Cheryl Bartlett, Canada Research Chair
CAPE BRETON UNIVERSITY in Integrative Science

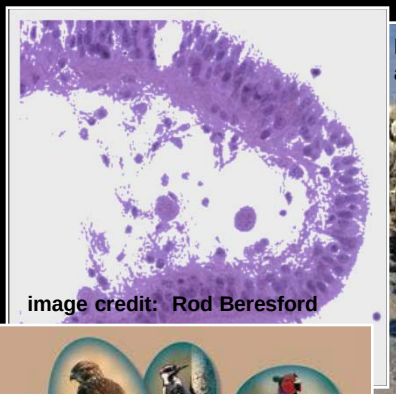
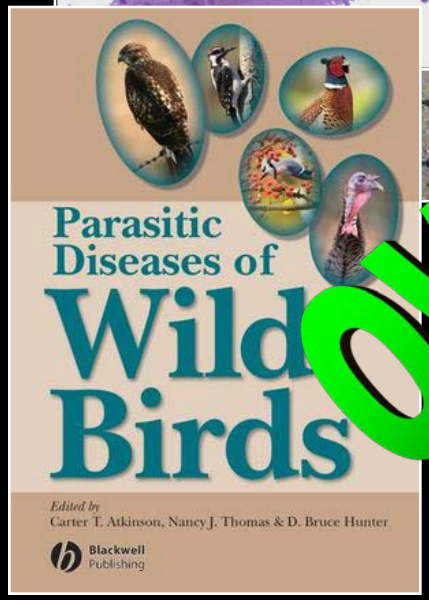


image credit: Rod Beresford


http://www.dnr.sc.gov/news/Yr2007/aug27/aug27_shellfish_pic.html




http://covenanthealthclinic.info/?p=142


DAISIE European Invasive Alien Species Gateway *Anguillicoloides crassus*: from: http://www.europe-aliens.org [Accessed 16 February 2009].


http://myanimalblog.wordpress.com/2008/03/08/moose/

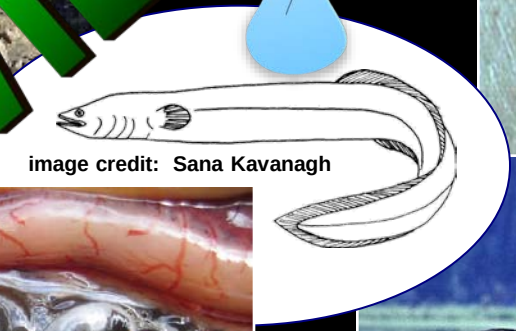


image credit: Sana Kavanagh

OVERVIEW

PARASITES AS AGENTS OF DISEASE IN ANIMALS (INCLUDING HUMANS)

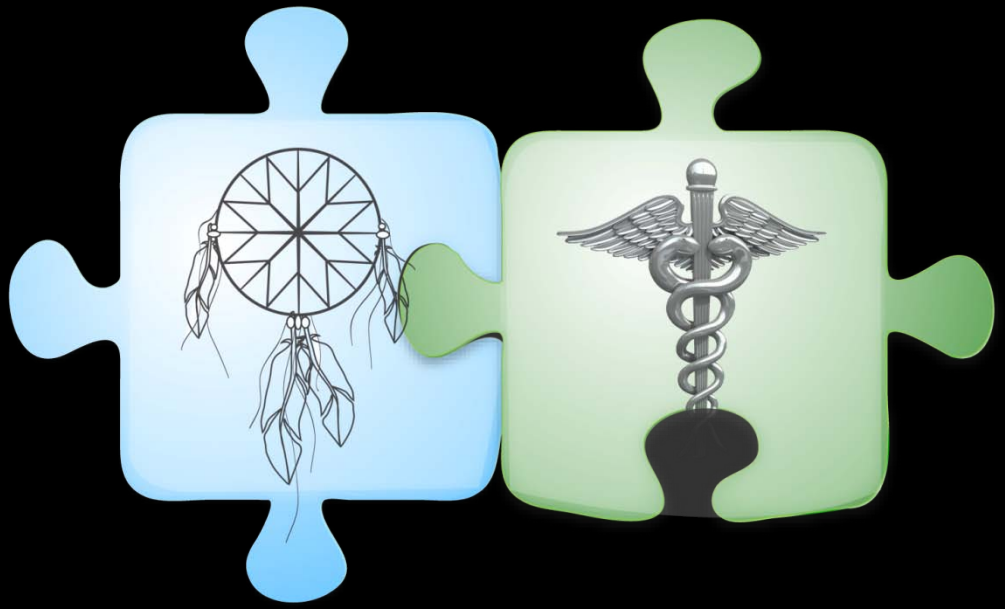
Let's Be Early Birds and Stop the Worm! (eel worm workshop, CBU, 18 Feb 2009)

Cheryl Bartlett, Canada Research Chair
in Integrative Science
CAPE BRETON UNIVERSITY

INTEGRATIVE SCIENCE
&
TWO-EYED SEEING

PARASITES AS AGENTS OF DISEASE IN ANIMALS (INCLUDING HUMANS)

Let's Be Early Birds and Stop the Worm! (eel worm workshop, CBU, 18 Feb 2009)



- worms
- arthropods
- fungi
- protozoa
- bacteria
- viruses
- prions

PARASITES AS AGENTS OF DISEASE IN ANIMALS (INCLUDING HUMANS)

- worms
- arthropods
- fungi
- protozoa
- bacteria
- viruses
- prions

HOLARCHY

- VISIBLE MATTER IN THE UNIVERSE -

- **Universe**
- **galaxies**
- **solar systems**
- **planet Earth**
- **ecosystems**
- **communities**
- **populations**
- **organisms** (multi-cellular)
- **organ systems**
- **organs**
- **tissues**
- **cells** (and uni-cellular organisms)
- **organelles**
- **rocks**
- **minerals**
- **molecules**
- **atoms** (elements)
- **baryons** (neutrons and protons)
- **fundamental particles** (quarks and leptons)

HOLARCHY

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- fungi
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HOLARCHY

- VISIBLE MATTER IN THE UNIVERSE -

- Universe
- galaxies
- solar systems

“live things”

- planet Earth
- ecosystems
- communities
- populations
- **organisms** (multi-cellular)
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- worms
- arthropods
- fungi
- protozoa
- bacteria
- viruses
- prions

PARASITES

- **infect**

(inside of another organism's body)

OR

- **infest**

(outside of another organism's body)

PARASITES sometimes cause:

- **DISEASE**
  which might or might not lead to death of other organism

OLARCHY

TER IN THE UNIVERSE -

- Universe
- galaxies
- solar systems
- planet Earth
- ecosystems
- communities
- populations
- organisms
- organ systems
- organs
- tissues
- cells
- organelles
- rocks
- inerals
- molecul
- atoms (ele
- baryons (neu
- fundamental p

- **INFLAMMATION**
  which might or might not lead to disease

worms

HOLARCHY

- VISIBLE MATTER IN THE UNIVERSE -

- **Universe**
- **galaxies**
- **solar systems**

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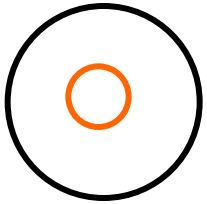
- **fundamental particles** (quarks and leptons)

WORMS

Roundworms

Flatworms

WORMS



Roundworms

and in separate bodies

Nematoda

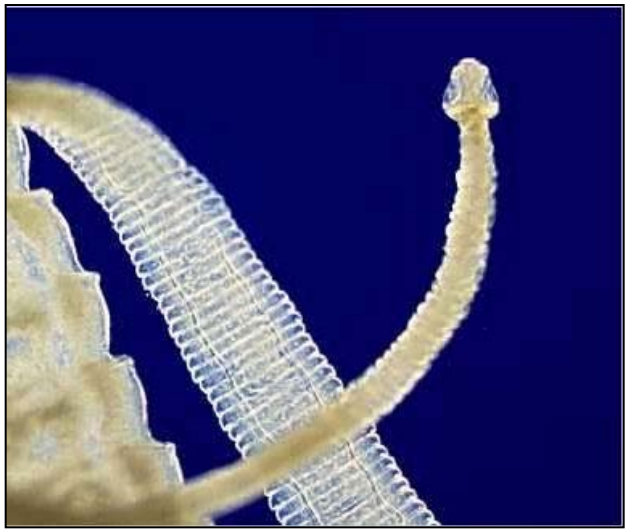
(nematodes)

Flatworms

and together in one body

Cestoda

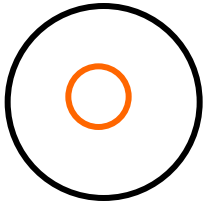
(tapeworms)



Trematoda

(flukes)

images source: Wikipedia



Roundworms

and in separate bodies

Nematoda

(nematodes)

(female)

(male)

image source: Wikipedia

DAISIE European Invasive Alien Species Gateway, 2008.
***Anguillicoloides crassus*; from:**
http://www.europe-aliens.org/images/LimitedSize/56_56_1_Hab_Anguillicola%20crassus.jpg
[Accessed 16 February 2009].

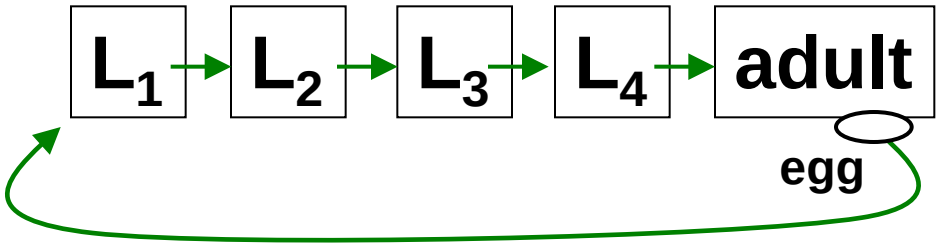
Roundworms

Nematoda

(nematodes)

image source: Wikipedia

5 stages in the life cycle



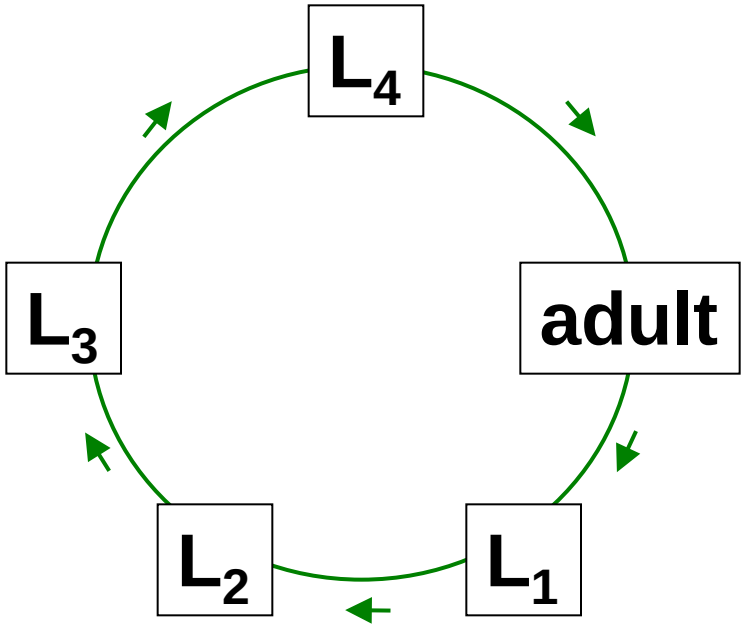
Roundworms

Nematoda

(nematodes)

image source: Wikipedia

5 stages in the life cycle

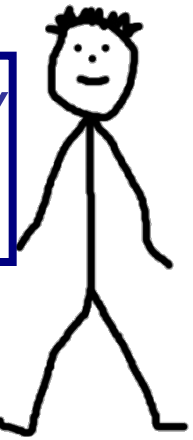


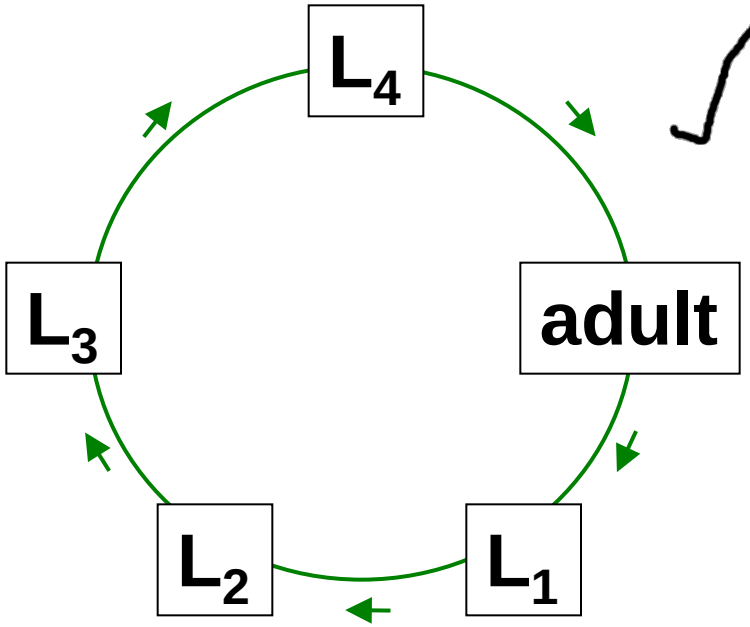
Roundworms

NEMATODES … infect

= inside of another organism's body

= HOST

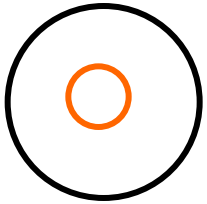




Nematoda

(nematodes)

image source: Wikipedia



Roundworms

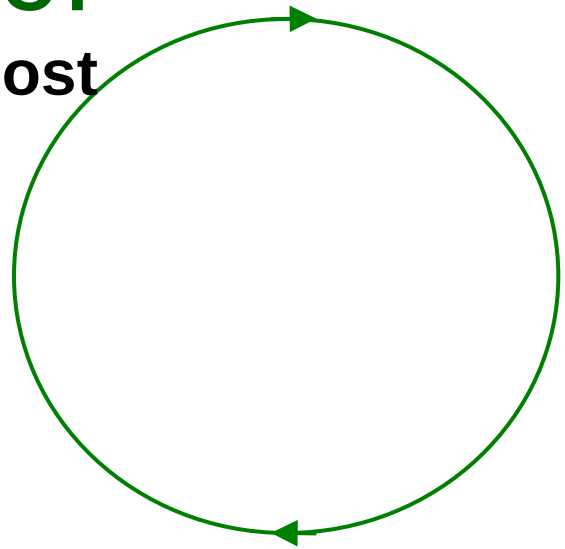
Nematoda

(nematodes)

image source: Wikipedia

DIRECT

one host



Roundworms

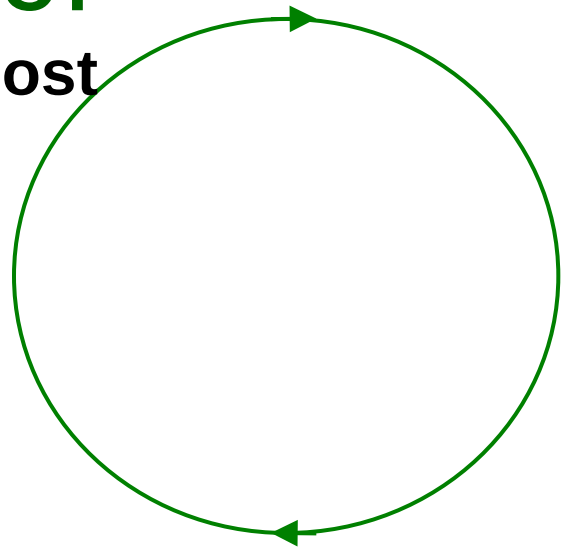
Nematoda

(nematodes)

image source: Wikipedia

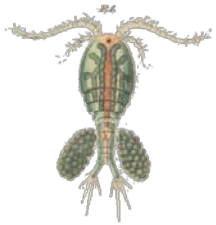
DIRECT

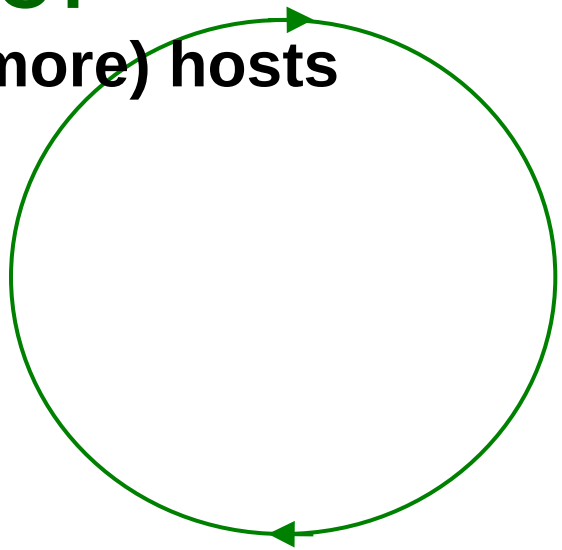
one host



INDIRECT

two (or more) hosts





(copepod image credit: Wisconsin A. Vernalis)

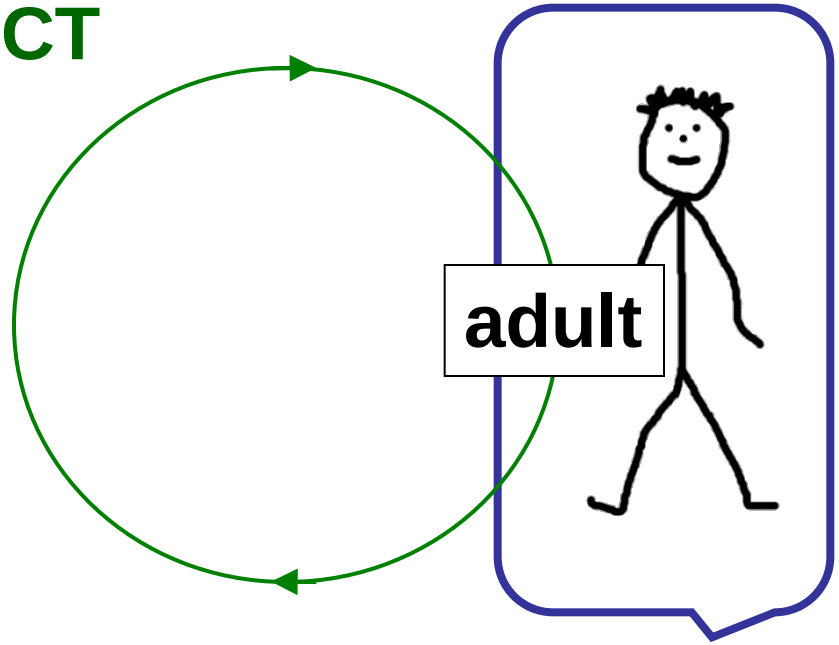
Roundworms

Nematoda

(nematodes)

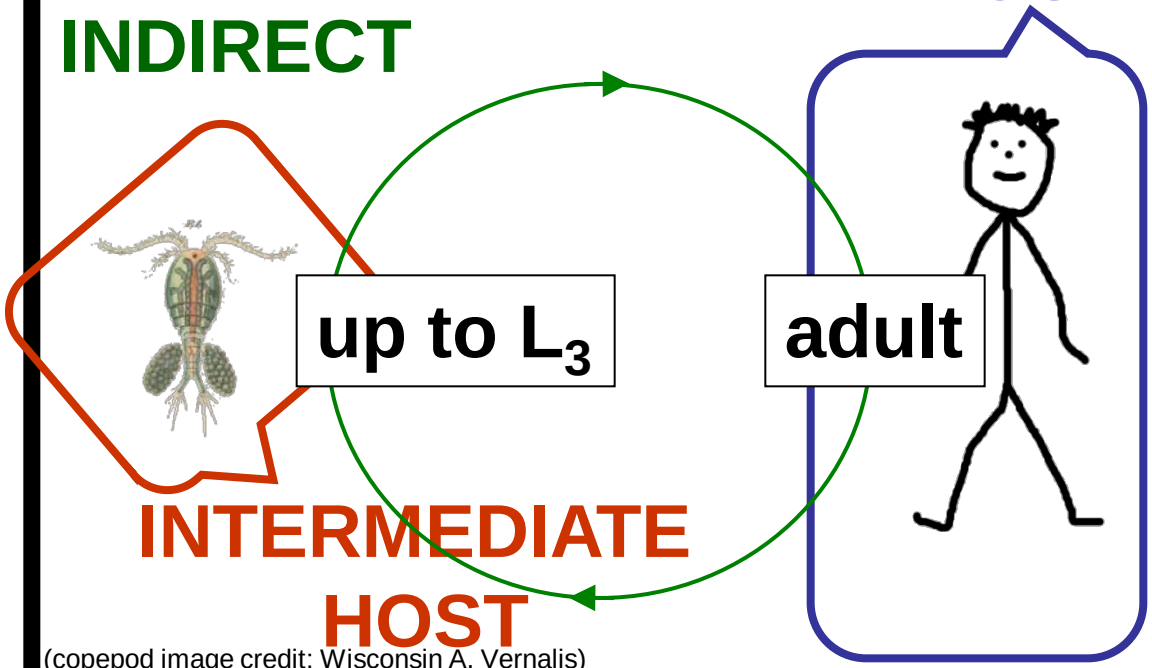
image source: Wikipedia

DIRECT



FINAL HOST

INDIRECT



INTERMEDIATE HOST

(copepod image credit: Wisconsin A. Vernalis)

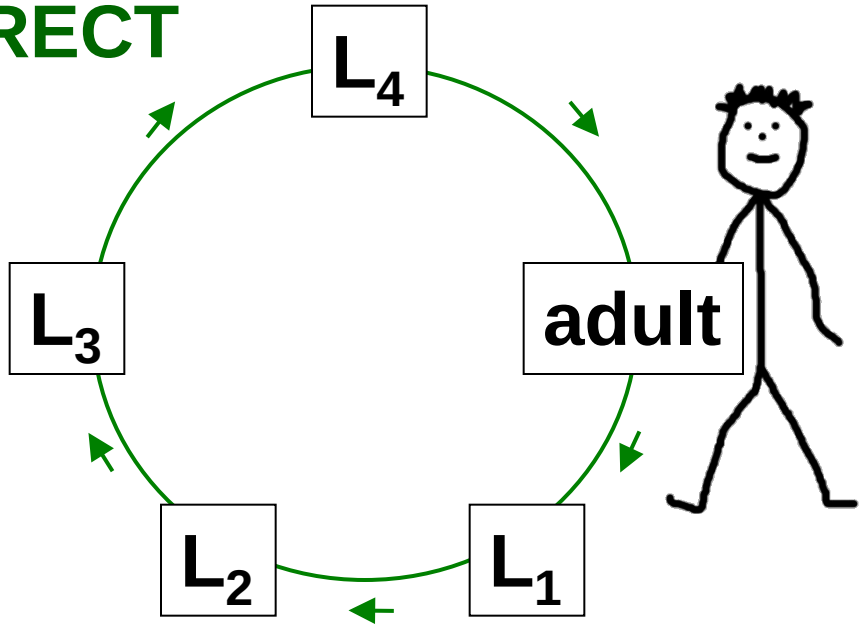
Roundworms

Nematoda

(nematodes)

image source: Wikipedia

DIRECT



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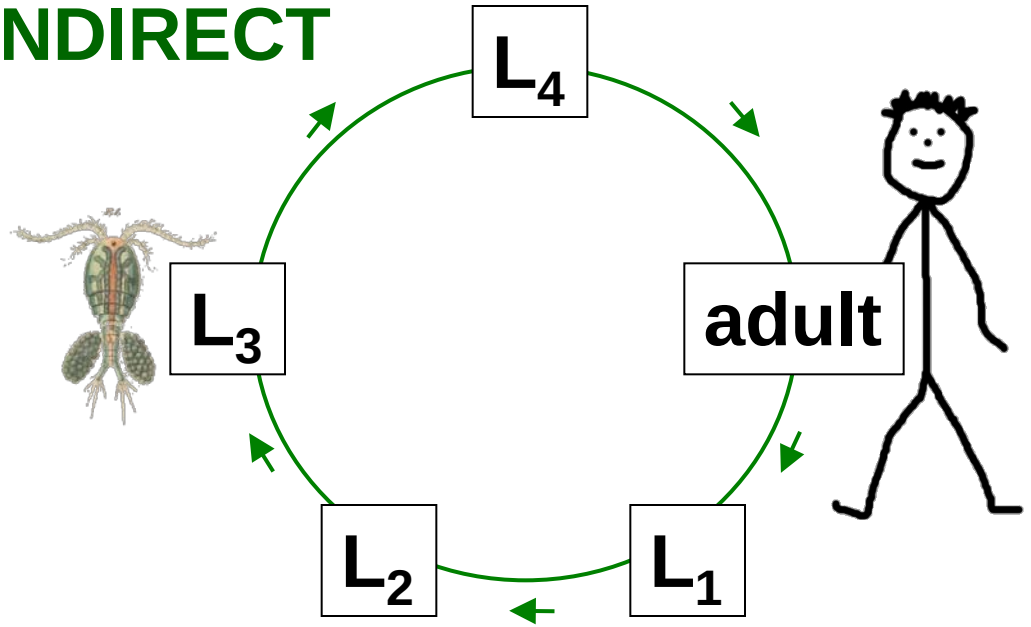


(copepod image credit: Wisconsin A. Vernalis)

Roundworms

Superfamily Oxyuroidea

Nematoda

(nematodes)

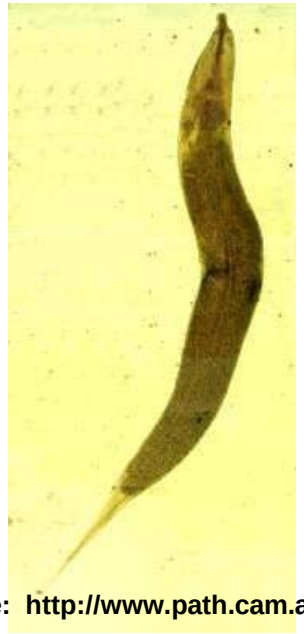
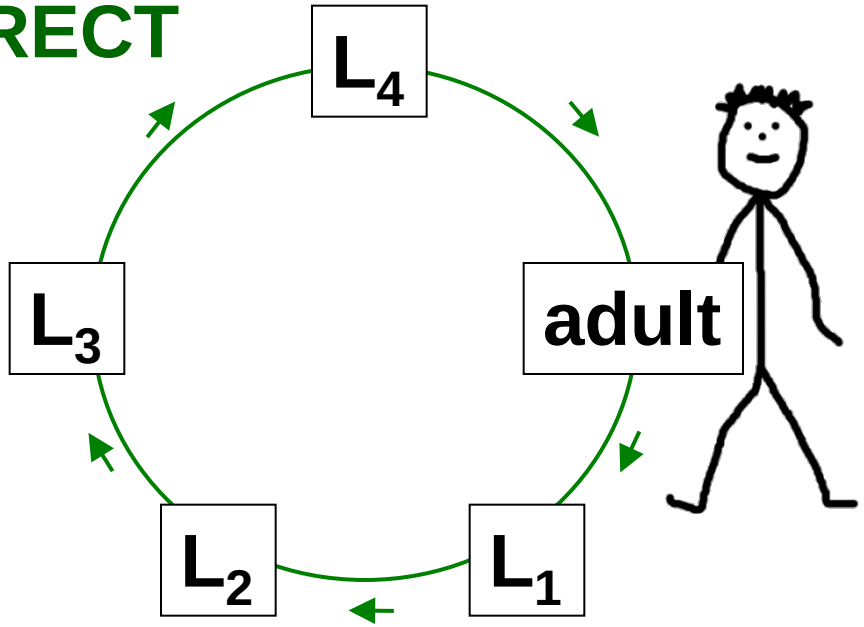


image source: http://www.path.cam.ac.uk/

DIRECT

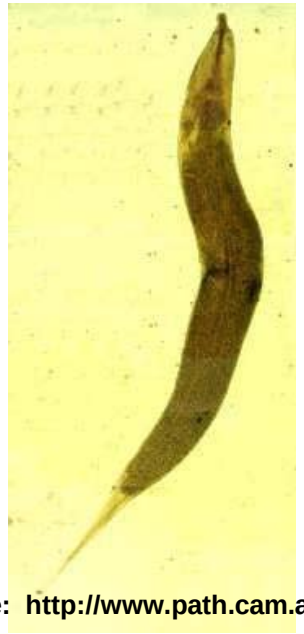


Roundworms

Superfamily Oxyuroidea

Nematoda

(nematodes)



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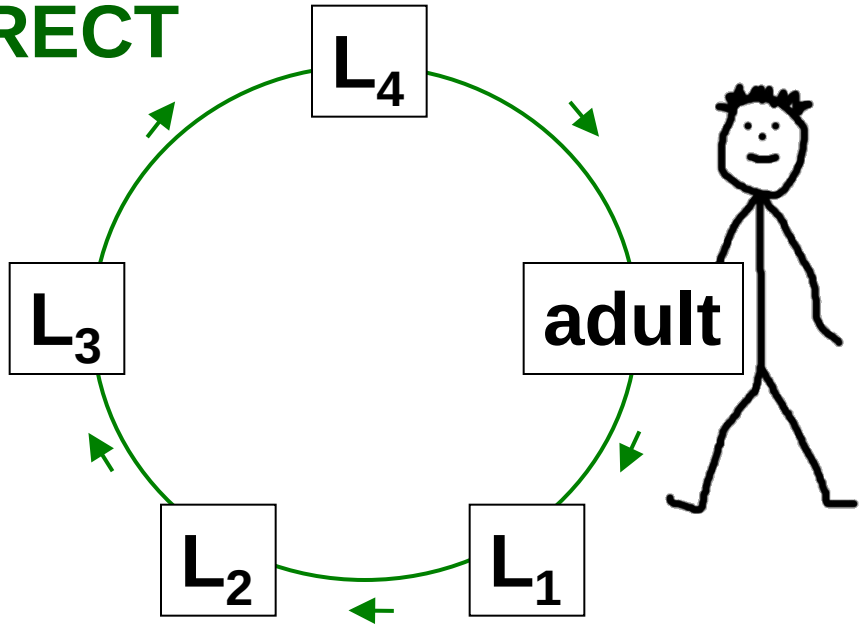
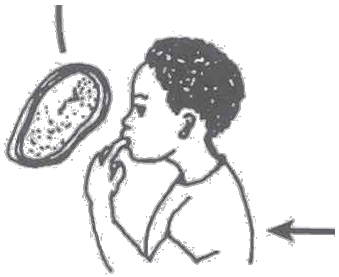
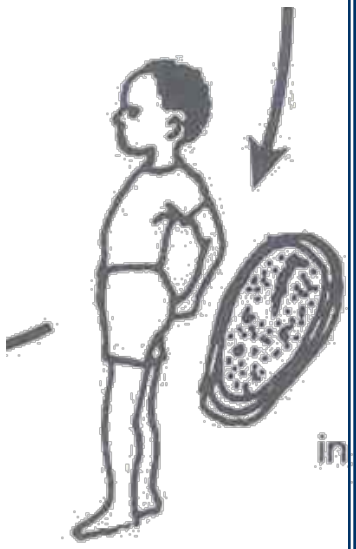


e.g. pinworm





images source: http://www.wikieducator.org/Lesson_15:_Intestinal_Helminths

Roundworms

Superfamily Dracunculoidea

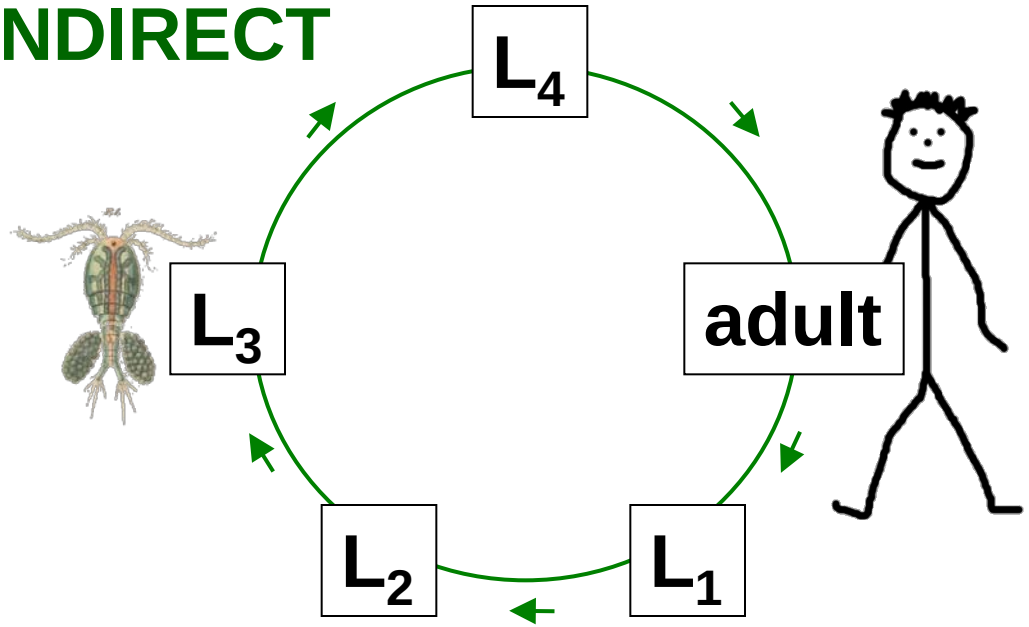
Nematoda

(nematodes)

images source: WHO

e.g. guinea worm

INDIRECT



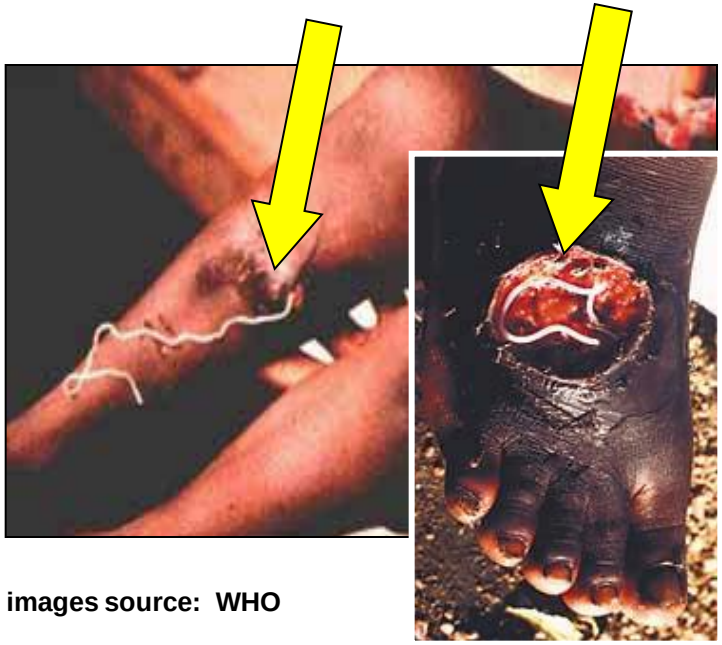
(copepod image credit: Wisconsin A. Vernalis)

Roundworms

Superfamily Dracunculoidea

Nematoda

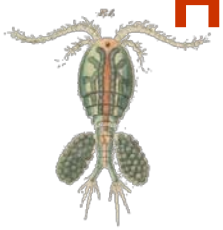
(nematodes)

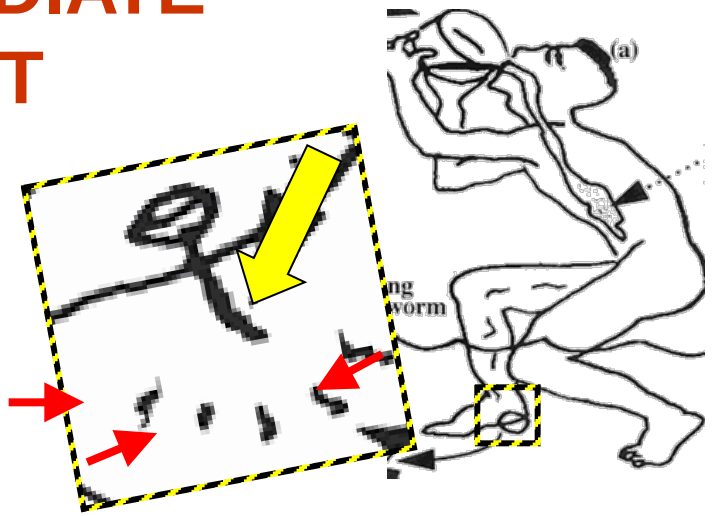


images source: WHO

image sources: travel.atlas.or.kr/disease/ Dracunculiasis.html

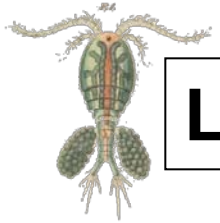
INTERMEDIATE HOST

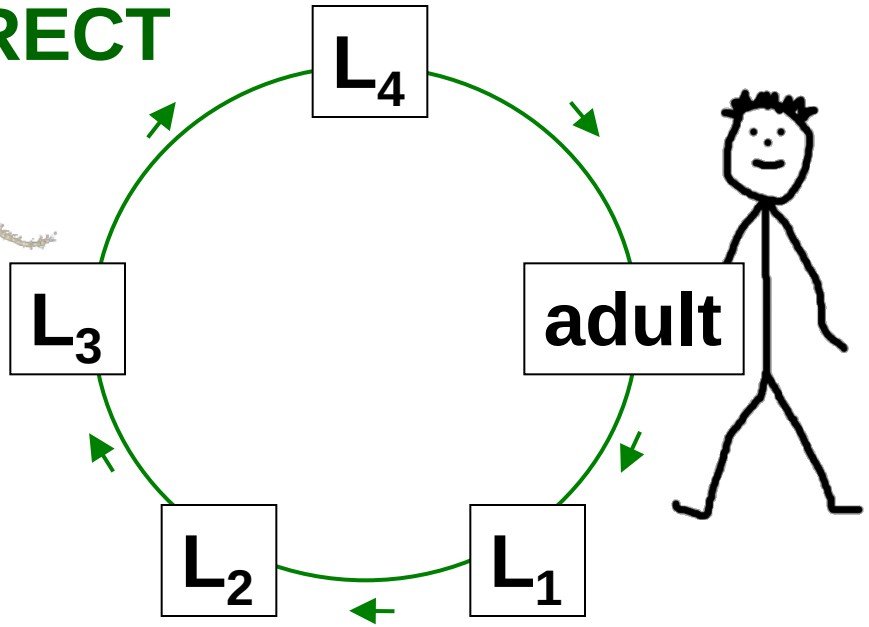




e.g. guinea worm

INDIRECT





(copepod image credit: Wisconsin A. Vernalis)

Roundworms

Superfamily Dracunculoidea

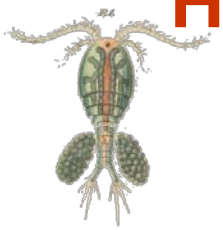
Nematoda

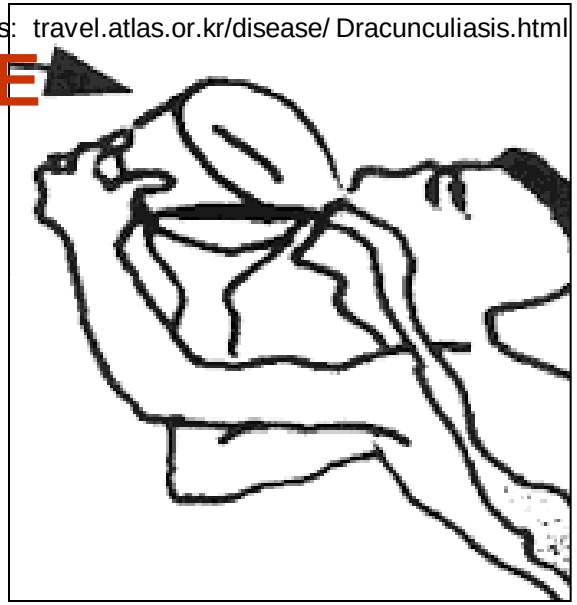
(nematodes)

images source: WHO

image sources: travel.atlas.or.kr/disease/ Dracunculiasis.html

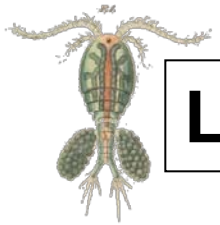
INTERMEDIATE HOST

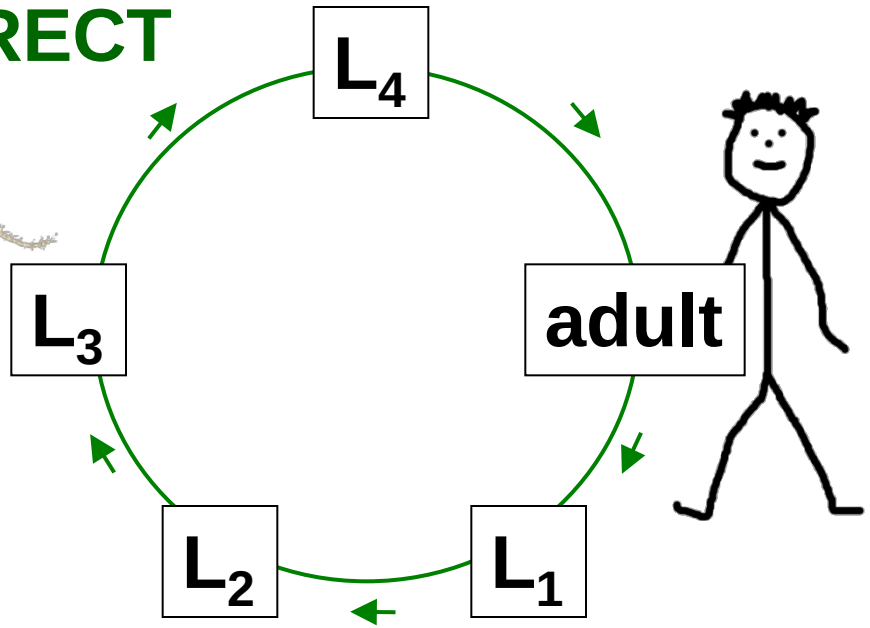




e.g. guinea worm

INDIRECT





(copepod image credit: Wisconsin A. Vernalis)

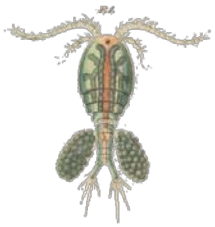
Roundworms

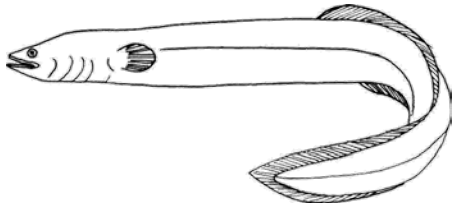
Superfamily Dracunculoidea

Nematoda

(nematodes)

DAISIE European Invasive Alien Species Gateway, 2008. ***Anguillicoloides crassus***; from: http://www.europe-aliens.org/images/LimitedSize/56_56_1_Hab_Anguillicola%20crassus.jpg [Accessed 16 February 2009].

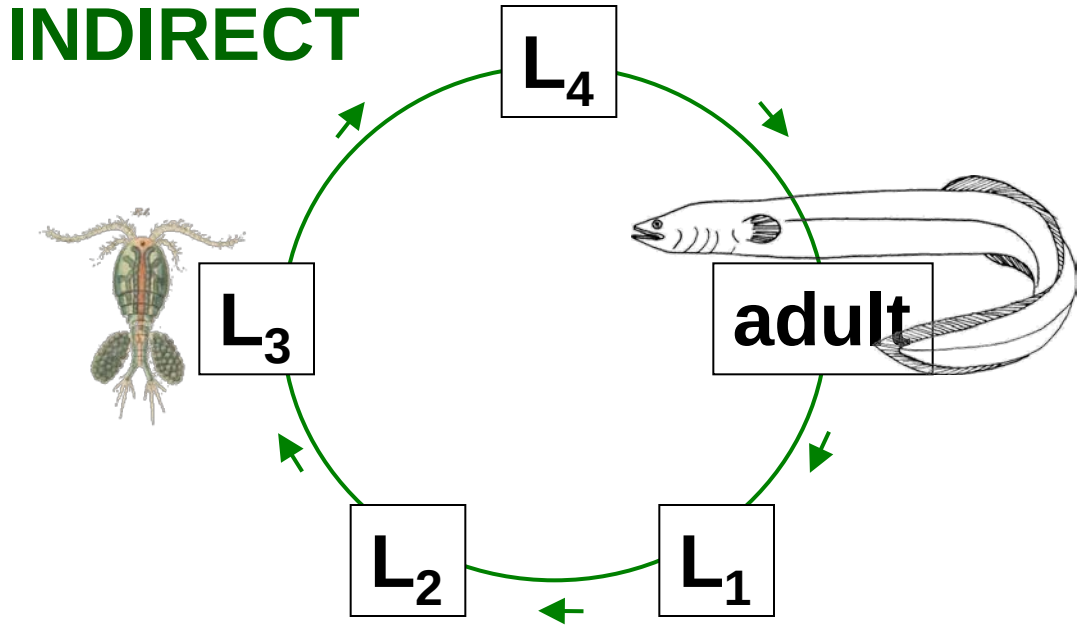




e.g. eel worm

eel image credit: Sana Kavanagh

INDIRECT



(copepod image credit: Wisconsin A. Vernalis)

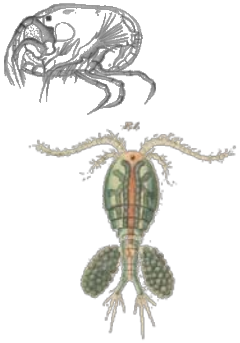
Roundworms

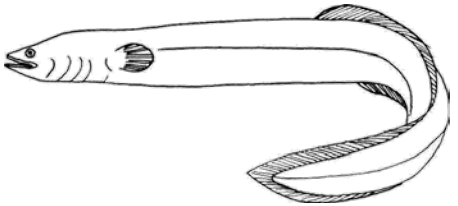
Superfamily Dracunculoidea

Nematoda

(nematodes)

DAISIE European Invasive Alien Species Gateway, 2008. ***Anguillicoloides crassus***; from: http://www.europe-aliens.org/images/LimitedSize/56_56_1_Hab_Anguillicola%20crassus.jpg [Accessed 16 February 2009].

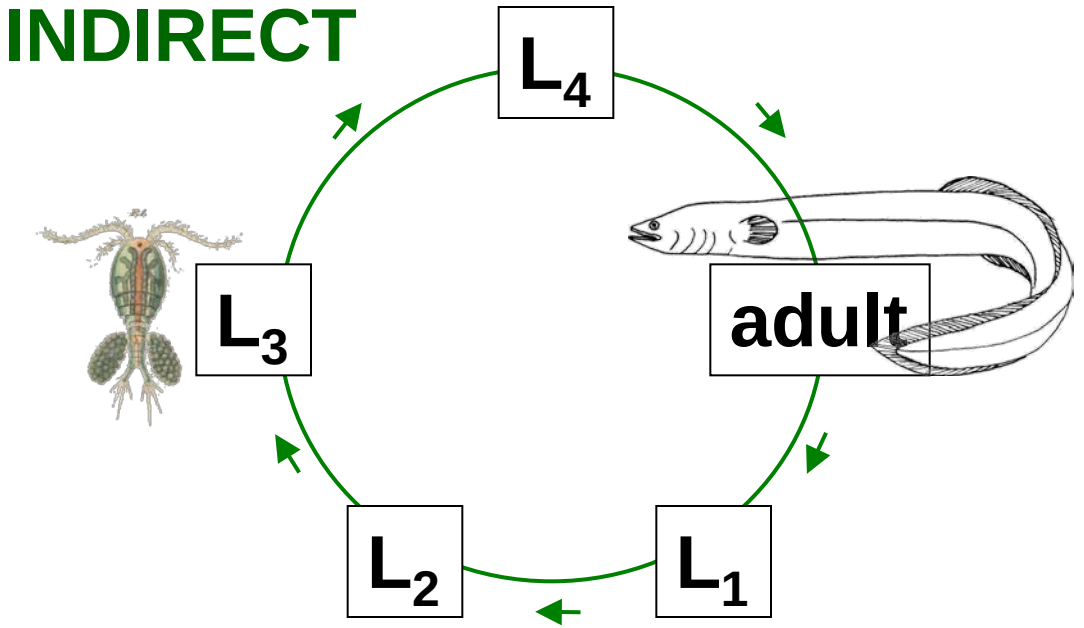




e.g. eel worm

eel image credit: Sana Kavanagh

INDIRECT



(copepod image credit: Wisconsin A. Vernalis; ostracod image credit: C. Miller

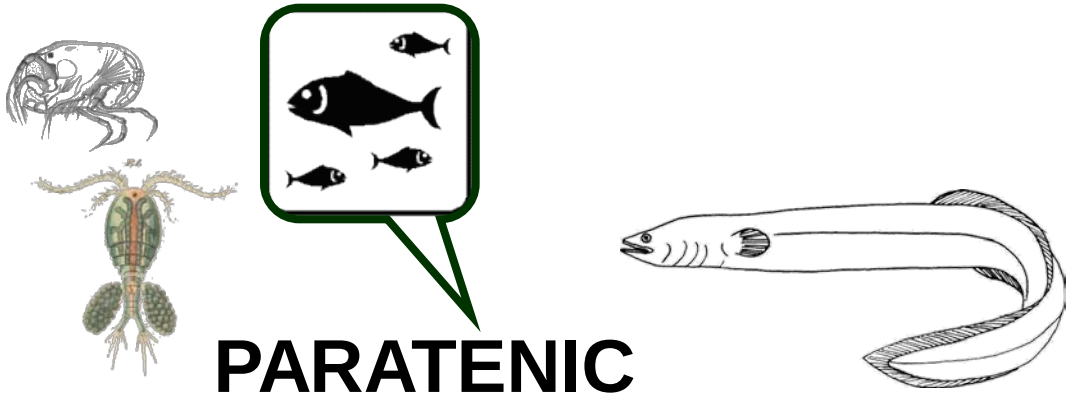
Roundworms

Superfamily Dracunculoidea

Nematoda

(nematodes)

DAISIE European Invasive Alien Species Gateway, 2008. ***Anguillicoloides crassus***; from: http://www.europe-aliens.org/images/LimitedSize/56_56_1_Hab_Anguillicola%20crassus.jpg [Accessed 16 February 2009].

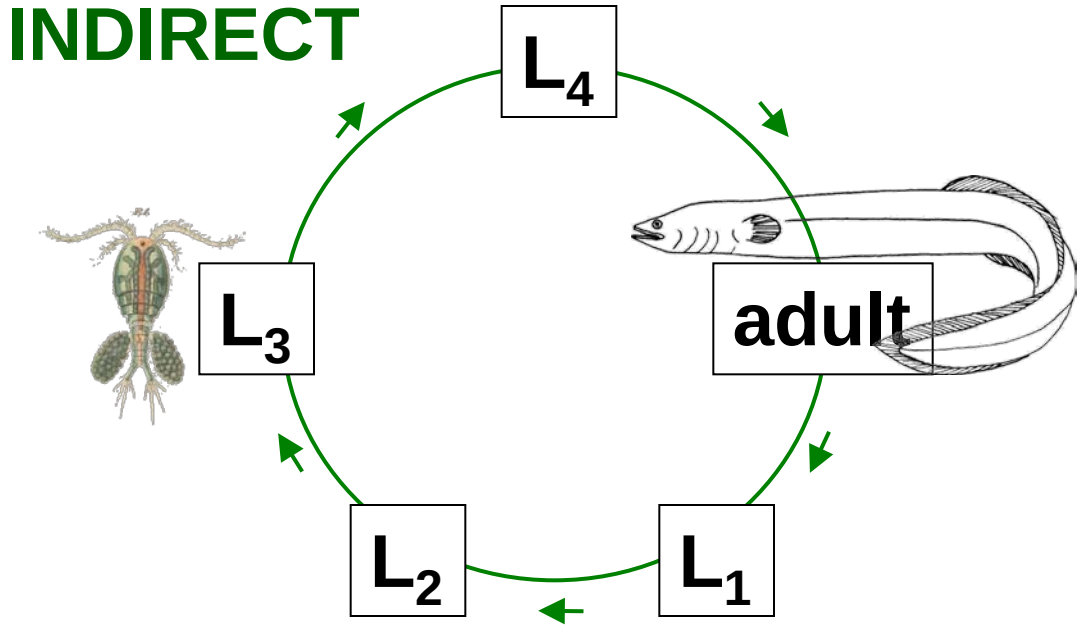


PARATENIC HOST

e.g. eel worm

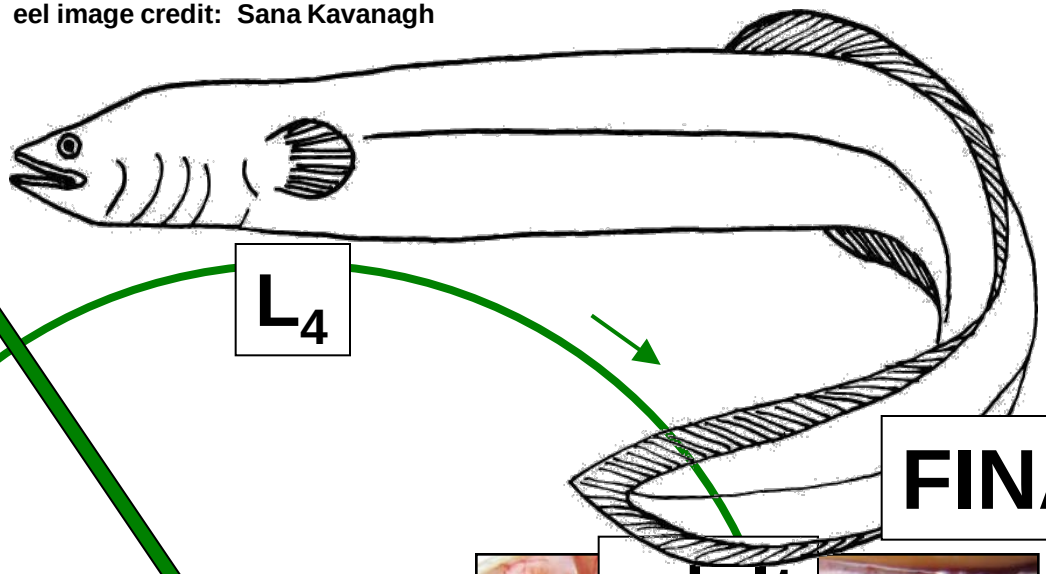
eel image credit: Sana Kavanagh

INDIRECT



(copepod image credit: Wisconsin A. Vernalis; ostracod image credit: C. Miller

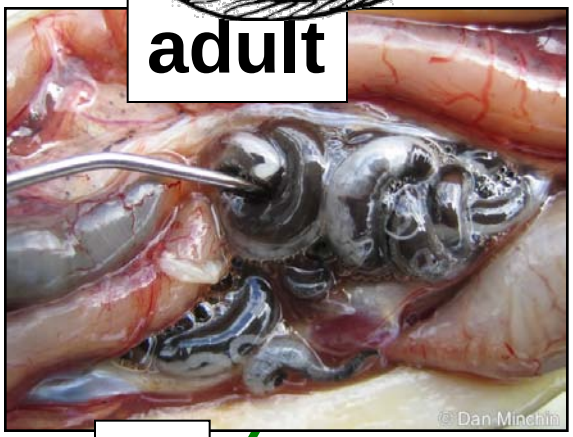
eel image credit: Sana Kavanagh



L_4

FINAL

adult



L_3

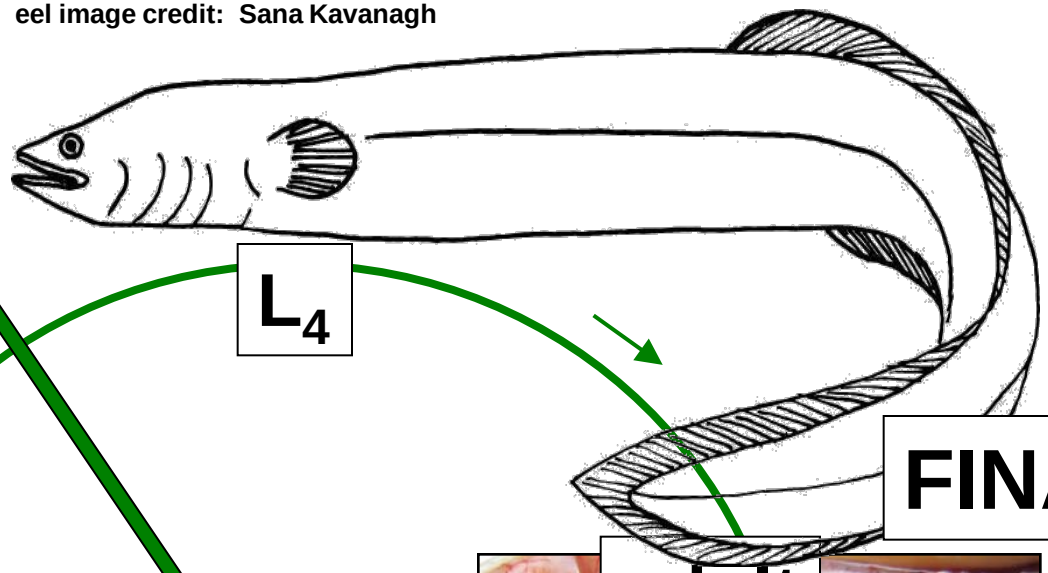
L_1

L_2

DAISIE European Invasive Alien Species Gateway, 2008. *Anguillicoloides crassus*; from: http://www.europe-aliens.org/images/LimitedSize/56_56_1_Hab_Anguillicola%20crassus.jpg [Accessed 16 February 2009].

(copepod image credit: Wisconsin A. Vernalis)

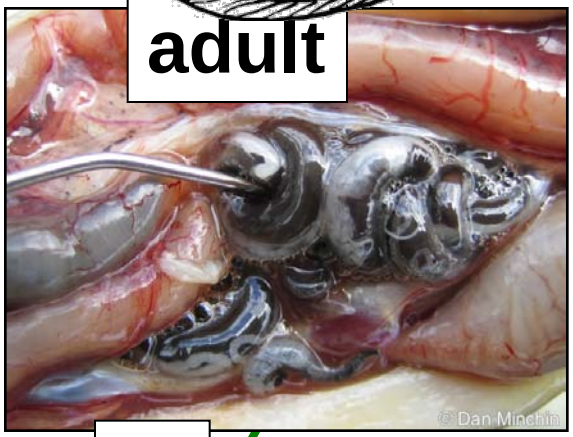
eel image credit: Sana Kavanagh



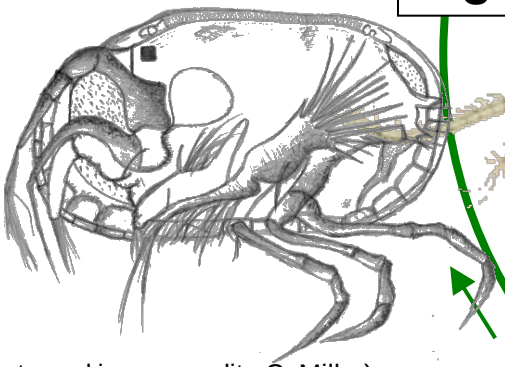
L_4

FINAL

adult



L_3

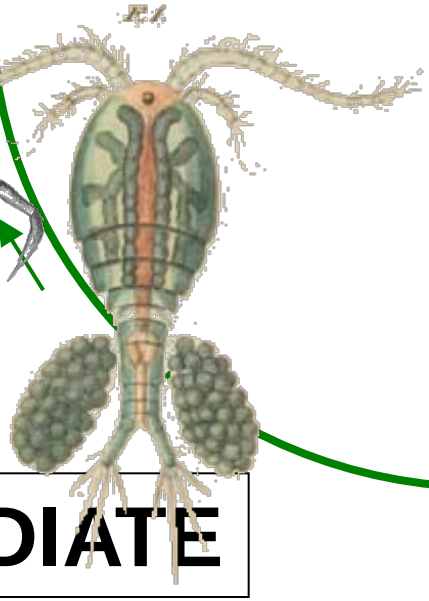


(ostracod image credit:: C. Miller)

L_1

DAISIE European Invasive Alien Species Gateway, 2008. *Anguillicoloides crassus*; from: http://www.europe-aliens.org/images/LimitedSize/56_56_1_Hab_Anguillicola%20crassus.jpg [Accessed 16 February 2009].

L_2

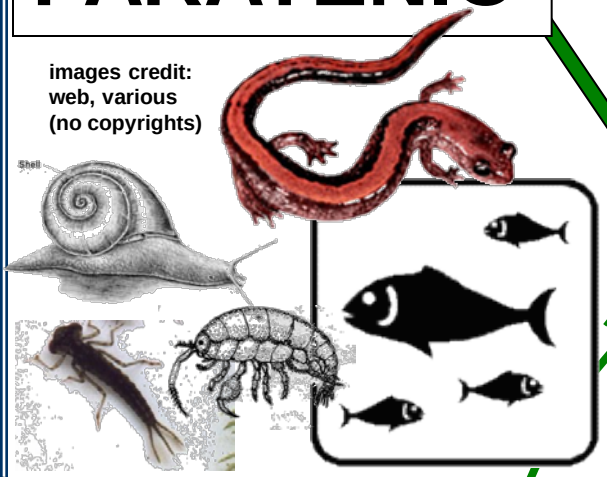


INTERMEDIATE

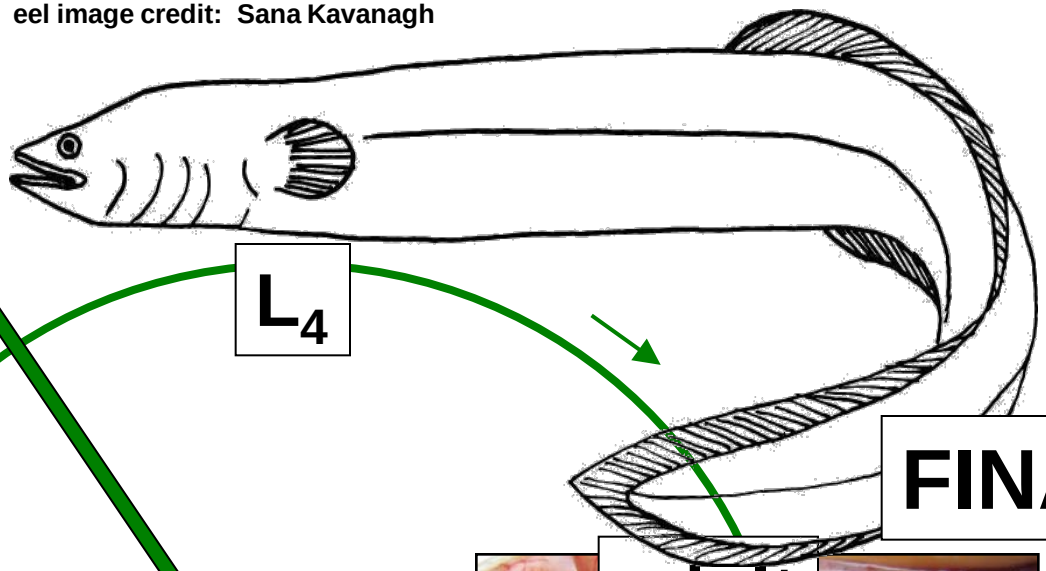
(copepod image credit: Wisconsin A. Vernalis)

PARATENIC

images credit:
web, various
(no copyrights)



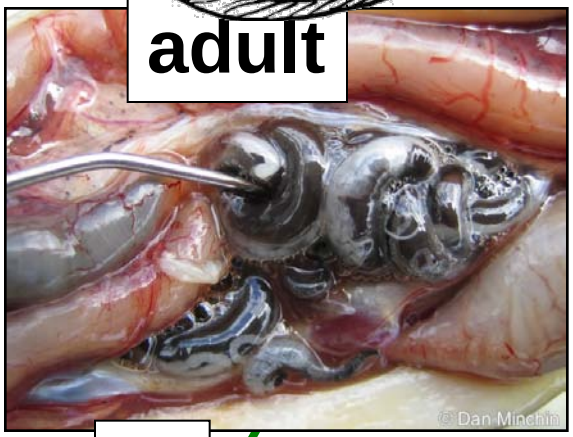
eel image credit: Sana Kavanagh



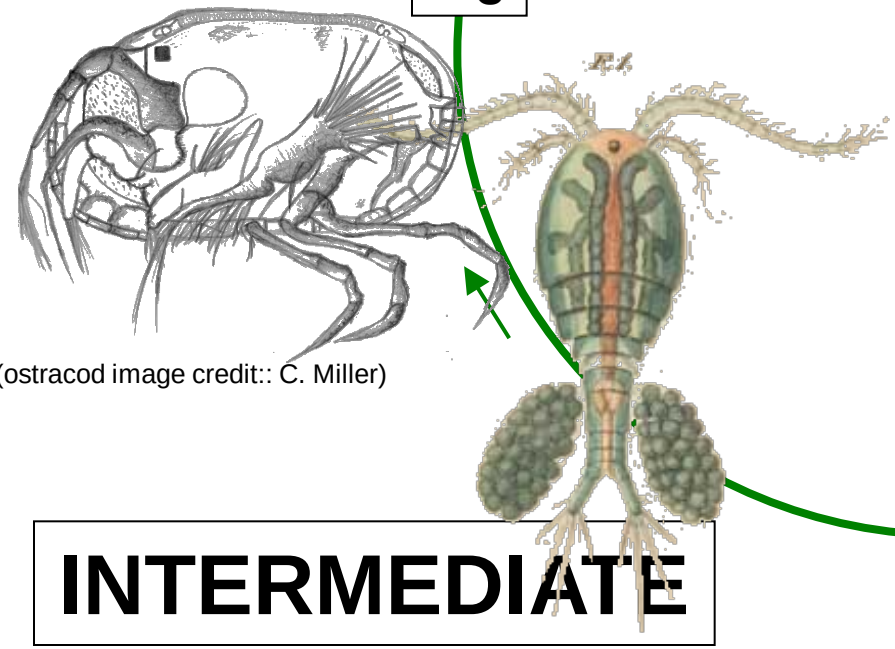
L_4

FINAL

adult



L_3



(ostracod image credit:: C. Miller)

L_1

DAISIE European Invasive Alien Species Gateway, 2008. *Anguillicoloides crassus*; from: http://www.europe-aliens.org/images/LimitedSize/56_56_1_Hab_Anguillicola%20crassus.jpg [Accessed 16 February 2009].

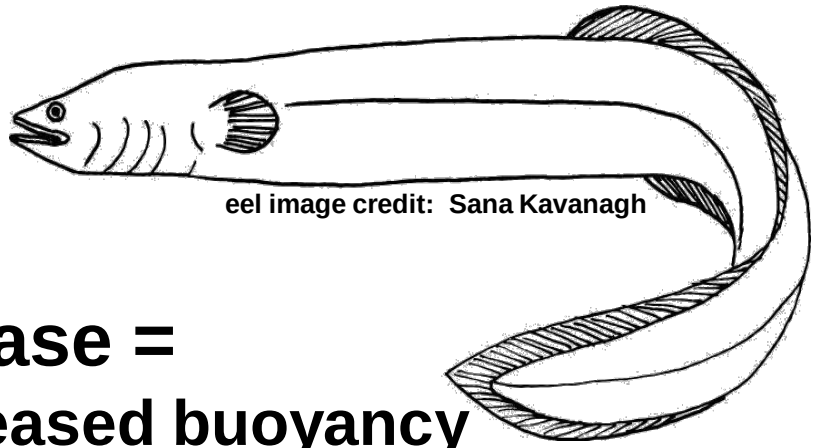
L_2

INTERMEDIATE

(copepod image credit: Wisconsin A. Vernalis)

inflammation =
increased redness and thickening of wall of swim bladder

adult worms →
dark red to black



eel image credit: Sana Kavanagh

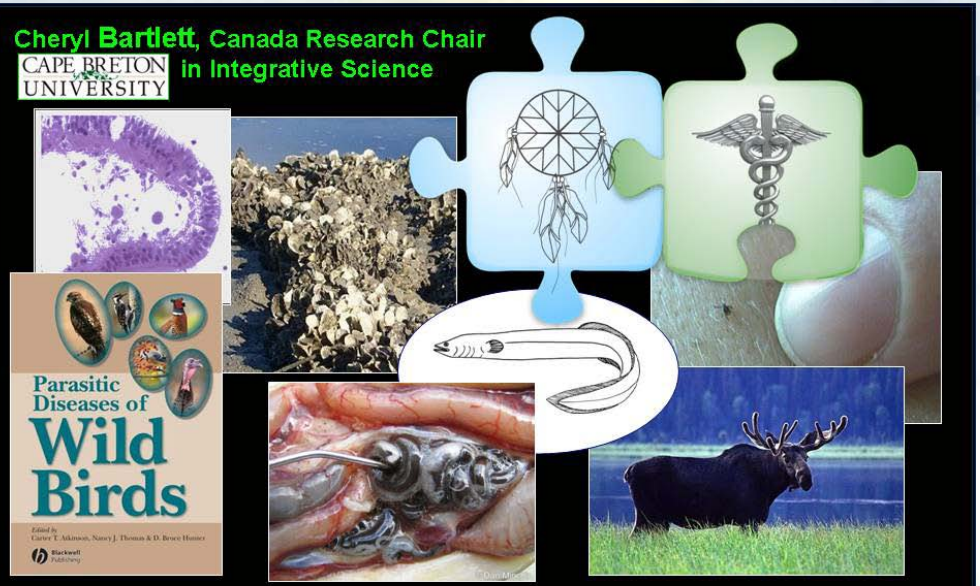
parasite photo credits:
DAISIE European Invasive Alien Species Gateway, 2008.
Anguillicoloides crassus; from:
http://www.europe-aliens.org/images/LimitedSize/56_56_1_Hab_Anguillicola%20crassus.jpg
[Accessed 16 February 2009].

disease =
decreased buoyancy and swimming ability

Wela'lioq & Thank You

NSERC
CRSNG

Cheryl **Bartlett**, Canada Research Chair
CAPE BRETON UNIVERSITY in Integrative Science



PARASITES AS AGENTS OF DISEASE
IN ANIMALS (INCLUDING HUMANS)