



Veltsos Worm eVolution

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Research interests

I am interested in the interplay between sexual selection, environmental adaptation and sex chromosome evolution.

Possible projects **in yellow**.

I am also happy to discuss other ideas.

Worms are great

Easy lab and genetic studies

- Grow fast
- Easy to cross
- Easy to keep

Extensive resources

- wormbase.org
- wormbook.org
- Worldwide collections
- Available genomes and transcriptomes

Training offered

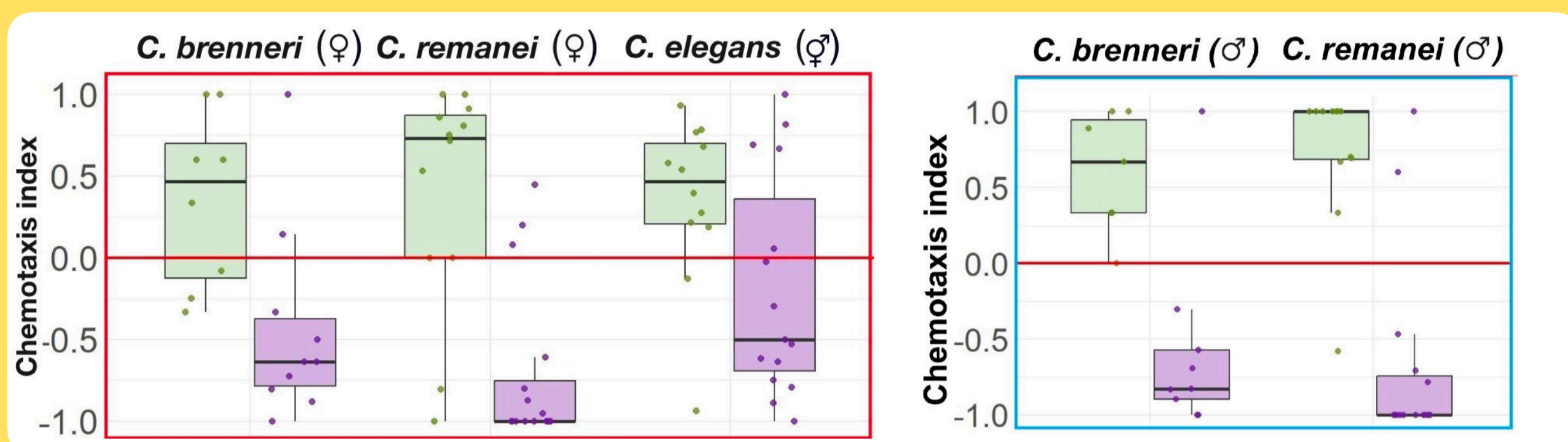
Depending on the project

- Experimental design
- Worm maintenance
- Aseptic technique
- PCR
- Statistical analysis (R)
- Maintaining a lab book
- Writing skills
- Presentation skills

Are there differences between the sexes?

Worms have a plastic response to salt which depends on their developmental environment. However sex differences are understudied.

We have replicated this literature result for *C. elegans*, and extended the study to males and 2 other species.



Worms grown on **high salt** will seek high salt as adults (+ve y axis values), while worms grown on **low salt** will seek low salt as adults (-ve y axis values).

Contrasting **females** and **males** reveals a subtle (but statistically significant) difference. Males show a more extreme chemotaxis response during the same observation time.

Possible future directions:

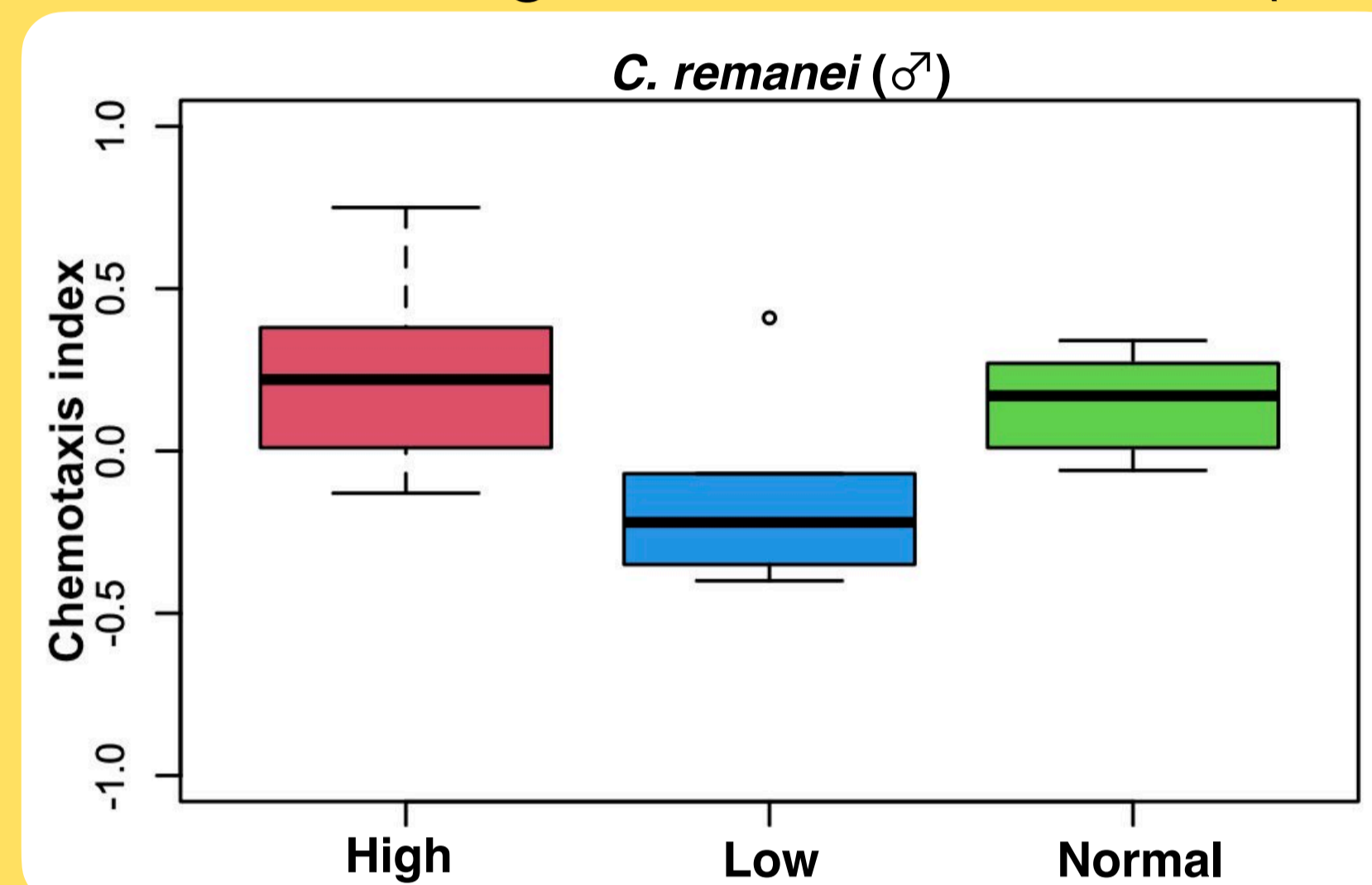
- Further explore (within-species) strain and sex differences.
- Test for similar responses to other stimuli (other salts, alcohol, glycerol, temperature).
- Investigate the effect of additional prior stress (such as temperature) to the worm response speed and intensity.
- Investigate the variability of the response.
- Investigate the timing of the response.

Experimental evolution for salt preference

Do worms have a genetic predisposition for salt preference in addition to their plastic response?

We maintained populations of high genetic diversity over the long-term on different salt concentrations (salt adaptation).

Worms preferred their experimentally evolved salt concentration, even after being raised on standard (non-evolved) salt concentration.



The offspring of worms evolving in **high salt** will seek it as adults (+ve y axis values) **even if themselves grew at normal salt**.

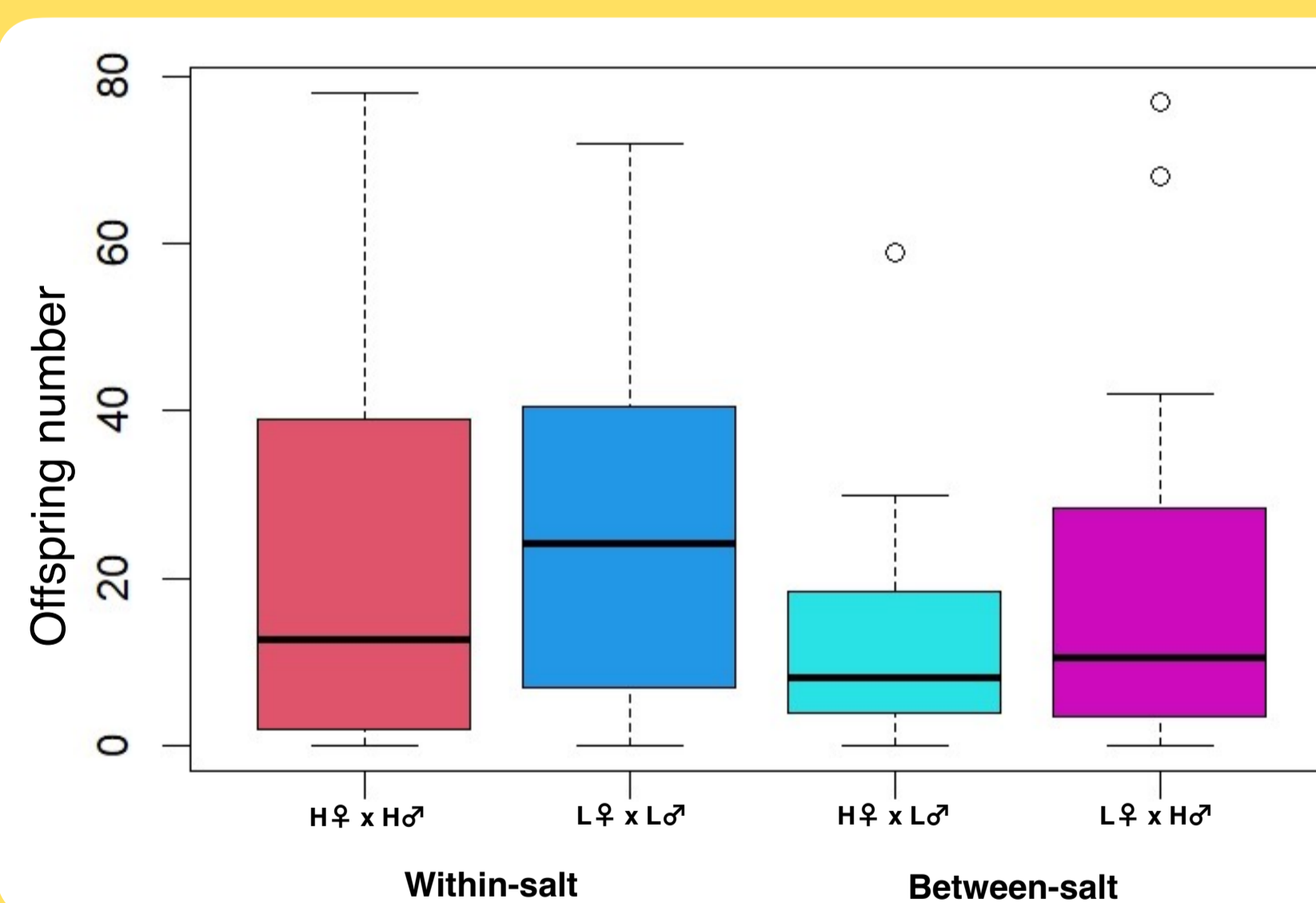
The result is also as expected for worms that grew in **low salt** and **normal salt** (control).

Possible future directions:

- Investigate whether the result is due to cross-generation (epigenetic) inheritance, or genetic adaptation.
- Attempt to break covariation for preference in males and females, by selecting a different environment for each sex.
- Directly select for salt preference instead of salt adaptation, and contrast result with salt adaptation.

Does salt adaptation cause reproductive isolation?

Possibly (preliminary evidence)



Fewer offspring ($p < 0.1$) were produced in between-salt conditions crosses compared to within-salt conditions crosses.

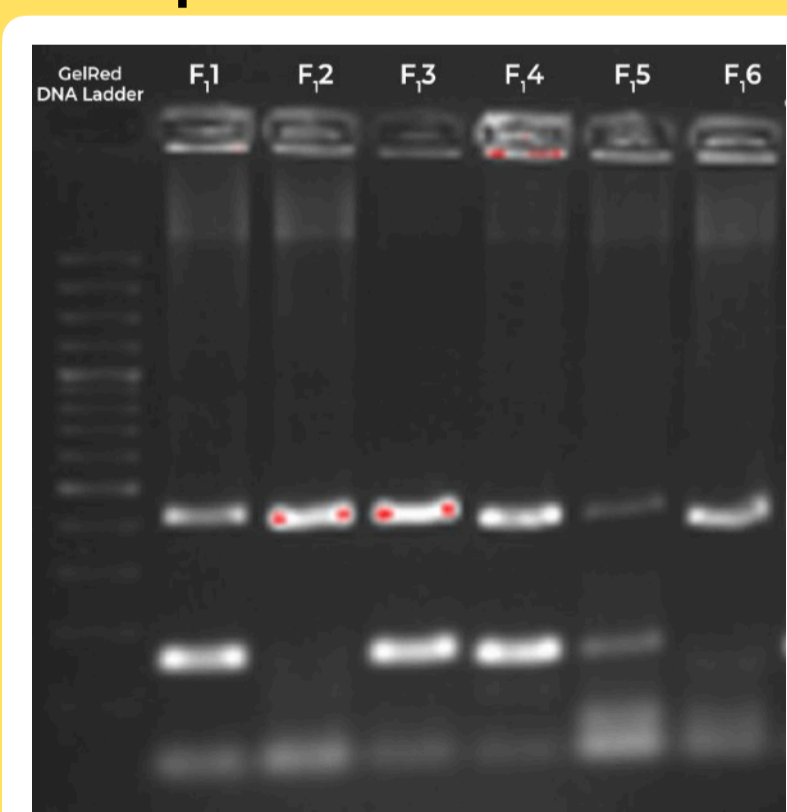
Adaptation to different salt conditions was over 4 generations only.

This result can be followed up:

- More generations of selection.
- Comparison with selection for preference instead of for salt adaptation.
- Other assays of reproductive isolation
 - Female choice.
 - Male attraction to females.
 - Offspring longevity.
 - Parent longevity in novel environment.

Genetics of reproductive isolation

A simple PCR test can detect cross-species hybridisation.



In this gel F₁ offspring of a cross between species (*C. remanei* x *C. brenneri*) show 2 PCR bands (lanes 1,3,4,5). The parental species have one band each.

Chromosome-specific PCR products (to be developed) will allow to test chromosome-specific introgression in backcrosses.

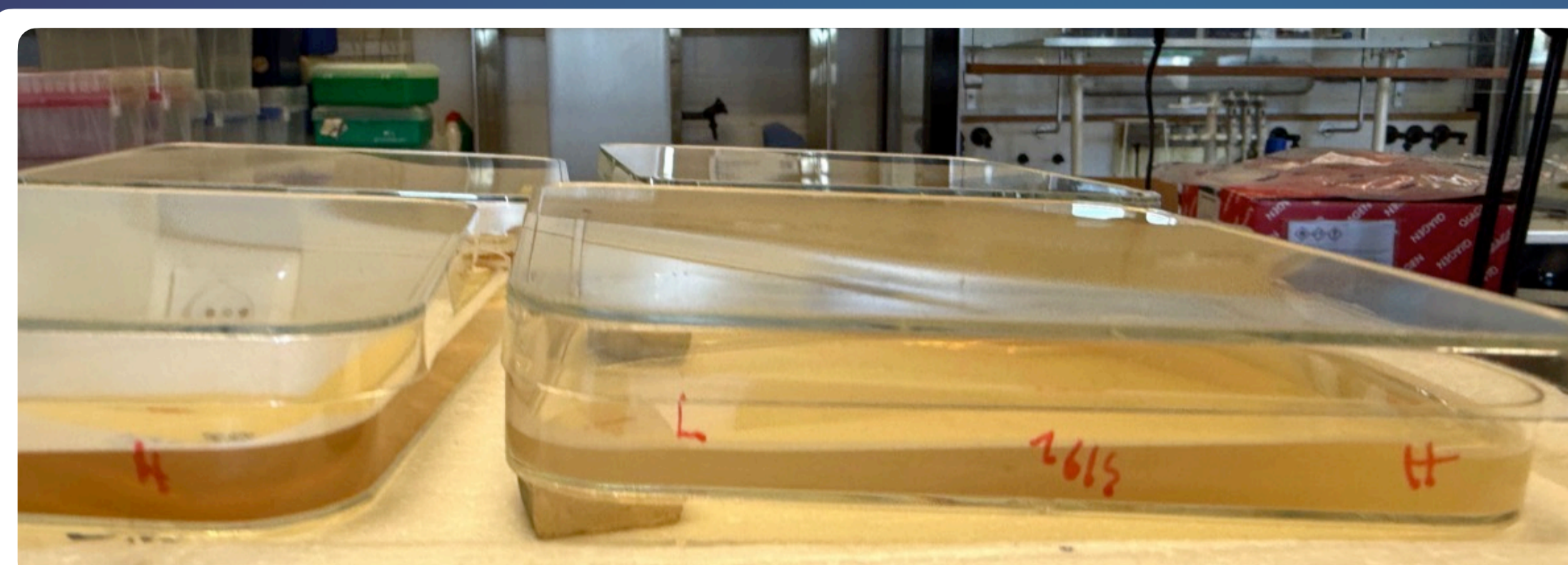
C. nigoni (dioecious) and *C. briggsae* (androdioecious) readily produce inter-specific hybrids.

They can be used to study the genetics of reproductive isolation (speciation), but also the transition between sexual systems (from hermaphrodites to separate sexes).

Both Haldane's rule and the large X effect are observed.

The male hybrids suffer more than the female hybrids and the X chromosome has a disproportionate effect on reproductive isolation.

- Is there within-species variation in reproductive isolation?
 - Compare outcome of crosses of different strains.
- Is the X chromosome more resistant to introgression than autosomes in all crosses (large X effect)?
 - Develop PCR markers to follow introgression of different chromosomes from the two species into backcrossed offspring.



Salt gradient plates: 2 layers of agar of different salt concentration establish a gradient. The movement of worms after they are placed in the middle allows to evaluate their preference (chemotaxis index).

