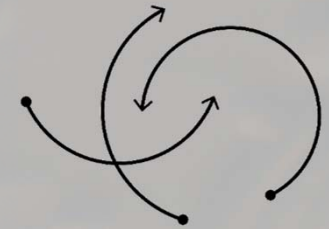


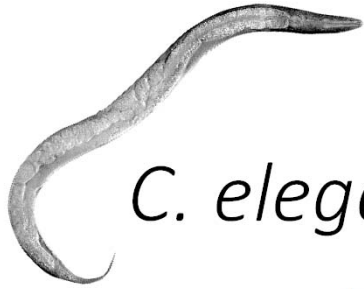
High-throughput behavioral experiments in *Caenorhabditis elegans*

Alfonso Pérez-Escudero

February 15, 2023



What is *C. elegans*,
and why should I care?



C. elegans foraging behavior is an ideal model

Well studied

- Model for
 - Neuroscience
 - Human diseases
 - Parasites

Simple...

- 1000 cells
- 300 neurons

...yet complex

- Chemotaxis
- Associative learning
- Elements for optimal foraging

Powerful for Neuroscience

- Pan-neuronal calcium imaging
- Genetic tools
- Laser ablation

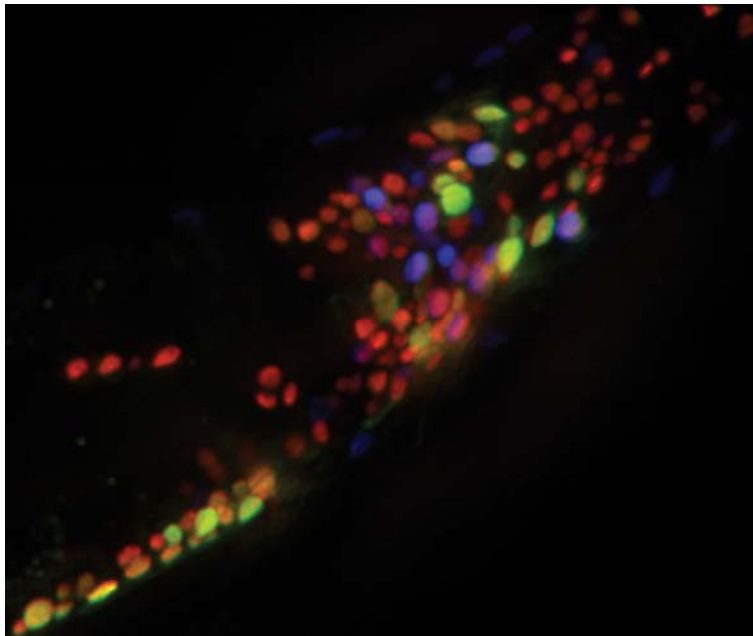
Tractable

- Short generation
- High offspring
- Handling techniques

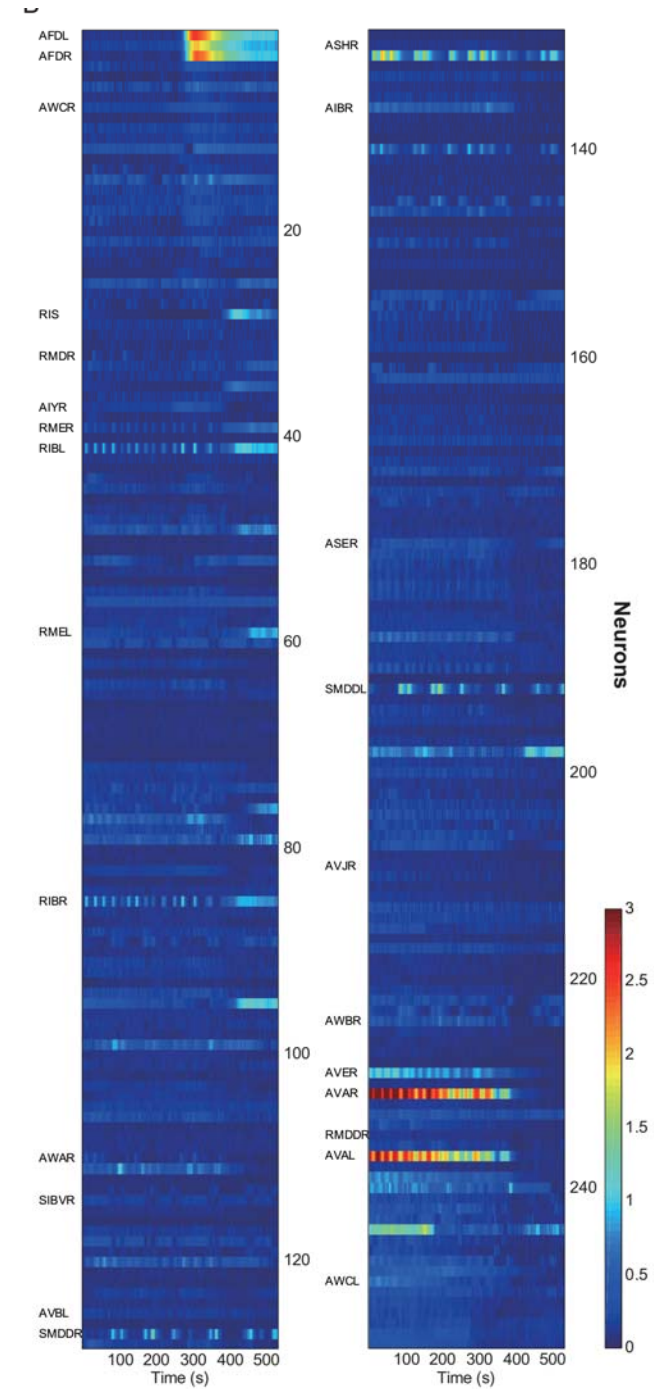
Foraging

- Complex
- Clear evolutionary significance
- Easy to study

Pan-neuronal imaging



Kotera *et al.* 2016



Mutants for 7€!



UNIVERSITY OF MINNESOTA
Driven to Discover™

CAENORHABDITIS GENETICS CENTER (CGC)

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(existing labs)

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(new labs)

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[Endogenously-tagged Loci](#)

[Wild Isolates](#)
(*Caenorhabditis* sp.)

[Wild Isolates](#)
(non-*Caenorhabditis* sp.)

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Field

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N2

All

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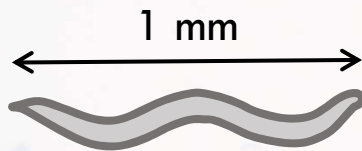
CSV

More Fields Restrict search to strains with endogenously-tagged loci

Strain	Species	Genotype	
AC365	<i>C. elegans</i>	sao-1(ok3335) V. Show Description	
AD294	<i>C. elegans</i>	cylc-2(mon2[cylc-2::mNG::3xFLAG) I; him-5(e1490) V. Show Description	
AE501	<i>C. elegans</i>	nhr-8(ok186) IV. Show Description	
AGK233	<i>C. elegans</i>	unc-119(ed3) III; niDf199 IV; armEx58. Show Description	
AGK234	<i>C. elegans</i>	unc-119(ed3) III; niDf199 IV; armEx53. Show Description	
AGK532	<i>C. elegans</i>	unc-119(ed3) III; niDf199 IV; armEx196. Show Description	

A high-throughput behavioral pipeline

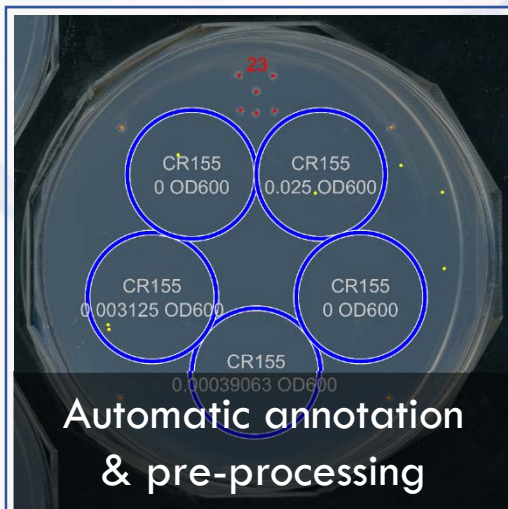
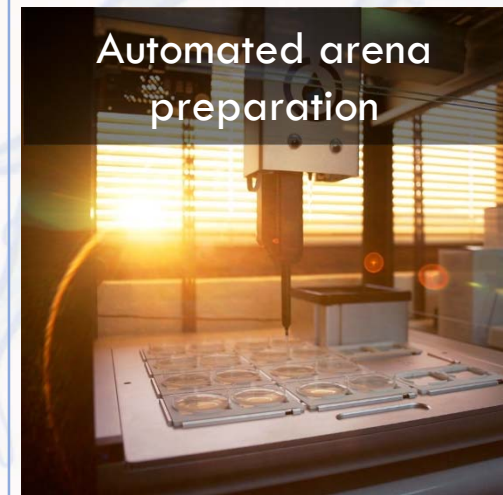
The universe
in a Petri dish



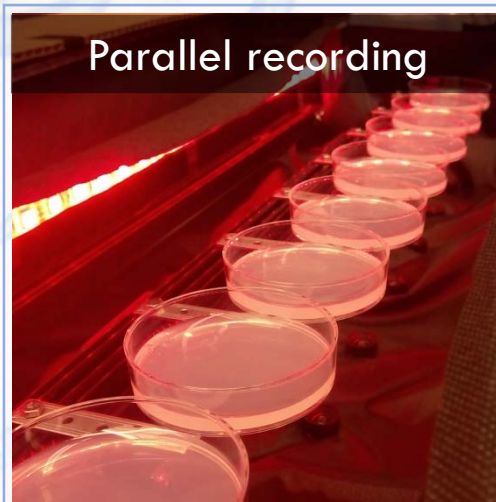
Handling techniques



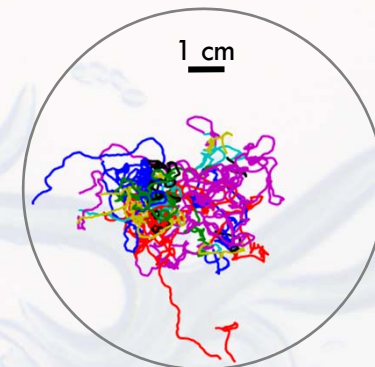
Automated arena
preparation



Parallel recording

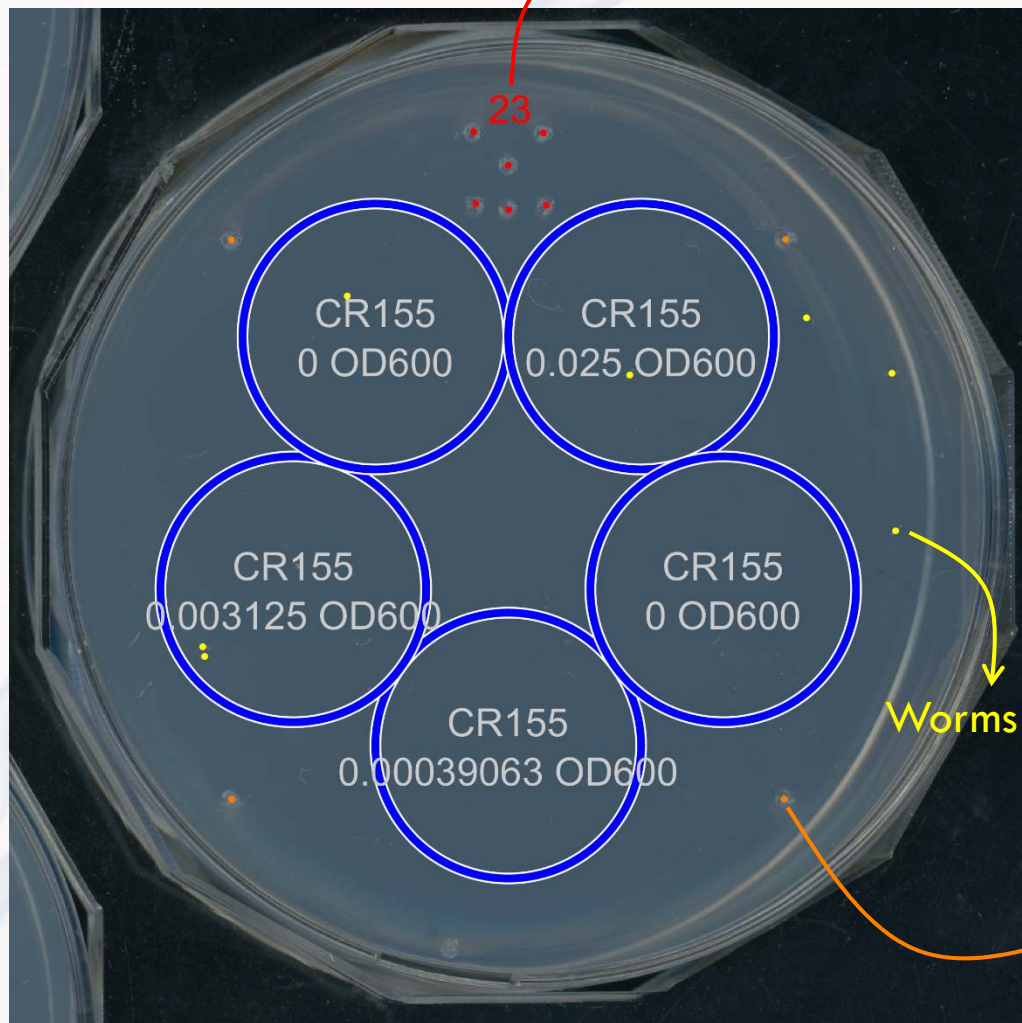


Automatic tracking



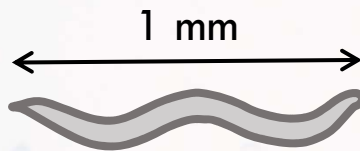
Automated annotation is key to high throughput

Condition: Bacterial densities and spp present, positions, etc.



A high-throughput behavioral pipeline

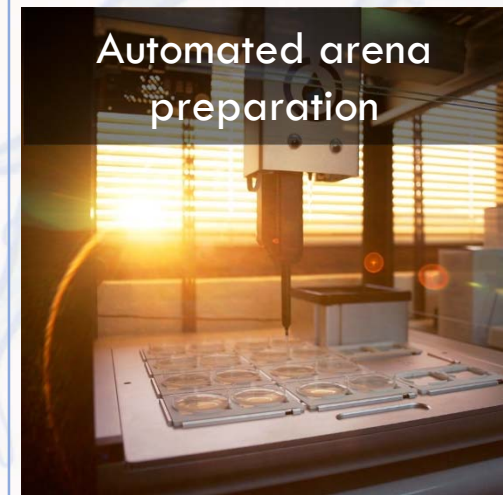
The universe
in a Petri dish



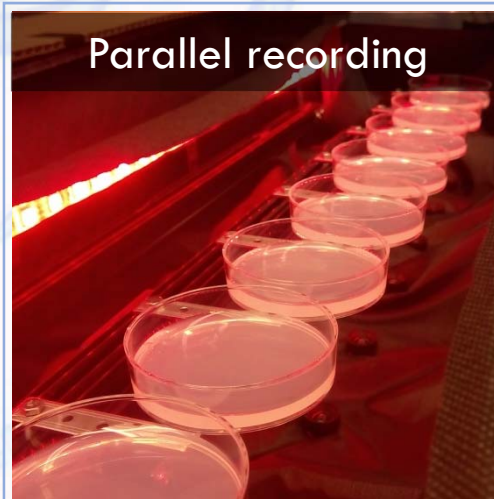
Handling techniques



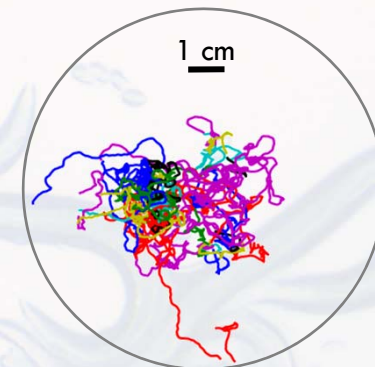
Automated arena
preparation



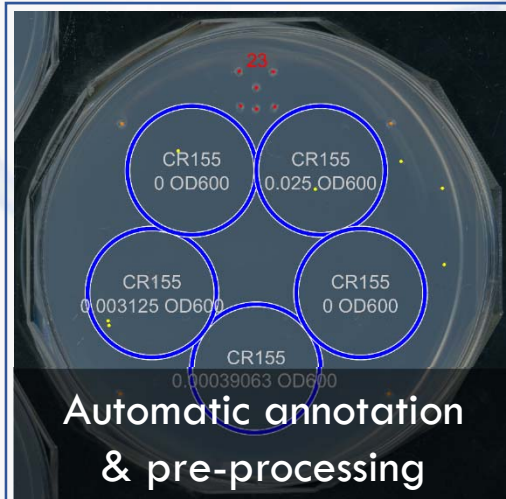
Parallel recording

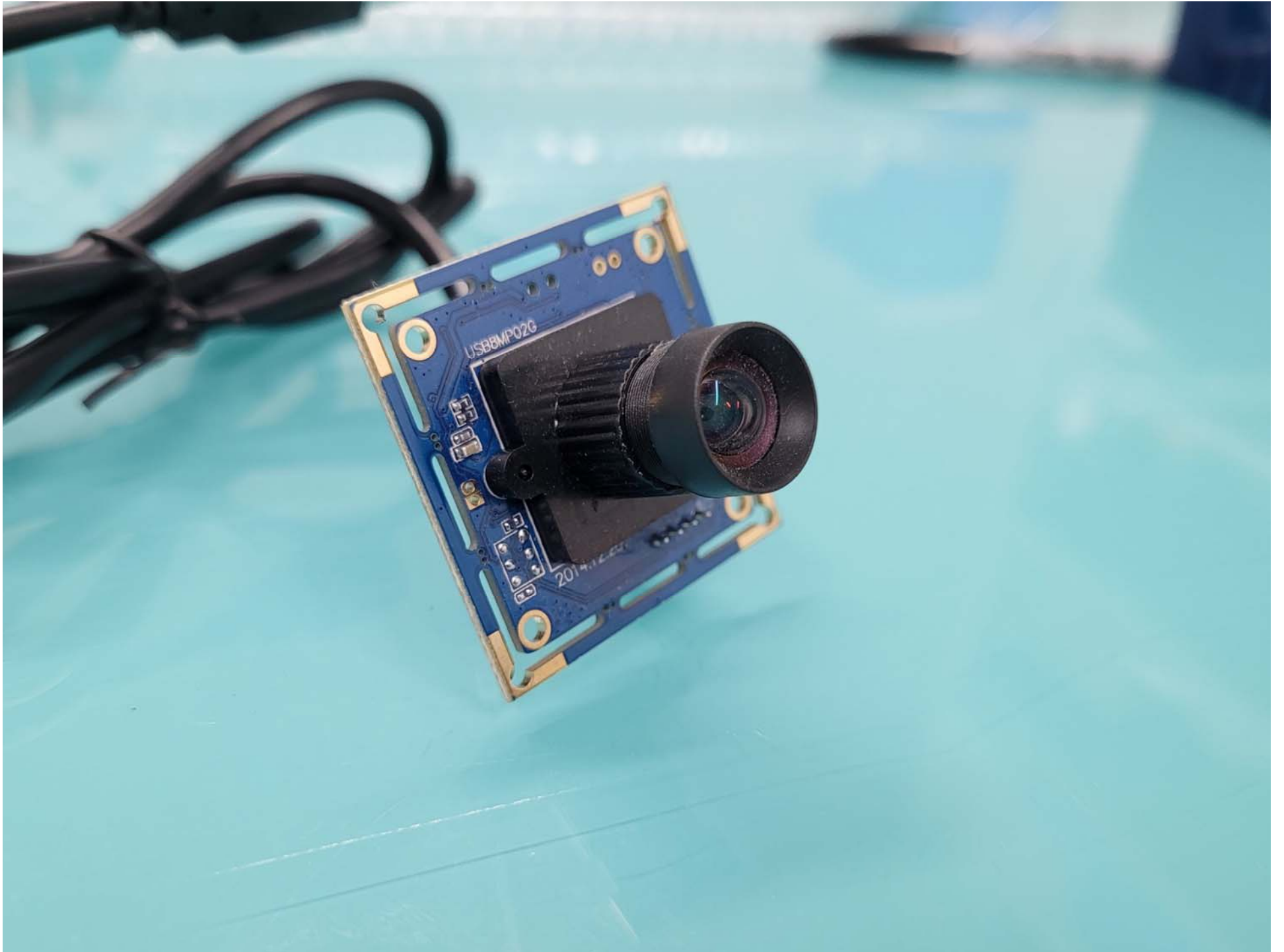


Automatic tracking



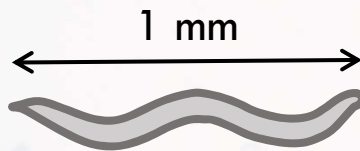
Automatic annotation
& pre-processing





A high-throughput behavioral pipeline

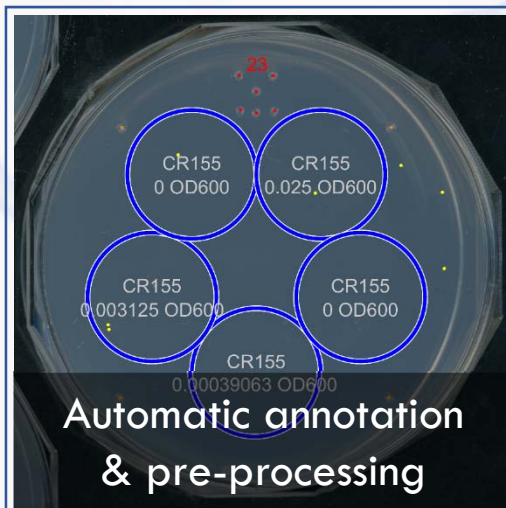
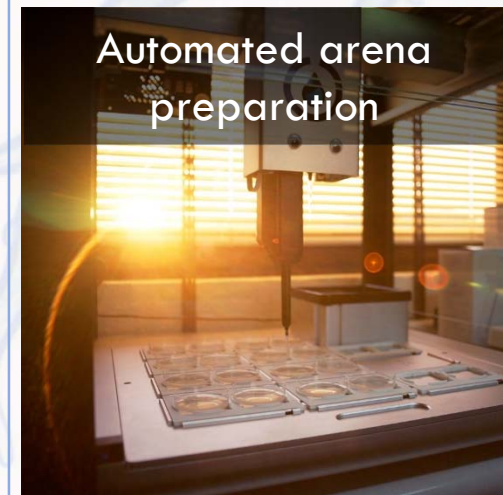
The universe
in a Petri dish



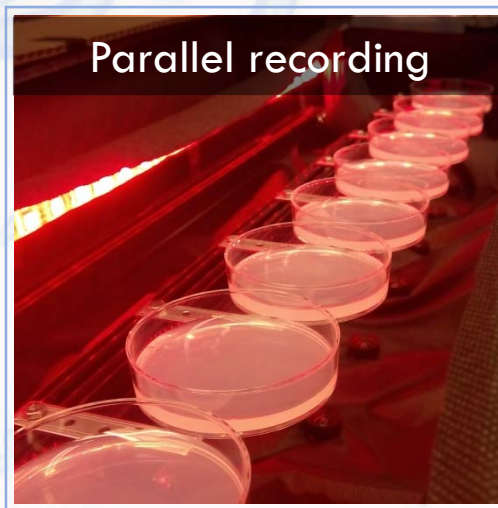
Handling techniques



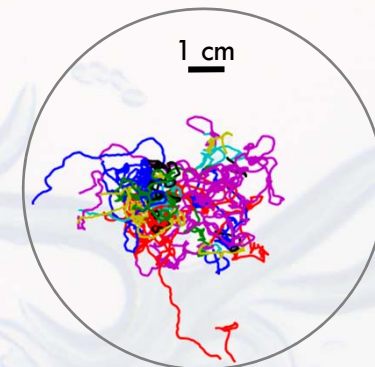
Automated arena
preparation



Parallel recording

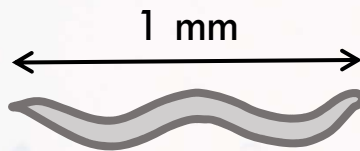


Automatic tracking



A high-throughput behavioral pipeline

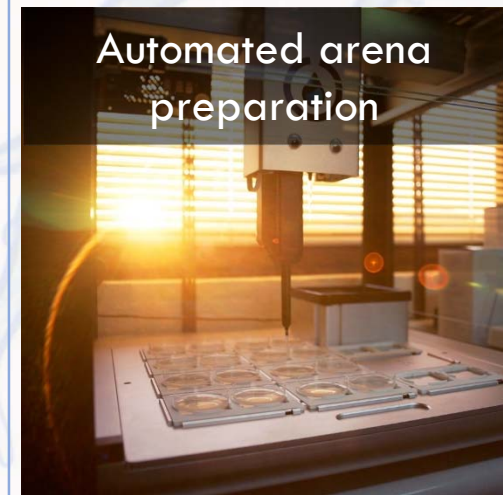
The universe
in a Petri dish



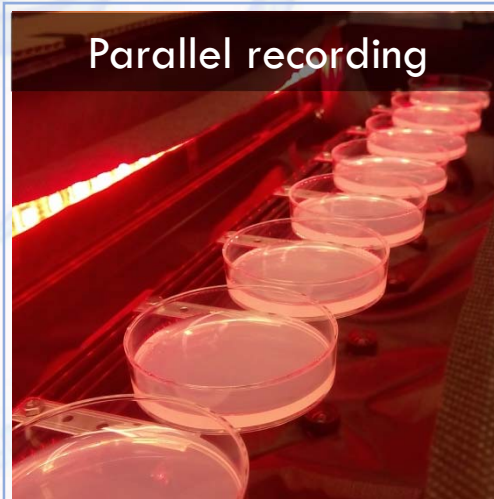
Handling techniques



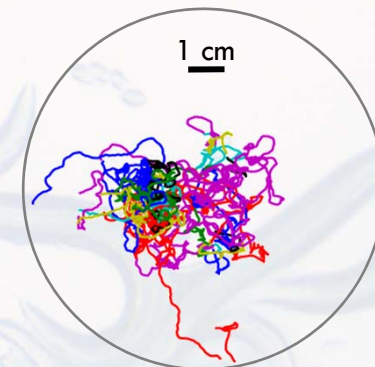
Automated arena
preparation



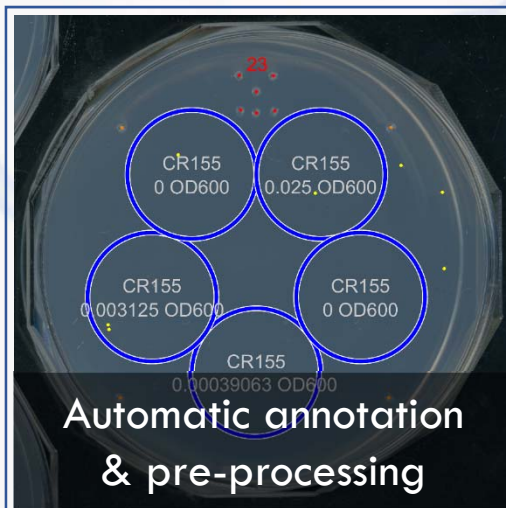
Parallel recording



Automatic tracking

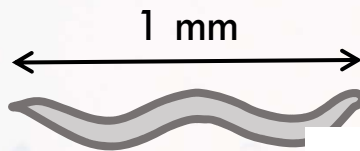


Automatic annotation
& pre-processing



A high-throughput behavioral pipeline

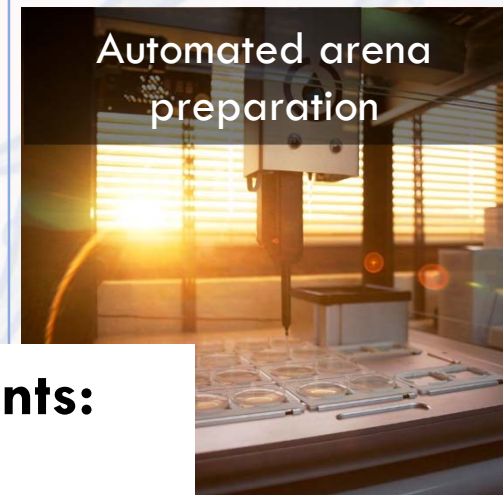
The universe
in a Petri dish



Handling techniques

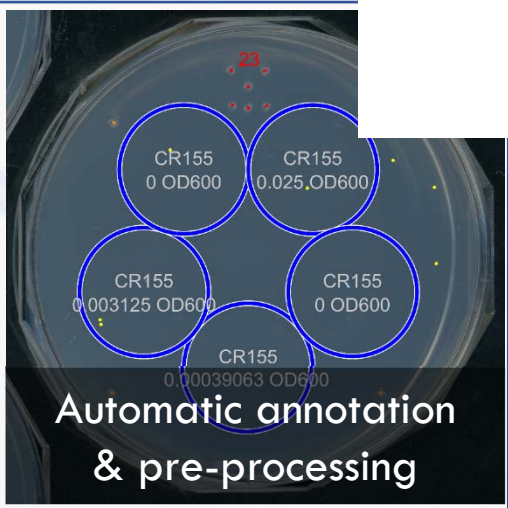


Automated arena
preparation



One week of experiments:

Up to 600 plates
Up to 10 000 worms



CR155
0 OD600

CR155
0.025 OD600

CR155
0.003125 OD600

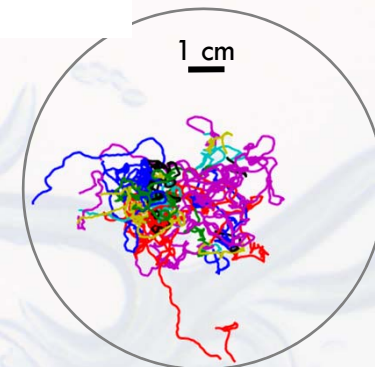
CR155
0 OD600

CR155
0.00039063 OD600

Automatic annotation
& pre-processing

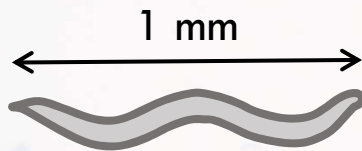
A top-down view of a petri dish containing several circular arenas. Each arena is annotated with a blue circle and text indicating the worm strain (CR155) and its optical density (OD600). A red number '23' is visible in the top right arena.

Automatic tracking



Merci !

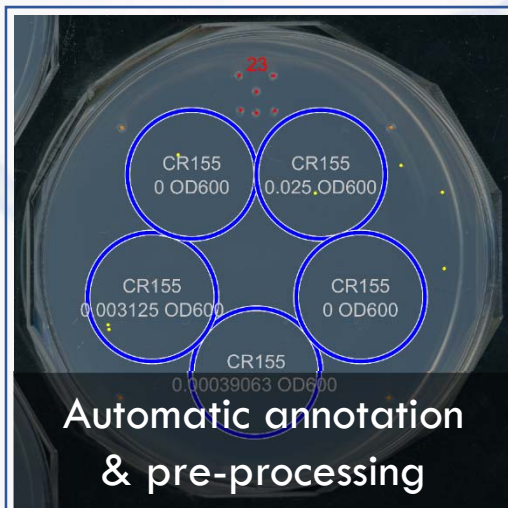
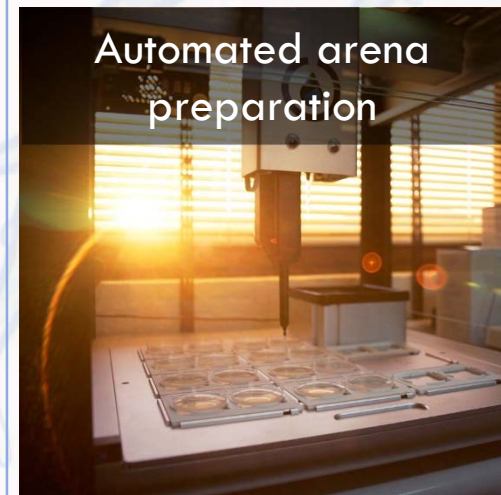
The universe
in a Petri dish



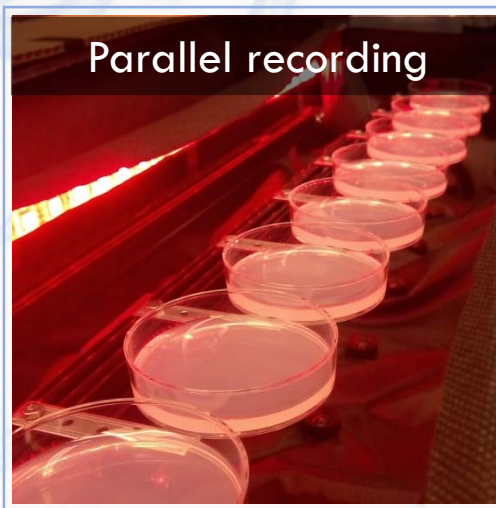
Handling techniques



Automated arena
preparation



Parallel recording



Automatic tracking

