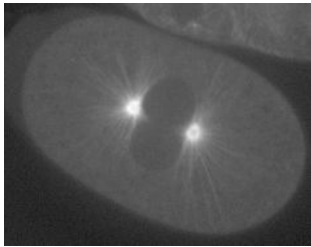
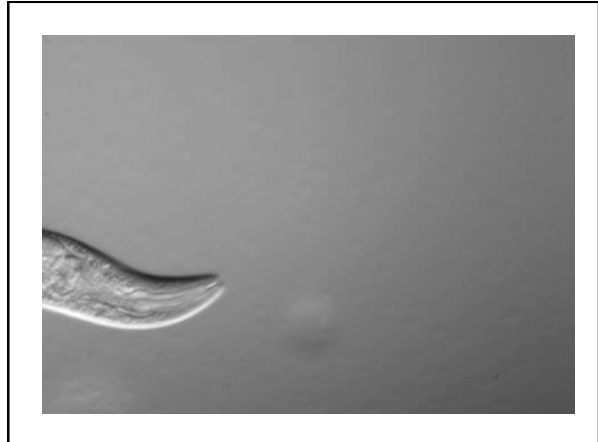


Using *C. elegans* to Interrogate Biological Questions

SDB Bootcamp  
 July 18<sup>th</sup>, 2012  
 McGill University, Montreal



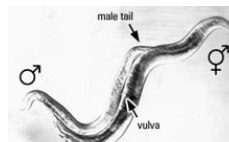
Desai Lab-UCSD



*C. elegans*-some advantages

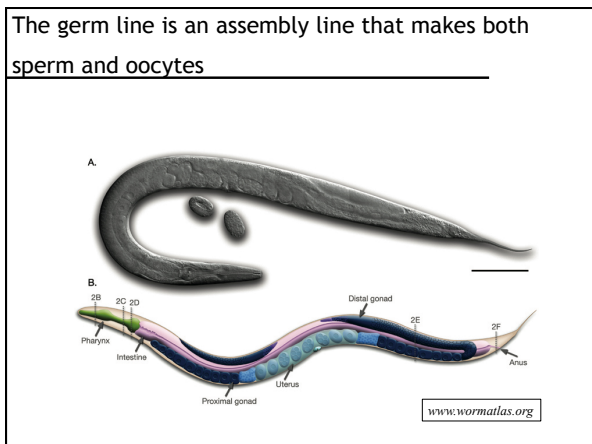
- Fully sequenced genome
- Excellent genetic model
- Hermaphroditic (males 1/500)
- Can freeze strains
- Invariant lineage (lineage map)
- Transgenesis
- GFP reporters (transparent/real time)
- Reverse genetics

*C. elegans* is a hermaphrodite...

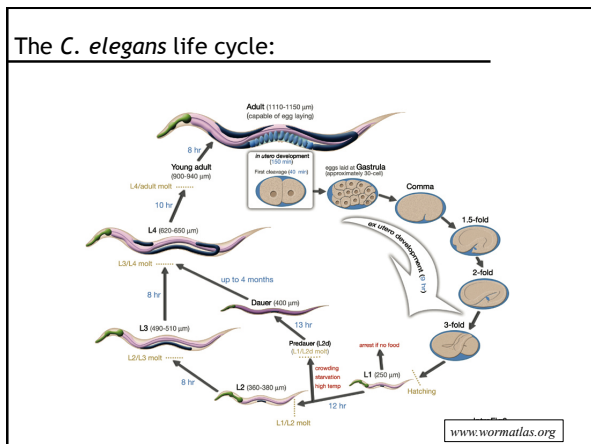


NO THANKS...  
 I CAN HANDLE IT...

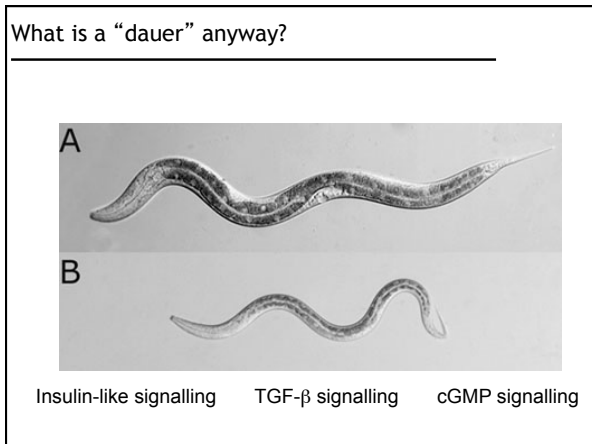
The germ line is an assembly line that makes both sperm and oocytes



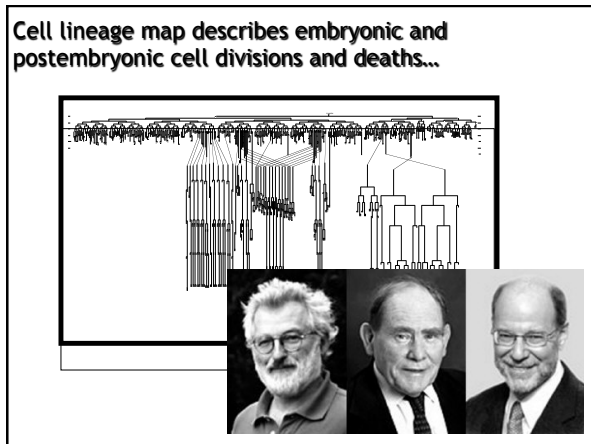
The *C. elegans* life cycle:



What is a “dauer” anyway?



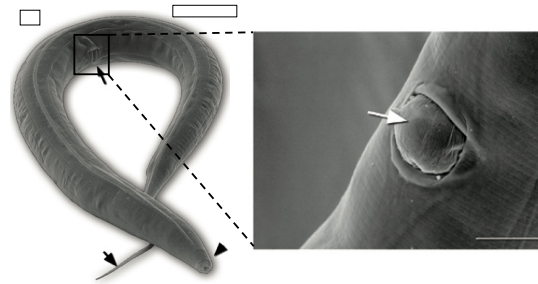
Cell lineage map describes embryonic and postembryonic cell divisions and deaths...



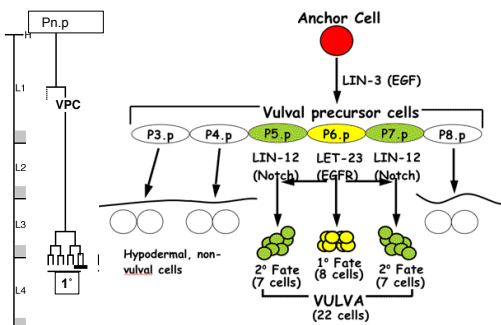
Early development unfolds before your eyes...



Vulval development yields secrets of signalling pathways and gene expression



Vulval development yields secrets of signalling pathways and gene expression



Genetic analysis: forward and reverse genetic screens

- Designing forward genetic screens to isolate alleles of genes that play novel roles in specific cellular processes
- Using reverse genetic resources (RNAi) to understand the specific roles of genes of interest (redundancy, targeting efficiency)

### Genetic analysis: forward and reverse genetic screens

- Mutagenesis will introduce mutations at random in the germline.
- These animals are allowed to self-fertilized (hermaphrodites) resulting a heterozygous F<sub>1</sub> population.
- Following further selfing 25% of the population F<sub>2</sub> will be homozygous for the mutant chromosome.
- Selection!

P <sub>0</sub>	+/+	(N2 Bristol)	
	$\searrow$		
	<i>m</i>	+	
F <sub>1</sub>	+/ <i>m</i>	x	+/ <i>m</i>
F <sub>2</sub>	1/4	1/2	1/4
	+/+	+/ <i>m</i>	<i>m/m</i>

### Scaling up RNAi to do full genome surveys of gene function

*from Fraser et al. Genome Biology 2005*

### Scaling up RNAi to do full genome surveys of gene function...

*from Fraser et al. Nature 2000*

### Screen automation

Courtesy of Jean-Claude LABBE, IRIIC, Université de Montréal.

At current efficiencies, all 16,757 clones present in the library can be screened in duplicate in approximately 2 weeks (400 x 96-well plates).

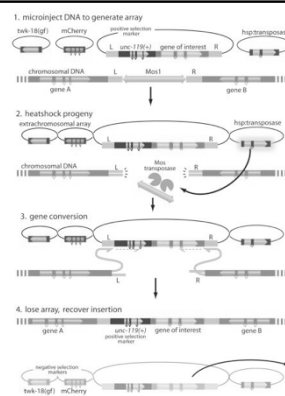
### Transgenesis



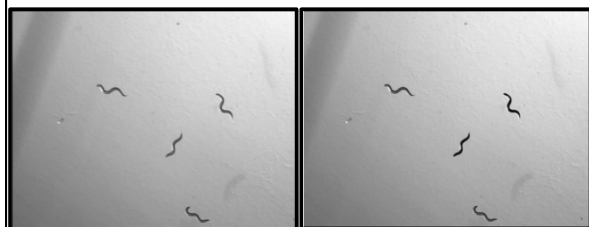
Courtesy of Ian Chin-Sang Queen's University

Transgenes can be introduced by injecting DNA in plasmid, PCR product or more recently in MosCI vectors for single copy transmission.

### Transgenesis



### Behavioural Analysis



From Moloud Ahmadi and Mohammed

Genetic analysis can also be used to dissect behavioural differences in *C. elegans* using video based image capture and analysis algorithms

### Behavioural Analysis



From Moloud Ahmadi and Mohammed Raessi

$$\text{Length Ratio} = \frac{\text{Worm Length}}{\text{Best Fit Line Length}}$$

Genetic analysis can also be used to dissect behavioural differences in *C. elegans* using video based image capture and analysis algorithms

