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Model Organisms in Molecular Biology

CAENORHABDITIS ELEGANS (C. ELEGANS) TO STUDY DISEASES ASSOCIATED WITH RNA

1. INTRODUCTION ABOUT *C. ELEGANS*

First of all we introduce a little this species as important for modern medicine as it is in C.elegans.

It is a species of nematode of the family Rhabditidae of free life that measures approximately 1 mm in length, bilateral symmetry and a transparent appearance thanks to four epidermal cords. Its diet is purely from microorganisms and dead organic matter.

As for the reproduction it is hermaphrodite but in global numbers the percentage of male specimens is very low. Even so, the male specimens are capable of inseminating both females and hermaphrodite specimens, thus increasing the reproductive capacity. In addition, it takes only 2-3 days to fertilize and hatch the eggs and the life of an individual lasts 2-3 weeks, making it easy to treat to study (College of biological sciences, n.d.).

The important question is why is it a model organism?

C. elegans has a very ancient species and has kept its genetics intact for millions and millions of years. It also has organs and functions very similar to those of animals as well as humans. For example, it is conceived from a cell with embryonic division coming from the union between sperm and ovum, it has a "brain" (the circumpharyngeal nerve ring) that allows it to have a rudimentary level of learning (of the 959 somatic cells that has 300 they are neurons), it has a maturing and aging process that ends with its death.

Thanks to all these biological features, this species has been tirelessly studied since the 70s. And it is that numerous studies have been taken in different fields where, thanks to studying this individual, many of the current diseases could be solved. Studies have been done for obesity, diabetes, aging, and Alzheimer's.

Figure 1: Photo of C. elegans. https://bitesizebio.com/

2. C. ELEGANS AND DESEASES

Just as in the introduction many studies are already known to try to treat various diseases such as obesity or Alzheimer's. The following points will show other studies that cover less common but equally significant diseases thanks to C.elegans. So with this I intend to show the wide spectrum of options that a model organism such as this nematode can allow.

2.1 CAENORHABDITIS ELEGANS AS A MODEL ORGANISM FOR STUDYING MITOCONDRIAL DISEASES ASSOCIATED WITH DEFECTS IN tRNA MODIFICATION

The 2015 Lynne, D., & Yenush, P. study attempts to treat embryonic disease. Everything arises from possible mutations in the MTU1 and GTPBP3 or MTO1 genes which participate in the post-transcriptional modification of uridine. If these mutations arise in these genes, they can cause acute infantile liver failure and infantile hypertrophic cardiomyopathy, respectively, which cause lethality during the first months of life.

The possible mutations show a reduction in the expression of the glycolysis genes and in the beta-oxidation of fatty acids, also affecting the transport of succinate within the mitochondria.

In addition, in case of double mutation it can cause embryonic latalidat, arrest of development in first larval stages and complete sterility in adults.

In summary, this work shows for the first time at the level of a model animal the important reprogramming of genes related to mitochondrial metabolism in response to U34 hypomodification of mt-tRNAs and reveals new connections between signaling pathways that increase longevity .

2.2 REGULATORY ROLES OF RNA BINDING PROTEINS IN THE NERVOUS SYSTEM OF C. ELEGANS

In the 2015 Sharifnia, P., & Jin study, Y. does not propose to directly attack a disease but seeks to obtain global but precise information on the nervous system of C.elegans in order to have a solid basis for more specific future studies. . Analytical tools in molecular genetics and simple neural anatomy of C. elegans offer advantages in defining gene functions in vivo at the single cell level.

To achieve this, they have focused on RNA binding proteins (RBPs), which are key regulators in the transcription, translation and degradation of RNA. Precise regulation of RNA, including mRNAs and small RNAs, is essential to control gene expression spatially and temporally. This study has identified critical roles of RBPs in neuronal development and synaptic transmission, which, when disrupted through mutations, can cause neurological disease.

The C. elegans genome encodes approximately 500RBP and many of these genes are conserved from nematodes to mammals, thus once again making C. eleans a magnificent organism for use as a model organism.

These studies have allowed the dissection of a single and global neuron of these interactions to highlight the complexity of the nervous system. Future studies of mRNAs in the C. elegans nervous system will continue to build a deeper understanding of complex regulations by RBPs. Still, the complexity of the nervous system continues to raise many questions about how its connections develop, grow, and maintain.

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