Biomedical Parasitology

Lice

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INSECTS

FLEAS	LICE	FLIES
		
laterally flattened wingless	flattened wingless	not flattened winged

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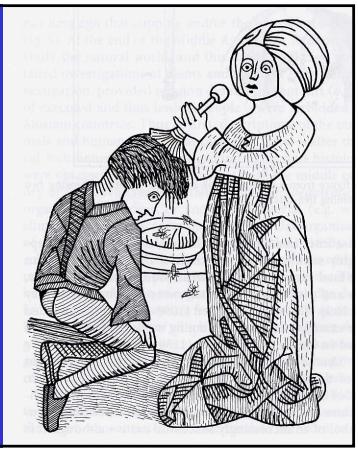
Medieval engraving

wife delousing husband with comb instrument



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INFESTATIONS

Lice – sucking lice (blood)
– chewing lice (hair/feathers)

cause:
- blood loss
- annoyance/irritation
- dermal lesions
- hypersensitivity
- secondary infections
- transmit other pathogens

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PHTHIRAPTERA (LICE)

MALLOPHAGA	ANOPLURA
	
chewing/biting birds & mammals	sucking mammals

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LICE

Over 3,500 species described
Most parasitic on birds and mammals
Some with long association with humans

Enlarged tarsal claws for clinging

Mouthparts modified for:
- chewing (3,000 species on birds & mammals)
- sucking (500 soecies on mammals only)

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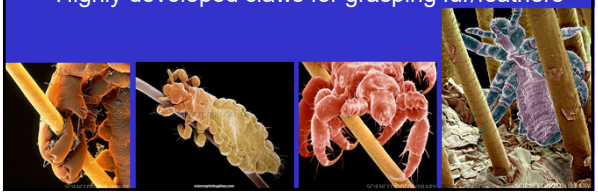
General morphology

- Small (0.4-10 mm), wingless insects (Order Phthiraptera)
- Dorso-ventrally flattened body
- Chewing or sucking mouthparts
- Highly developed claws for grasping fur/feathers



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Diversity of louse fauna

- 5,000 species/subspecies described
- 300 genera, 24 families
- Worldwide distribution

- Sucking lice (Anoplura): 500 spp. on eutherian mammals

- Chewing lice (Mallophaga): 4,500 spp. on birds & mammals) Three suborders:
  - Amblycera (1300 spp., 85% on birds)
  - Ischnocera (3200 spp., 90% on birds)
  - Rhyncophthirina (3 spp. on mammals)

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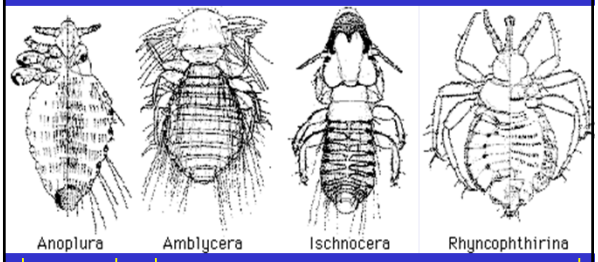
Suborders of lice



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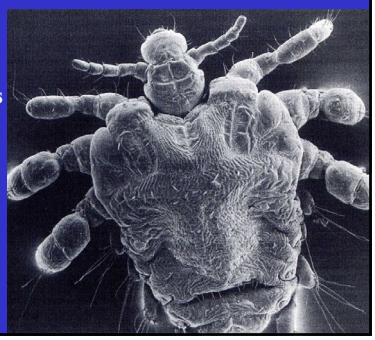
FEEDING

solenophage (‘*pipe-eating*’) sucking mouthparts

telmophage (‘*pool-eating*’) cutting mouthparts



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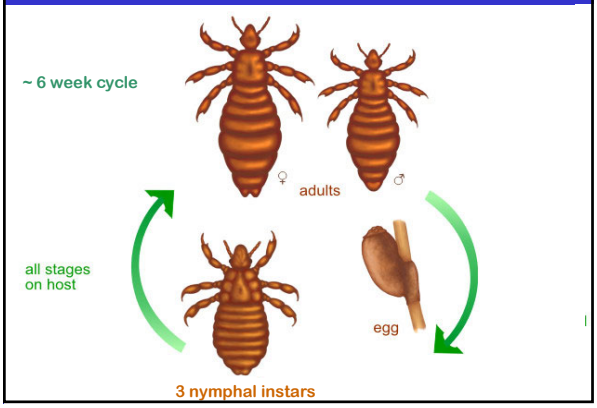
Life cycle – incomplete metamorphosis



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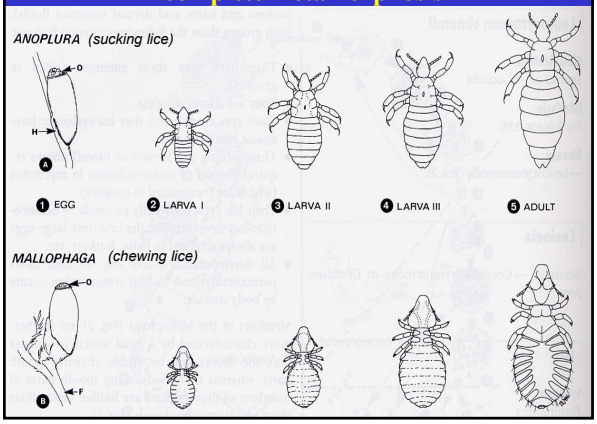
Incomplete metamorphosis



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EGGS (NITS)

(colloquisms – lousy, nitwit, nit-picking)

- **eggs cemented to**
  - **hairs/fibres**
  - **clothing**
- **hatch around 7 days**
- **egg cases remain attached**
- **hard to dislodge**

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Common vernacular

lousy

adjective (**lousier** , **lousiest**)

1 *informal* very poor or bad; disgusting *: the service is usually lousy | lousy weather.*

2 ill; in poor physical condition *: she felt lousy.*

3 infested with lice. [predic.] (**lousy with**) informal teeming with (something regarded as bad or undesirable) *: the town is lousy with tourists.*

nitwit

noun *informal*

a silly or foolish person (often as a general term of abuse).

nitpicking

Informal adjective

looking for small or unimportant errors or faults, esp. in order to criticize unnecessarily *: a nitpicking legalistic exercise.*

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Effects on hosts

- Light infestations – little harm (itchy)
- Heavy, prolonged infestations may cause:
  - Pruritus (severe itching)
  - Hypersensitivity
  - Blood loss or hair loss
  - Secondary infection
- Some species transmit microbial pathogens

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Host specificity

- Very high host-specificity compared to other insects
- Infest one or a small number of closely related species
  [a few exceptions: *Menacanthus eurysternus* (Ischnocera) has been recorded from 118 species of birds]
- Spend entire lives on the same host
- Survive only 1-3 days off hosts
- Dispersal via body contact
-
- 3 species infest humans on 3 different sites:
  - Head: *Pediculus (humanus) capitis*
  - Body (clothes): *Pediculus (humanus) humanus*
  - Pubis: *Pthirus pubis*

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Species of medical importance

- Human head louse, *Pediculus humanus capitis*
- Human body louse, *Pediculus humanus humanus*
- Human pubic louse, *Pthirus (or Phthirus) pubis*

- Flying squirrel louse, *Neohaematopinus sciuropteri*
- Spined rat louse, *Polyplax spinulosa*
- Tropical rat louse, *Hoplopleura pacific*
- Rabbit louse, *Haemodipsus setoni*
- Dog-biting louse, *Trichodectes canis*

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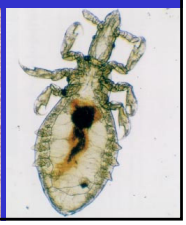
HUMAN HEAD LICE

Pediculus humanus capitus

(cooties, greybacks, mechanized dandruff)

- **attach to hair (esp. back of neck and behind ears)**
- **infestations associated with crowding**
- **bites cause red papules**
- **intense pruritis**
- **dermatitis**
- **secondary infection**

- **emerging resistance to chemicals**
- **resurgence in schools**
- **clean hair/girls**



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Human head lice

- Infests mainly school children
- esp. girls with long clean hair
- Lice attach to hair at back of neck & behind ears
- Bites cause intense itching on the scalp (pruritus)
- May lead to secondary bacterial infections
  e.g. *Sthaphylococcus aureus* causing inflammation (cellulitis)

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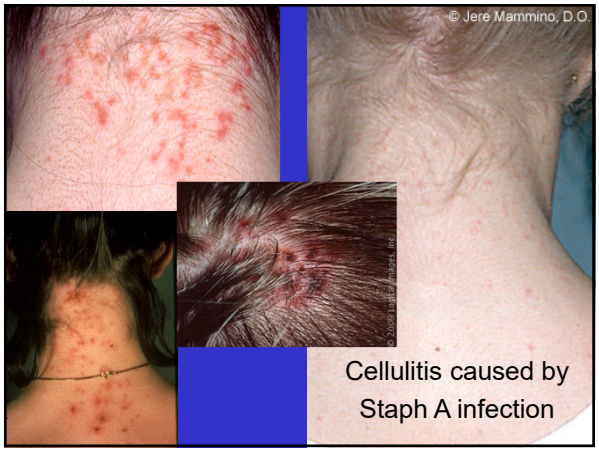

Cellulitis caused by Staph A infection

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Control of head lice

- Mechanical - combing, cracking
- Shaving heads
- Insecticides - pyrethrums, organophosphates, herbal extracts & essential oils
- Repellents - kerosene, herbal sprays

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Human body lice

- *Pediculus humanus humanus* infests mainly homeless people, refugees, who live in crowd or unhygienic conditions
- Lice spend most time in clothing
- Nits attached to fibers in clothes
- Causing itchiness
- Vector of infectious diseases
- Control: change clothes; boiling to kill all lice and eggs



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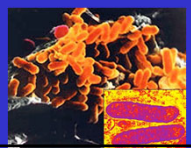
Human body lice as disease vector

Transmit 3 species of pathogenic bacteria:

- *Bartonella quintana*, causing trench fever (pain, high fever but not lethal)
- *Borrelia recurrentis,* causing relapsing fever (mortality 30-60% without treatment)
- *Rickettsia prowazekii,* causing epidemic typhus (severe headache, high fever, chills, etc; mortality 10-60% without treatment)

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Human pubic lice

- Infests mainly adults; found in pubic area, armpits, beard, eyebrows, eyelashes, chest
- Bites cause pruritus
- Infestation often spread through sexual contact, thus considered as a STD
- Control: insecticides, abstinence


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Many species of economic importance

- Sheep
  - Sheep body louse, *Bovicola ovis*
- Cattle
  - Cattle biting louse, *Bovicola bovis*
  - Long-nosed cattle louse, *Linognathus vitula*
  - Short-nosed cattle louse, *Haematopinus eurysternus*
  - Tubercle-bearing louse, *Solenopotes capillatus*

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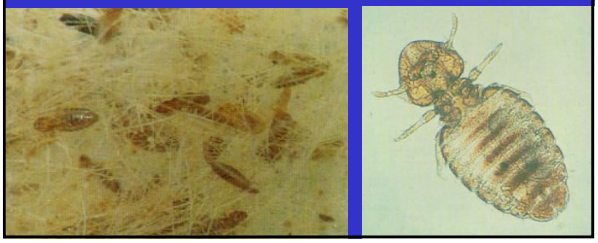
ANIMAL INFESTATIONS

Biting lice: *Damalinia (=Bovicola)* spp.

- **cause serious economic losses through:**
  - **irritation, fibre loss**
  - **weight loss**
  - **anaemia**

red biting/chewing louse



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Sheep body lice

Bovicola ovis cause serious economic losses:

- Intense irritation, causing the sheep to bite, scratch, rub on trees, fences, etc
- Reduce wool production and quality
- Increase labor & insectcide cost
- Increase susceptibility to fly strike

Control: shearing and chemical application

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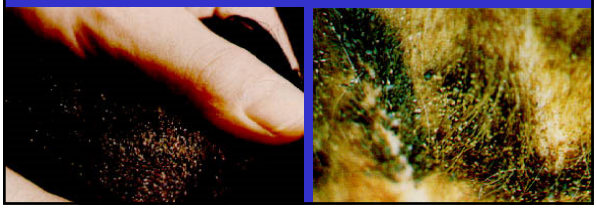
ANIMAL INFESTATIONS

Sucking lice: *Linognathus* spp.

- **cause skin irritation**
- **aggravated by host rubbing and biting**
- **resulting in abrasions and hair loss**

canine sucking louse **blue catlte louse**



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Cattle lice

6 species infest cattle (4 very common)

- Cause skin irritation
- Cattle rub and bite to get relief
- Result in abrasions and hair loss
- Reduce hide quality and value
- Damage to fencing & other fixtures

Control: insecticide (spray, pour-on, eartag)

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Heavy infestation of cattle lice

Bovicola bovis

Linognathus vitula

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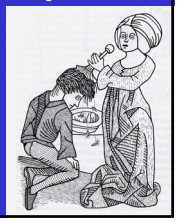
TREATMENT

- grooming/preening behaviour
  - birds use ants to clean plumage
  - humans use fine-toothed combs (pharaohs)
- insecticidal lotions/shampoos/hair-care products
  - 1% permethrin (10 min contact)
  - herbal formulations
- injectable formulations
  - moxidectin
- impregnated eartags



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Arthropodicidal drugs

1940's	- chlorinated hydrocarbon (DDT)	sodium channel
	- " " (cyclodiens, lindane)	chloride channel
1950's	- organophosphates	AChE
1960's	- carbamates	AChE
1970's	- pyrethroids	sodium channel
	- amidines	biogenic amines
1980's	- avermectins/milbemycins	chloride channel
1990's	- arylpyrazole (fipronil)	chloride channel
	- chloronicotinyles (imidacloprid)	nicotinic AC res
1980's	- insect growth regulator (cyromazine)	disrupt cuticle
	- " " (benzoylphenylureas)	inhibit cuticle
	- " " (juvenoids)	mimic juvenile h

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Summary

- Lice are small wingless insects
- Parasitize mammals and birds

- Sucking lice infest mammals and suck blood
- Chewing lice infest birds, sometimes mammals

- Incomplete metamorphosis with 3 nymphal stages
- High host specificity

- Heavy infestations cause pruritus, hypersensitivity, blood/hair loss
- Predispose to secondary bacterial infection
- May transmit microbial pathogens

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