



# Space Worms!

## Proyecto Uniandino Aeroespacial PUA

**Universidad de los Andes Departamento de Biología**  
**FACULTAD DE CIENCIAS UNIVERSIDAD DE LOS ANDES**

Bogotá D.C. Agosto 2014

# Séneca IX - EVODEVO

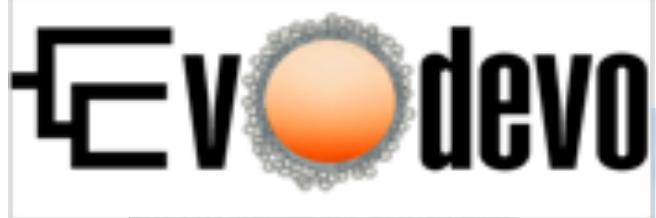


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BOGOTÁ

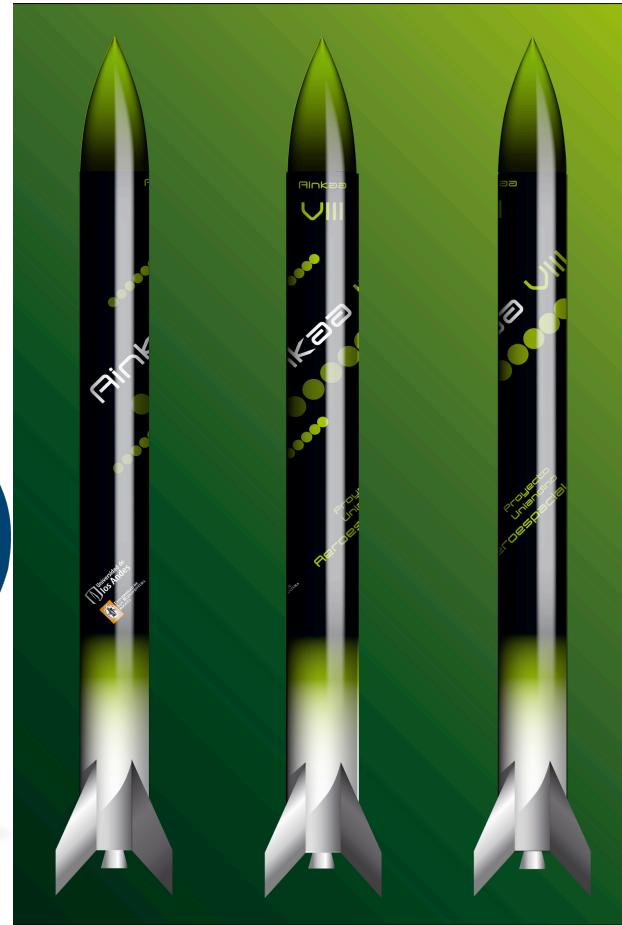


Universidad de  
los Andes  
Facultad de Ciencias









Organismo Biológico que nos presente algo interesante!



Resistente!

Modelo Biológico

Usado por la nasa ...  
en Experimentos

<http://www.youtube.com/watch?v=GgZHziFWR7M>

## **Worms survived Columbia disaster**

**Hundreds of worms that were part of an experiment aboard the doomed space shuttle Columbia have been found alive in debris recovered from the crash site, US space agency (Nasa) officials say.**

The *Caenorhabditis elegans*

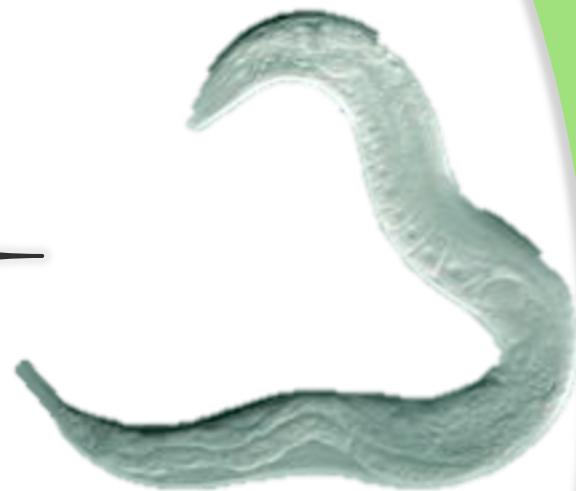


The *C. elegans* worm: The animal to have its genetic code laid bare

## *C. Elegans* como Modelo...



Distintos “Lifespan”

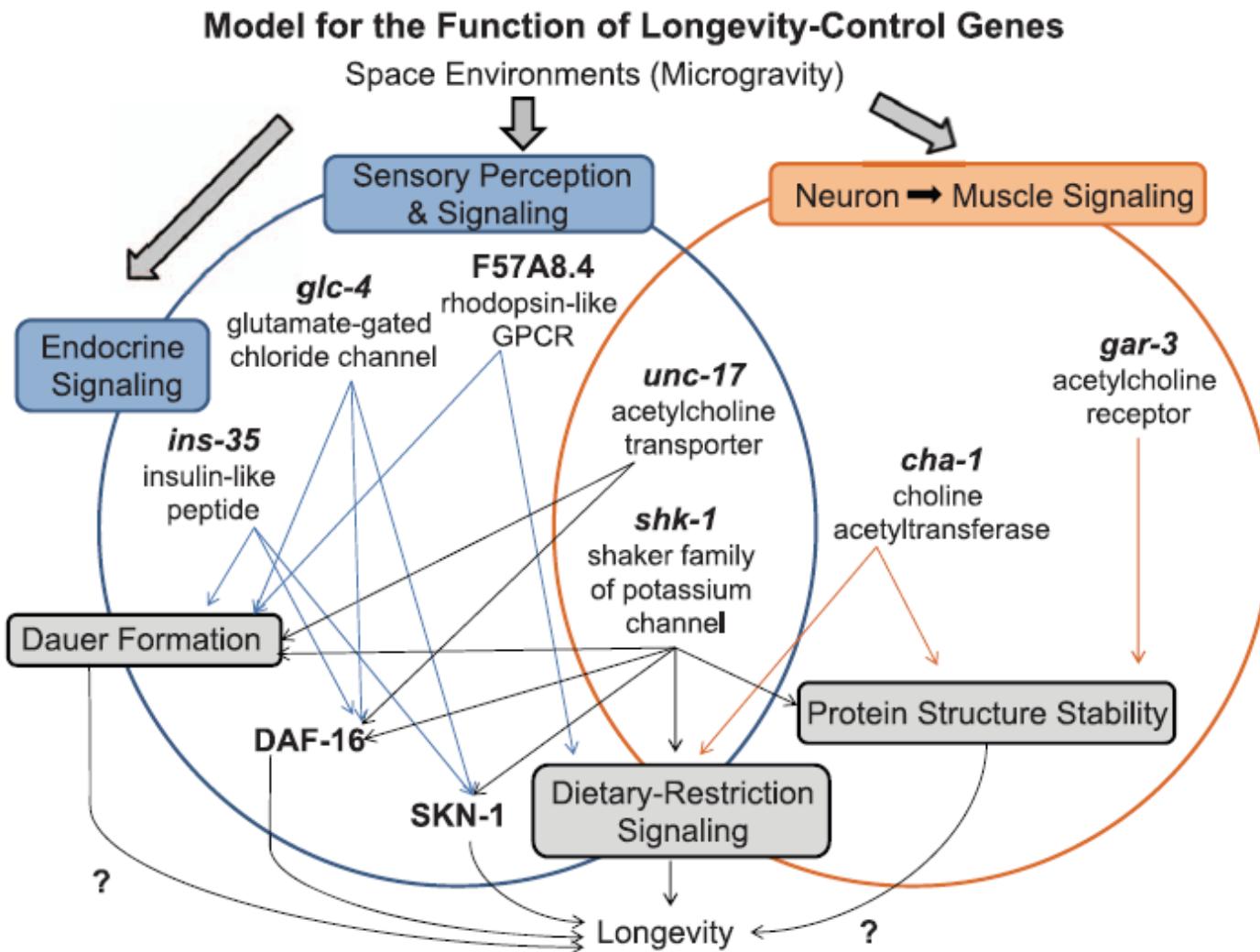


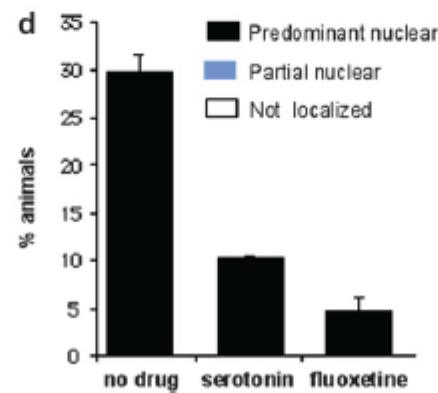
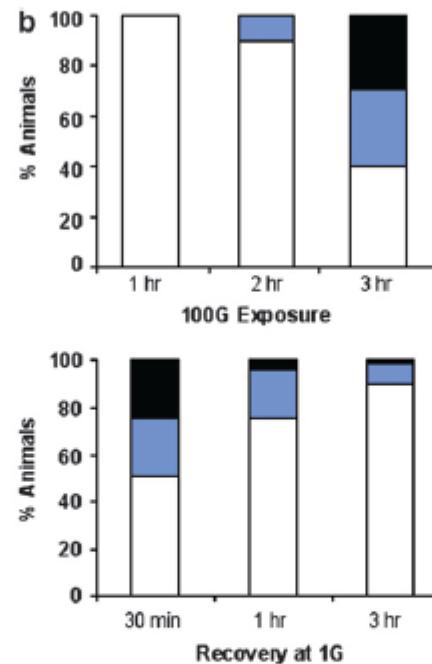
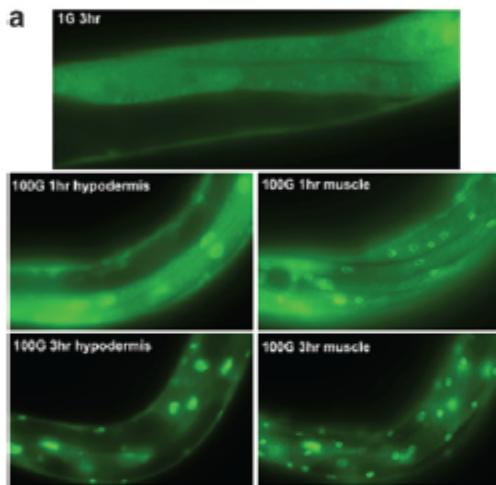
Modelo

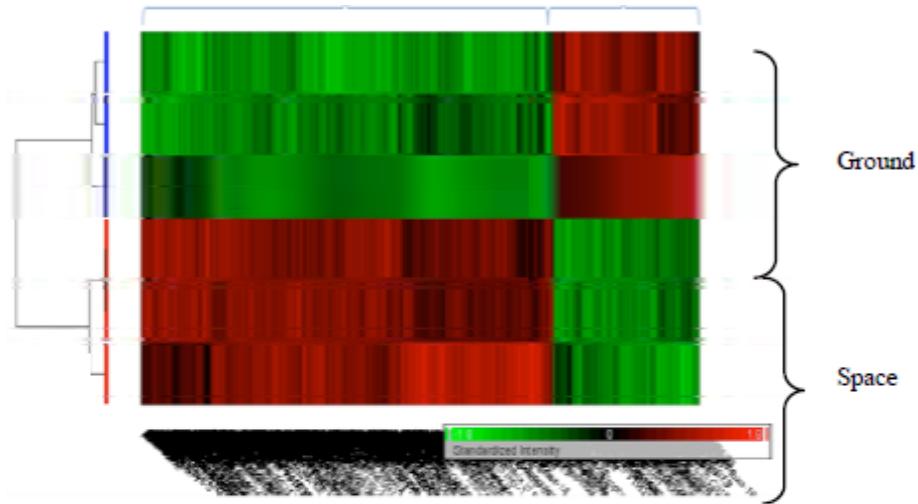
# International Caenorhabditis elegans Experiment First Flight-Aging (ICE-First-Aging) - 07.29.14



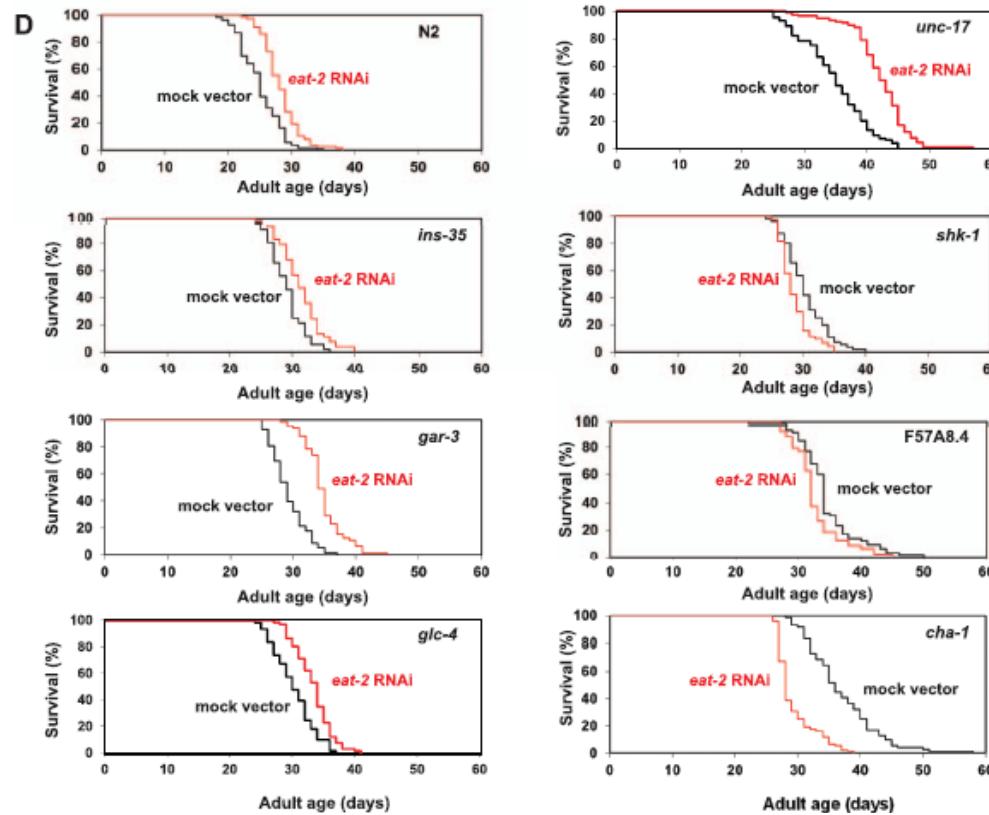
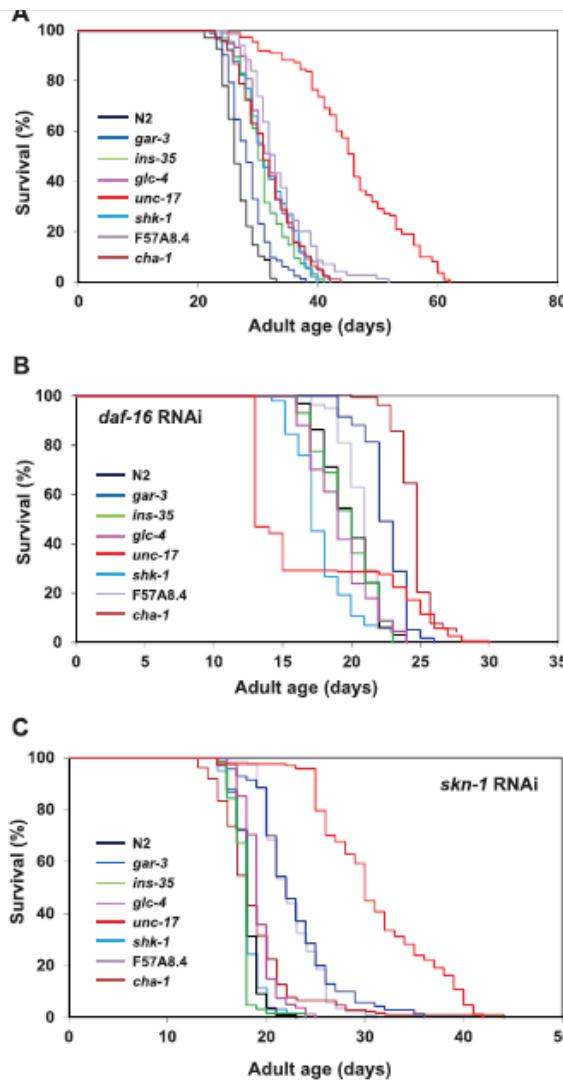
# ICE – Experimento de la NASA



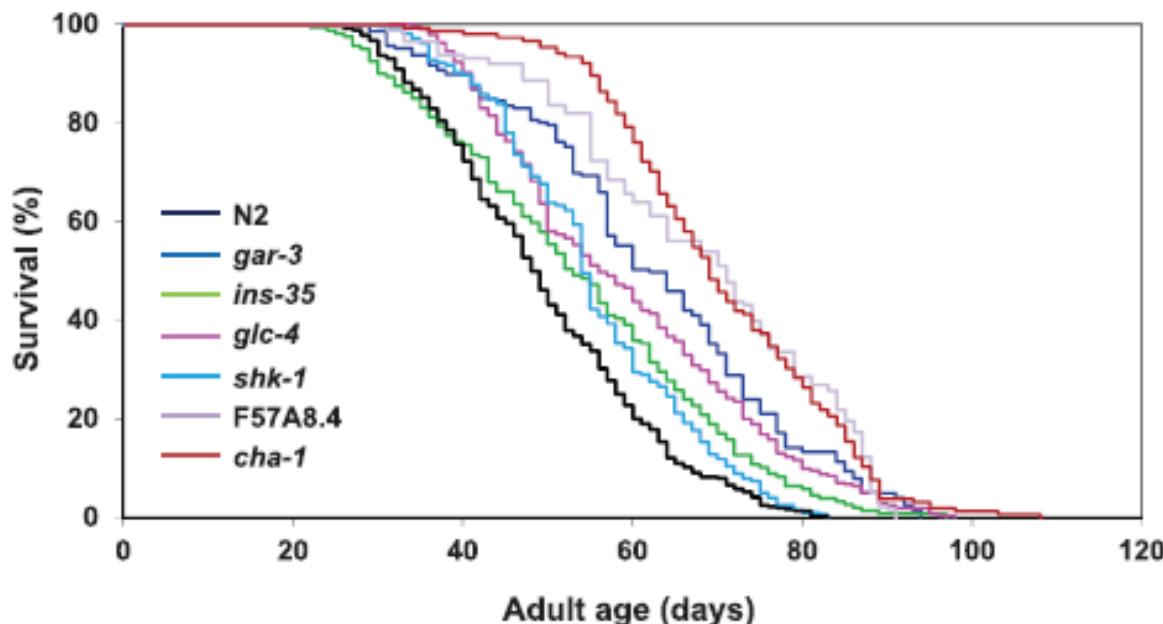




**Figure 1:** Hierarchical Clustering of 1228 genes which were differentially expressed ( $p\text{-value} \leq 0.05$ , fold change  $\geq \pm 2$ ) between space and ground control samples selected among the 22,625 genes interrogated using the *C. elegans* Whole Genome array. Among of these genes, 906 genes were up-regulated, while 322 genes were down-regulated under the same conditions. Red and green colours correspond to up and down regulation, respectively, with a darker colour denoting less differential expression.

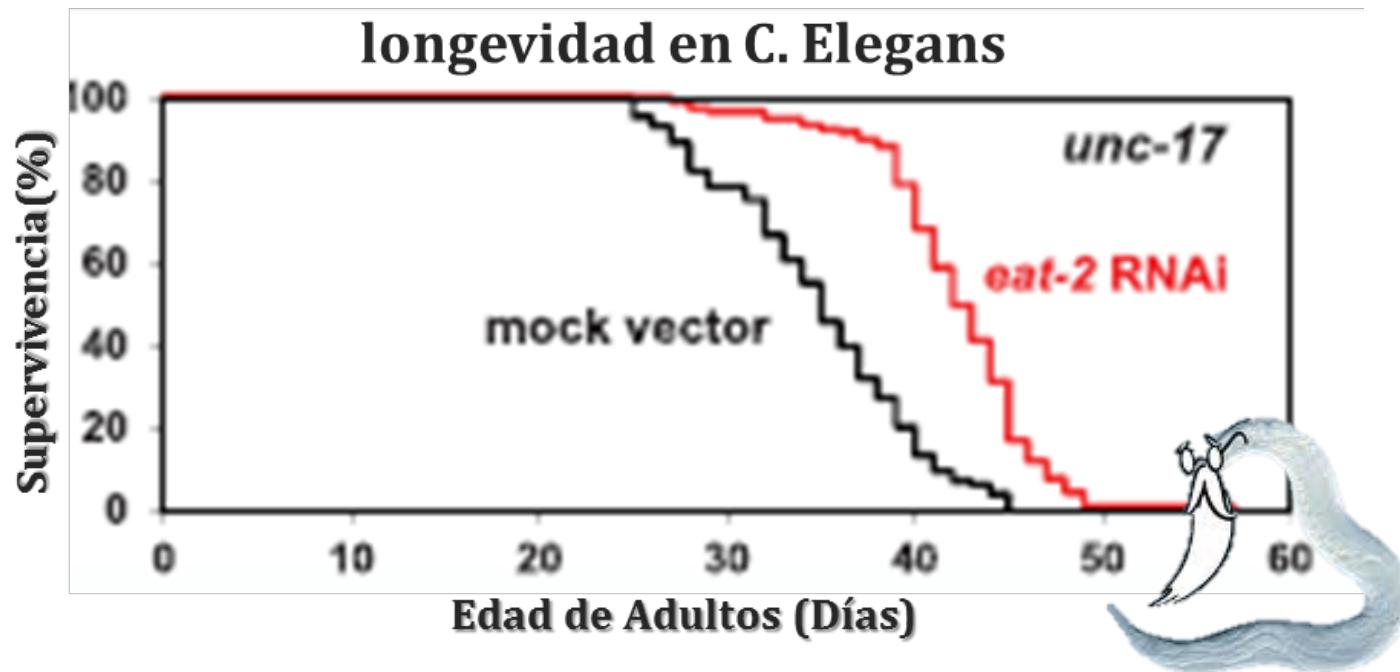


**Figure 4 | Lifespan of the mutants in the genes down-regulated by spaceflight.** (A) The survival curves of N2 and the mutants in the genes that were down-regulated by spaceflight, on NGM with UV-killed OP50 are shown. The percentage of live worms is plotted against adult age. Lifespans of the mutants in the seven genes were longer than those of the wild type. Day 0 corresponds to the L4 molt. Data are one of two experiments, each of which gave similar results, detailed parameters of which are indicated in Supplementary Table S1. The survival curves of N2 and the mutants treated with *daf-16* RNAi (B), *skn-1* RNAi (C) and *eat-2*-RNAi (D) from the L1 stage until death. Data are one of two experiments detailed parameters of which are indicated in Supplementary Table S2 with the data of worms treated with mock-vector RNAi bacteria as control experiments.

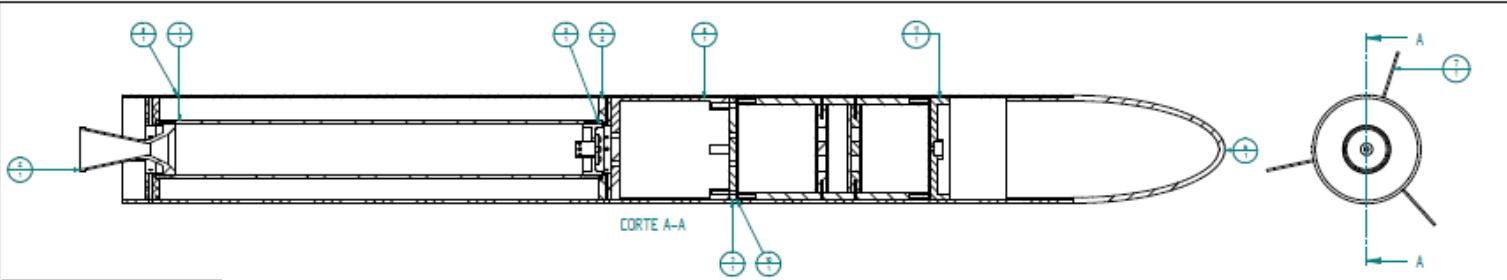


**Figure 5 |** The survival curves of N2 and the mutants in the genes that were down-regulated by spaceflight, in liquid CeMM. The percentage of live worms is plotted against adult age. Day 0 corresponds to the L4 molt. Mean adult lifespan  $\pm$  S.E. (day), number of assayed worms and statistical significance with N2 wild type are: N2:  $49.5 \pm 0.7$ ,  $n=364$ ; *gar-3(gk337)*:  $62.3 \pm 1.1$ ,  $n=205$ ,  $p<0.001$ ; *ins-35(ok3297)*:  $53.5 \pm 1.3$ ,  $n=159$ ,  $p<0.01$ ; *glc-4(ok212)*:  $59.0 \pm 0.9$ ,  $n=286$ ,  $p<0.001$ ; *shk-1(ok1581)*:  $55.2 \pm 0.8$ ,  $n=204$ ,  $p<0.001$ ; F57A8.4 (*tm4341*):  $68.1 \pm 1.2$ ,  $n=179$ ,  $p<0.001$  and *cha-1(p1152)*:  $70.5 \pm 1.1$ ,  $n=155$ ,  $p<0.001$ .

## Influencia Gravitacional aumenta la longevidad en C. Elegans

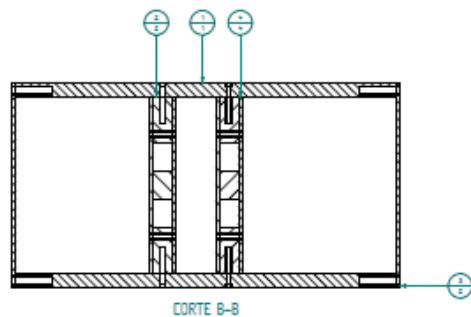


Exploración de los efectos del Vuelo de Corta Duración sobre la  
Inducción de Genes relevantes al Proceso de Longevidad en  
*Caenorhabditis elegans*?



Número de Elemento	Título	Materiales	Cantidad
1	Zedig Motor	Abras 1020	1
2	Tires	Abras 1020	1
3	Prop Motor		1
4	Velocidad Centrifuga	Austonio	2
5	Rueda	PVC	1
6	Ojiva	Hule	1
7	Motor Motor	Austonio	2
8	Caixa de Transporte	400, auto impreso	1
9	Trans Caixa de Transporte	400, auto impreso	1
10	Lámpara		1
11	Patas	Goma	1

Objetivo:	Nombre: A. Rodriguez	Universidad de los Andes
Compartimento:	Nombre: A. Rodriguez	Proyecto Unidimensional Aeronáutico - PUA
Fecha:	Octubre 2012	Modelo: Motor 2 - ARDUINO
Sobre indicación suministrada:	Indicaciones en el documento	Art: Documento Vehículo
	Ángulos en grados	Unidades: Grados
	Referencias: <30 y >70	
		Boceto: 10

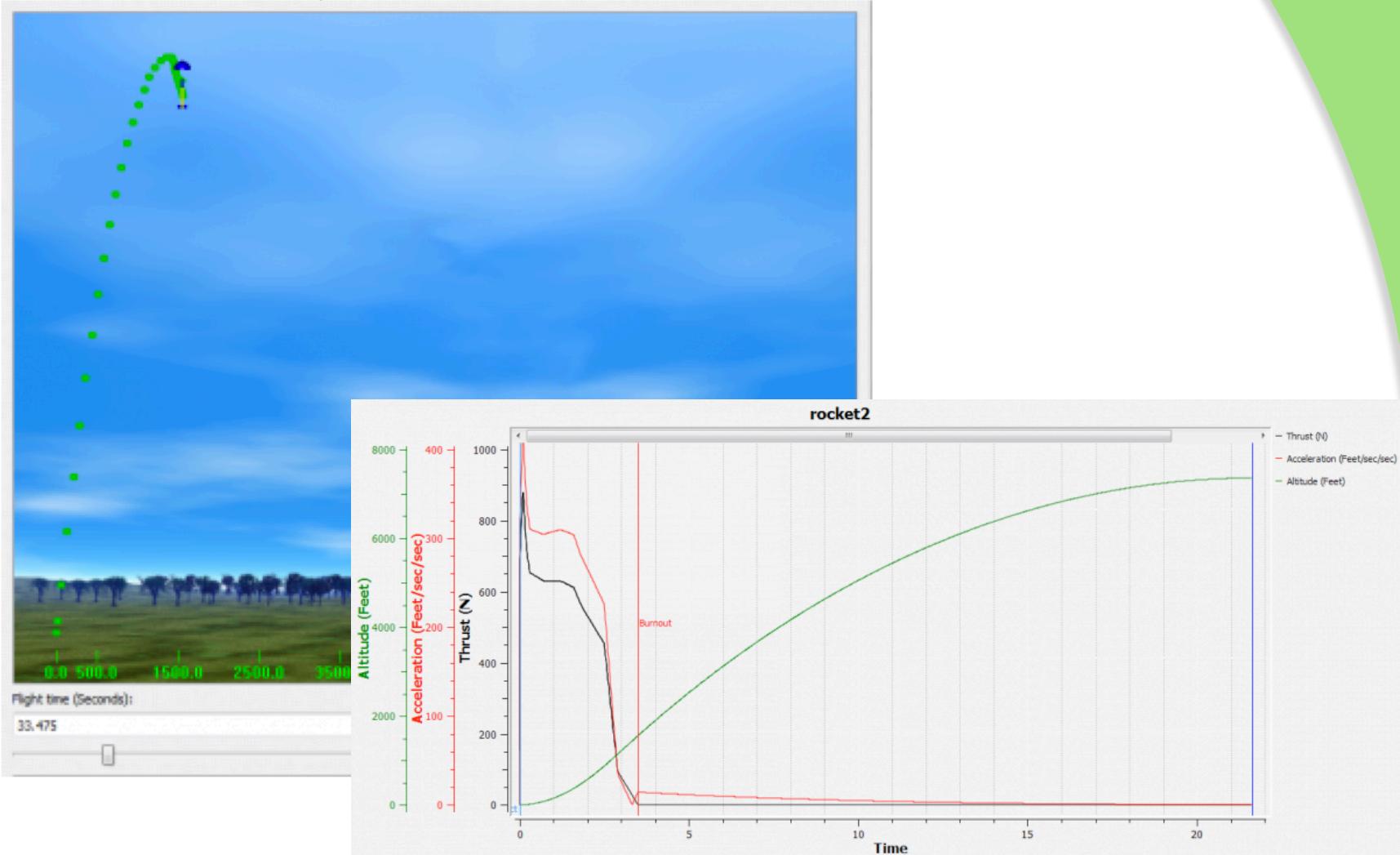


Número de Elemento	Título	Materiales	Cantidad
1	Caixa Lámpara	Abras 1020	1
2	Bloco de Alimentación	Goma	2
3	Trans Caixa de Lámpara	Abras 1020	1
4	Trans Motor de Alimentación	400	1

Objetivo:	Nombre: A. Rodriguez	Universidad de los Andes
Compartimento:	Nombre: A. Rodriguez	Proyecto Unidimensional Aeronáutico - PUA
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## Simulación de la trayectoria de vuelo del vehículo.



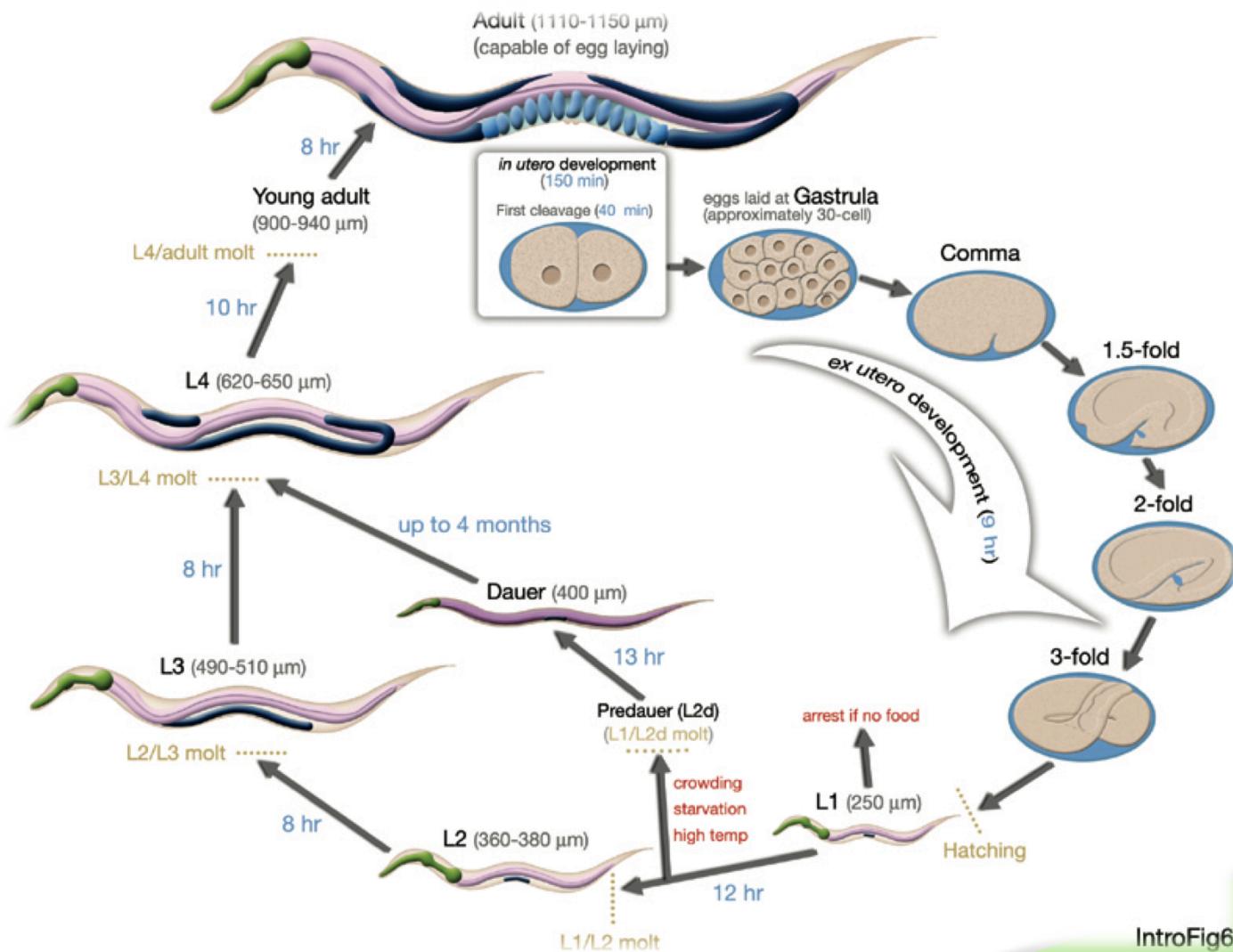
**Resultados de la simulación de a) altitud, b)  
aceleración y c) empuje del motor-cohete del vehículo.**

Comparaciones enfocandonos en los efectos del vuelo ...



VS

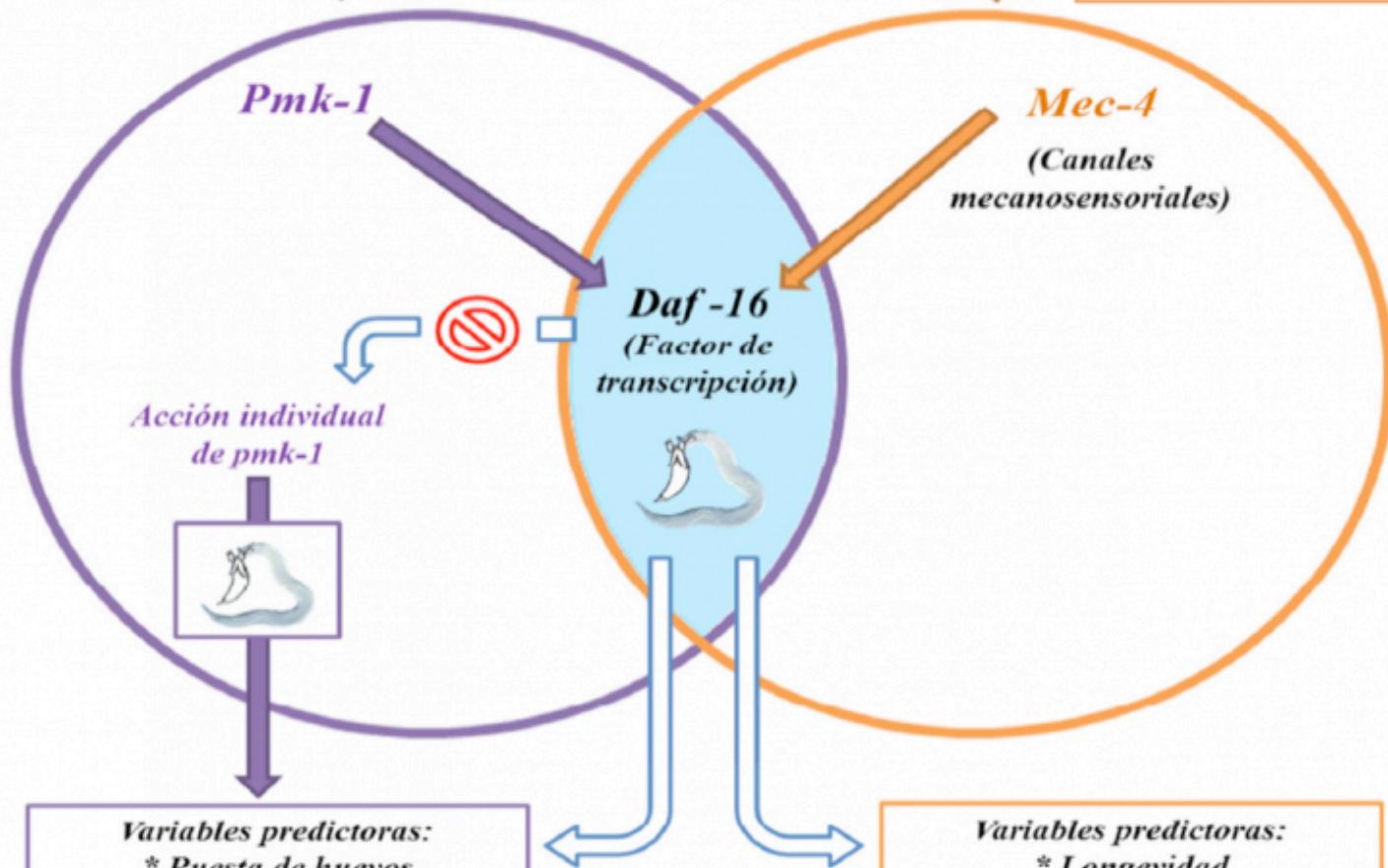




IntroFig6

*Factores Ambientales  
(Estrés por viaje)*

*Factores Gravitacionales  
(sensibilidad a cambios  
gravitacionales)*





















*Factores Ambientales  
(Estrés por viaje)*

*Factores Gravitacionales  
(sensibilidad a cambios  
gravitacionales)*

*Pmk-1*

*Mec-4*

*Daf-16*  
(Factor de  
transcripción)

*Acción individual  
de pmk-1*

*(Canales  
mecanosensoriales)*

*Variables predictoras:*  
\* *Puesta de huevos*  
*(apoptosis de línea germinal)*

*Variables predictoras:*  
\* *Longevidad*  
*\* Formación de Larvas Dauer*

# Séneca IX



**Gracias!**