flies – Myiasis

1. Blow Flies – Family Caliphoridae

I. Screwworms

1. *Cochliomyia* - New World screwworms

- *Cochliomyia hominovorax* = 1° screw worm
  - Feed on living tissue (hominovorax = “man eating”)
  - Obligate myiasis
- *Cochliomyia macellaria* = 2° screw worm
  - Feed only on necrotic tissue (dead carcasses)
  - Facultative myiasis

- Green to violet-green blowflies with 3 longitudinal stripes on the thorax
- *Cochliomyia hominivorax* are 8–10 mm in length.
- *Cochliomyia macellaria* are 6–9 mm in length.
- Both *C. hominivorax* and *C. macellaria* thrive in warm, tropical areas.
- Are important causes of myiasis in cattle, horses, sheep, goats, pigs, dogs & humans
The Flies – Myiasis

1. Blow Flies – Family Caliphoridae

Life History

- *C. hominovorax* (primary screwworm)
  - Female flies deposit eggs in fresh uninfected wounds of all kinds (even as small as a tick bite!) and can even initialize penetration of the skin to create an entry wound
  - Females reproduce **only once** during their lifespan

- *C. macellaria* (secondary screwworm)
  - Deposits eggs in carrion, infected wounds, or other myiasis sites (necrotic tissues)
    - Umbilical cords, castration sites, etc.
  - Is often found with *C. hominovorax*
  - Does not have single-lifetime breeding

Pathology

- If untreated *C. hominovorax* infestation is extremely pathogenic & will rapidly cause death
- In the wound, the *maggots* stay bunched together while feeding, their heads are down and tails are up showing **two dark spots on the end of each tail**. This bunching causes the wound to become larger as the maggots grow. The wound usually emits a strong pungent, sickly smell.
The Flies – Myiasis

1. Blow Flies – Family Caliphoridæ

• *C. hominivorax* and *C. macellaria* thrive in warm, tropical areas.

• *Cochliomyia hominivorax*
  – Was distributed throughout the northern South America, Central America, Caribbean Islands, and the United States
  – The Sterile Male Release Eradication Program *eradicated it from the U.S. and Mexico.*
    • However, the bordering Central American countries serve a challenge to keep the species eradicated since these countries still have populations of this fly.
    • Many of these countries continue to implement eradication program.

• *Cochliomyia macellaria*
  – The most common Cochliomyia species found in North America.
  – Distributed throughout southern Canada, United States, Central America, northern South America, and Caribbean Islands
The Flies – Myiasis

1. Blow Flies – Family Caliphororidae

- Obligate myiasis
  1. New World screwworm: *Cochliomyia homnivorax*
  2. Old World screwworm: *Chrysomya bezziana* (Bezzi’s blow fly, Oriental fly)
    - Found in Africa, the Indian subcontinent, and southeast Asia from Taiwan in the north to Papua New Guinea in the south. (Not Australia.) Owing to its geography, the most likely potential port of entry for *C bezziana* to the USA is Hawaii.
The Flies – Myiasis

I. Blow Flies - Family Calliphoridae
   1. Screwworms
      • Cochliomyia hominivorax
      • Chrysomyia bezziana
   2. Strike flies
      • Lucilia, Phormia, Protophormia, Calliphora

II. Bots & Warbles - Family Oestridae
   1. Oestris
   2. Gasterophilus
   3. Hypoderma
   4. Cuterebra
The Flies – Myiasis

1. Blow Flies – Family Caliphoridae

Important Genera

1. New World screwworms: *Cochliomyia* (1° and 2°)
2. Old World screwworms: *Chyrysomya*
3. Strike flies: *Phormia, Protophormia, Lucilia, Calliphora*
   - These Blow Flies are facultative parasites that can cause a condition known as “fly strike” or “strike” in livestock (sheep & cattle) & sometimes other domestic animals
   - Primary strike flies in the USA and Canada
     • *Phormia regina* and *Protophormia terraenovae* (the black blow flies)
     • *Lucilia sericata* (the green bottle fly).
     • *L. illustris* (and *Cochliomyia macellaria*) and some others are usually 2° invaders
   - Australia and South Africa
     • *L. cuprina*
   - Great Britain
     • *L. sericata*
   - New Zealand
     • *L. cuprina, L sericata, and Calliphora stygia*
The Flies – Myiasis

1. Blow Flies – Family Caliphoridae

3. Strike Flies

Phormia, Protophormia - Black Blow Fly
- Metallic blue to black adult flies
- Lay eggs in necrotic tissues associated with wounds
- Common causes of **livestock myiasis** in Northern USA & Canada (northerly habitats)

Lucilia - Green Bottle Fly
- Metallic green flies
- Deposit eggs in **areas soiled by urine & feces** (perianal & inner thigh regions)
- Are the **most important cause** of **primary strike in sheep**
  - Are attracted to animals with fleece rot
- *Lucilia cuprina* kills ~3 million sheep each year in Australia
  - “Australian Sheep Blow Fly”
- *Lucilia sericata* → **fly strike in rabbits** in Europe

Calliphora - Blue Bottle Fly
- Metallic blue adult flies
- Are attracted to feces & urine
- Often deposit eggs in a current myiasis wound
- Implicated in transmission of some taeniid tapeworms
The Flies – Myiasis

1. Blow Flies

Fly Strike in Rabbits

- **Blow flies** lay eggs on living rabbits in the summer months
  - Usually caused by *Lucilia sericata* (UK and Europe)
- The green bottle flies are attracted to **damp fur, urine, faeces** or the odour of rabbit scent glands
  - Myiasis typically occurs on or around the rabbit’s rear end
- Any rabbit which is **unable to clean itself properly** may become infected
  - Obese rabbits
  - Females with large dewlaps or skin folds around their abdomen
  - Rabbits with urinary problems
  - Elderly or arthritic rabbits
  - Long-coated breeds
  - Rabbits with teeth problems (unable to groom themselves).
  *Look for possible underlying problem* if a rabbit presents with myiasis!
- **Skin wounds** also provide a perfect place for the fly to lay its eggs, as the odour and moisture from the flesh attracts them.
- Wound cleaning & debridement
  - Sedation or general anaesthesia is often necessary
  - Removal of larvae (maggots) **AND** clumps of eggs
The Flies – Myiasis

1. Blow Flies – Family Calliphoridae

3. Strike Flies

Control & Treatment

- **Sanitation** & avoidance of surgical treatment during fly season
- Reduce perineal staining
  - Control of enteric pathogens that cause diarrhea (e.g., coccidiosis in lambs)
  - Removal of soiled fur or wool
- Apply pesticides to animals with shearing wounds
- Insecticides should be applied to infested livestock
- Ivermectin & moxidectin are **not** effective treatments for strike once infestation has taken place
- Small animals
  - Clip hair & remove visible maggots (tweezers)
  - Use a flea comb to remove all eggs and L1 larvae
  - Topical pesticide to prevent further infestation
  - Analgesics, NSAIDs, IV fluids, and/or antibiotics, as needed
  - Wound management
The Flies – Myiasis

I. Blow Flies - Family Caliphoridae
   1. Screwworms
      • *Cochliomyia hominivorax*
      • *Chrysomyia bezziana*
   2. Strike flies
      • *Lucilia, Phormia, Protophormia, Calliphora*

II. Bots & Warbles - Family Oestridae
   1. *Oestris*
   2. *Gasterophilus*
   3. *Hypoderma*
   4. *Cuterebra*
The Flies – Myiasis

2. Bots & Warbles – Family Oestridae

1. *Oestrus*
2. *Gasterophilus*
3. *Hypoderma*
4. *Cuterebra*
The Flies – Myiasis

2. Bots & Warbles – Family Oestridae

• Obligate parasites
• Highly host specific
• Larvae have posterior spiracular plates containing numerous small pores
  – 3rd stage larvae are air-breathers
• Adults have primitive or non-functional mouthparts & are short-lived
The Flies – Myiasis

2. Bots & Warbles – Family Oestridae

1. Oestrus ovis, the sheep nasal bot fly

**Morphology**

- Immature larvae are white, 1 mm in length
- Larvae become yellow or brown as they mature, growing up to 20 mm
- Adults are grey, 10-12 mm in length, with small black spots on the abdomen & have reduced (knob-like) mouthparts
The Flies – Myiasis

2. Bots & Warbles – Family Oestridae

1. *Oestrus ovis*

**Life History**

- Females are oviviparous & deposit larvae (up to 25 at a time) in or on the nostrils of sheep (or goats)
- Larvae crawl into the nasal passages & sinuses where they attach to the mucus membranes, feed on mucus & desquamated cells & develop
- Mature to 3rd stage larvae & enter the nasal cavities where they crawl out or are sneezed out of the nose
- Upon reaching the ground they pupate
- Development can take 25-35 days during the warmer months
- 1st stage larvae will overwinter in the sinus cavities of the host until the spring
The Flies – Myiasis

2. Bots & Warbles – Family Oestridae

1. *Oestrus ovis*

Pathology

- Irritation & inflammation caused by the larvae → sticky mucoid nasal discharge, sneezing, nose rubbing or head shaking
- Larvae-positing females cause annoyance → sheep bunch together with heads towards the centre or sheep will run in panic → less grazing time & reduced weight gain

Treatment

- Ivermectin
The Flies – Myiasis
2. Bots & Warbles – Family Oestridae

1. Oestrus
2. Gasterophilus
3. Hypoderma
4. Cuterebra
The Flies – Myiasis
2. Bots & Warbles – Family Oestridae

2. *Gasterophilus*
   - Obligate parasites of horses & donkeys
   - Important species in North America
     - *Gasterophilus nasalis* (Throat Bot fly)
     - *Gasterophilus intestinalis* (Horse Bot Fly)
     - *Gasterophilus hemorrhoidalis* (Nose Bot Fly)

**Morphology**
- Adults are 11-15 mm in length
- Resemble a honeybee
- Long curved ovipositor
- Non-functional mouthparts
The Flies – Myiasis

2. Bots & Warbles – Family Oestridae

2. *Gasterophilus*

*Life History*

- **Eggs are attached to the hairs** of the host in a particular body region
  - *G. nasalis* on hairs of the *intermandibular* skin
  - *G. hemorrhoidalis* on the hairs of the *lips*
  - *G. intestinalis* on the hairs of the *forelegs*

- **Eggs hatch**
  - *G. nasalis* - Spontaneously
  - *G. hemorrhoidalis* - in response to moisture
  - *G. intestinalis* - in response to temperature
    - In response to the horse licking its legs

- **Larvae enter the mouth** → migrate through the tongue & interdental spaces → feed on tissue exudates & develop

- 2\textsuperscript{nd} stage larvae enter the stomach & develop to 3\textsuperscript{rd} stage larvae → **attach to the stomach or duodenum mucosa by the mouth hooks in areas above the fluid line** (3\textsuperscript{rd} stage larvae are air breathers!) = gastric bots

- Bots attach → develop (up to 12 months) → **detach & are passed in the feces**

- Larvae pupate in the soil & adults emerge 2 weeks to 2 months later
The Flies – Myiasis

2. Bots & Warbles – Family Oestridae

**Gasterophilus intestinalis**
- Reddish larvae
- Favor the cardiac region of the stomach and cluster at the boundary of glandular and non-glandular epithelium

**Gasterophilus nasalis**
- Yellowish larvae
- Attach around the gastric pylorus and sometimes the duodenum.
2. Bots & Warbles – Family Oestridae

**Gastric bots:** The two species we typically encounter are *G. nasalis* and *G. intestinalis*. *G. nasalis* is farthest from the nose, *G. intestinalis* is farthest from the intestine.
The Flies – Myiasis

2. Bots & Warbles – Family Oestridae

2. *Gasterophilus*

Pathology

- **Light infestations have little effect**
- Larval oral migration can cause irritation (stomatitis)
  - If secondarily infected, these may cause oral or sinus tracts
  - May produce pain upon eating
- The main pathogenic effect is caused by gastric larvae
  - Attach by oral hooks to the lining of the stomach → erosions and ulcerations at the site of attachment + a hyperplastic reaction around it
  - **Little evidence that this results in clinical disease** (i.e., are incidental findings)
- Bots **may** be associated with reduced weight gain, disruption of digestion, ulceration & stomach rupture
- Heavy infestations of bots in the pyloric region of the stomach (*i.e.*, *G. nasalis*) could cause partial obstruction of the pylorus → **intermittent colic**
- Humans may become infested with larvae (migrate through oral tissues but do not complete the life cycle) by “horse kissing”
The Flies – Myiasis

2. Bots & Warbles – Family Oestridae

2. *Gasterophilus*

**Treatment & Control**

- Washing legs with warm water will induce hatching of *G. intestinalis* & wash away the larvae
- Trimming or removing hairs with nits – or eggs – on them, using clippers or a bot knife. This must be repeated as eggs are noticed again on the animals.
- Topical treatments of pesticides to kill eggs/larvae
- Traditionally, systemic pesticides to kill larvae (use periodically throughout the season) with final application 1 month before killing frost
- Common treatments now macrolides (at least 1 treatment annually at the end of bot fly season)
  - Ivermectin (effective against oral and gastric larvae)
  - Moxidectin (effective against gastric stages)
The Flies – Myiasis

2. Bots & Warbles – Family Oestridae

1. Oestrus
2. Gasterophilus
3. Hypoderma
4. Cuterebra
The Flies – Myiasis
2. Bots & Warbles – Family Oestridae

3. *Hypoderma* (warbles, heel flies, or cattle grubs)

- *Hypoderma lineatum* - Common Cattle Grub
  - occurs in USA & parts of Canada
- *Hypoderma bovis* - Northern Cattle Grub
  - occurs in Northern USA & Canada

**Morphology**
- Adults are 13-15 mm in length
- Bee-like in appearance
- Lack mouthparts
The Flies – Myiasis

2. Bots & Warbles – Family Oestridae

3. Hypoderma

Life History

- Adult females deposit eggs on the hairs of the lower legs (heels →”heel fly”) of cattle
- Eggs hatch → larvae penetrate the skin directly or through the hair follicle → migrate through the tissues (2-4 months) → preferred tissue for development
  - H. lineatum – Esophageal submucosa
  - H. bovis - Epidural tissues of the spinal canal
- Larvae develop for another 3 months → migrate to dorsal subcutaneous tissues → cause a small swelling (warble) & cut air holes in the hide (their dorsal spiracle at air hole)
- Moult twice (2 months) → warble enlarges (~1 inch) and larvae enlarge the air holes → exit & drop to ground to pupate
  - H. lineatum – warbles appear in January&February
  - H. bovis - warbles appear in March
The Flies – Myiasis

2. Bots & Warbles – Family Oestridae

3. Hypoderma

Pathology

- Warbles result in carcasses being trimmed & downgraded
- Hide damage → ↓value as leather
- Ovipositing females result in dramatic avoidance behaviour in cattle called “gadding” which can result in self injury and ↓ grazing
  - Cattle panic in the presence of the fast-moving flies
  - May run wildly with their tails high in the air in an effort to escape (but flies neither bite nor sting)
- Heavy infestations in replacement animals can result in poor weight gain, delayed time to first lactation, and long-term production losses.
- Anaphylactic shock can result from warble being crushed during removal
The Flies – Myiasis

2. Bots & Warbles – Family Oestridae

3. Hypoderma

Treatment & Control

• Systemics ivermectin, doramectin, moxidectin
• Organophosphates to kill larvae early in migration
• Treat animals after adult fly activity ceases & before larvae reach sensitive tissues (correct time varies with geographic region)
  – Treating when larvae have reached tissues around esophagus & spinal cord can result in serious tissue & nerve damage → bloat, ataxia or paralysis
• Manual removal of grubs involves injecting 1 ml of 3% hydrogen peroxide into air hole & grub will emerge in about 15 seconds
  – Note: Piercing grub during procedure can result in fatal anaphylactic shock!
The Flies – Myiasis

2. Bots & Warbles – Family Oestridae

1. Oestrus
2. Gasterophilus
3. Hypoderma
4. Cuterebra
The Flies – Myiasis

2. Bots & Warbles – Family Oestridae

4. **Cuterebra** (rodent or rabbit bot fly)

- These fly larvae infest the skin of rabbits, squirrels, mice, rats, chipmunks, and occasionally dogs, cats, and ferrets.

**Morphology**

- Adults are rarely seen
  - Resemble a bumblebee with vestigial mouthparts
- Second instar larvae are 0.5–1.0 cm long and are gray to cream in color.
- Third instar larvae are dark, thick, heavily spined (~2.5 cm) and are the stage most commonly seen by veterinarians.
The Flies – Myiasis

2. Bots & Warbles – Family Oestridae


**Life History**

- Females deposit eggs around the openings of animal nests, burrows, along runways of the normal hosts, or on stones or vegetation in these areas (5-15 eggs/site)
- Eggs hatch instantly when animals run by (respond to heat of nearby host) & larvae attach
- Larvae enter the body through the mouth or nares during grooming or, less commonly, through open wounds
- After penetration, the larvae migrate to various species-specific subcutaneous locations on the body, where they develop and communicate with the air through a breathing pore
- After ~30 days, the larvae exit the skin, fall to the soil, and pupate
- Cats & dogs are often infested when trying to stick their heads down a rabbit burrow entrance (August-October)
  - Free-roaming cats >>> indoor cats.
The Flies – Myiasis

2. Bots & Warbles – Family Oestridae


**Pathology**

- Warbles usually found subcutaneous connective tissues of the cervical skin in cats, dogs, and ferrets
- Lesions usually develop in the summer
- Typically presents as a fistulous swelling
  - Usually ~1 cm in diameter
- Hair is often matted over the lesion
- Cats may aggressively groom the area
- Most common differential diagnoses are an abscess, foreign body, or tumor
- Abberrent migrations may occur
  - Head, brain, nasal passages, pharynx, and eyelids
  - Usually fatal if the brain is involved
The Flies – Myiasis

2. Bots & Warbles – Family Oestridae


**Treatment**

- Complete surgical removal (if possible) & wound treatment
- Explore suspect lesions for possible larvae
  - Carefully enlarge fistula (breathing pore) with forceps
  - Usually **only 1 *Cuterebra* larva per lesion**
- Parasite may retreat into the opened pore
  - Can try covering the fistula (breathing pore) with white petroleum jelly for 10–15 minutes before grasping the parasite
- **Larva should be removed in one piece**
  - Recurrent abscesses = residual infection or remaining larval pieces
- Do not squeeze the lesion!
  - Rupture of larva → chronic foreign body reaction +/- 2° infection.
  - Anecdotal reports of larval rupture causing anaphylaxis.
- Wound should be thoroughly flushed with sterile saline, debrided (if necessary), and allowed to heal by granulation (may heal slowly)
- CNS cuterebriasis (usually fatal)
  - Diphenhydramine 1–2 hr before ivermectin & dexamethasone
The Flies – Myiasis
Other Warbles of Small Animals (FYI)

*Wohlfahrtia vigil* (gray flesh fly) **FYI**
- Cutaneous myiasis in North America, particularly in southern Canada and the northern part of the USA
- All reports of infestation are in the skin of healthy animals, particularly the unbroken skin of the young

*Cordylobia anthropophaga* (African tumbu fly) **FYI**
- Boil-like (furuncular) myiasis in both people and animals in Africa, particularly in the sub-Saharan regions
The Flies - Myiasis

Two Important Families for Myiasis Files
1. Blow flies
2. Bots & Warbles

2 important groups of blow flies
   I. Screwworms
   II. Strike flies

4 Important Genera of bots and warbles:
   1. *Oestrus* (sheep nasal bots)
   2. *Gasterophilus* (horse bots)
   3. *Hypoderma* (cattle grubs or warbles)
   4. *Cuterebra* (rabbit bots)
The Flies

Ways to control flies:

1. **Sanitation:**
   - Since manure and organic matter are common breeding grounds for flies, **regular removal of manure & organic matter** will deter fly populations by reducing the number of eggs laid.

2. **Mechanical control**
   - **Preventing accumulation of water and wet areas** reduces fly breeding.
   - Mechanical control of flies in buildings through the use of **screens**.

3. **Insecticides**
   - Can be delivered by ear tags, dust bags, oils, sprays, pour-ons, and feed additives.