Núria Hernando

SEMINARI 12/11- EXPLORING THE ROLE OF TRANSPOSABLE ELEMENTS IN ADAPTATION AND LIFESPAN

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She explained her background and told us a little about her professional life and when she started getting into computer science. Now, in 2025, she's doing a postdoc at the UAB.

Her work focuses on TEs in adaptation, invasions and aging.
Transposable elements are fragments of DNA that move within the genome and were discovered by Barbara McClintock in the 1940s. This elements have different transposition mechanisms (cut and paste, copy and paste).
They are found in almost all studied genomes but at different frequencies — the highest frequency is in maize and the lowest in *Saccharomyces cerevisiae*.
These elements have a mutagenic effect because they can land in the middle of the gene disrupting the function.

They were considered bad elements to our genome, nowadays the investigators says that some of them can help to evolution.

Her first postdoc was to study TEs in *Drosophila Melanogaster*. She did one specific retrotransposon (**roo**) inserted in front of *Lime* gene (link between metabolic response and immunity and maybe involved in cold stress), when the TE was there the transcript was longer, and it was selected.

We know that the level of nucleotide diversity between copies of roo is low but a considerable structural variation in 5'-UTR. Transposition of roo a high frequency has been shown.

She took different populations of Drosophila and studied if they had the TE or not. In non stress conditions both strains didn't have a change, but when they were infected only the flies with de TE increased the transcription of the gene.
To prove that it was the TE that made changes, she modified/altered the gene with CRISPR, the only difference was the presence or absence of the TE. The efficiency was a little lower. Choosing the ones with no red fluorescent eyes, she measured the Lime expression again, and the results were consistent with previous findings: in infected conditions without the elements didn't show the increased expression. So she concluded that the TE was the cause.
She also did an *in vivo* reporter assay, where she saw the same as the other experiments.
She performed survival experiments, the ones with the element lived longer. So this also affirms that the TE was modifying the expression on the gene, being beneficial to the flies.

She switched to *D.suzukii*, which are originary from Japan. It's an invasive species, because they have no competitors and nor parasitoids… this species has spread worldwide. So they're a good model to study adaptation. This species has 50% of TE.
One of the interesting TE was inside the ***Mrp4*** gene (inserted in the first introne). Flies from Japan had the element, but the other two did not (USA and France). She did the same as the other study (gene expression

with and without stress), flies from Japan had increased expression on this gene, this element is stronger paraquat-induced upregulation of *Mrp4* gene.
She also did a allele specific expression, she had heterozygous flies and checked the expression, the allele with the element was more expressed.
So is another example of a TE modifying the gene expression.
Flies with the element were more sensible to paraquat, so this insertion does not confer increased resistance.
She also did CRISPR but she had only a change in eye colour.

The study of the lifespan is the most bioinformatic part.
In many species, males and females have different life expectancies. Heterogametic sex is usually the one with reduced lifespan, typically males live shorter lives (in this study were the females who lives shorter).
The toxic Y effect says that in chr Y have a lot of TE compared to other chromosomes, with the pass of time many of them can be activated producing mutations that can reduce lifespan in males and an increased somatic mutations. So they say that the amount of TE is the main cause of the reduced lifespan.
The postdoctoral study focused on the TEs in the Y chromosome across three species with varying percentages of TEs.
In males, the ones with increased expression of TE live shorter. TE expression increases in old samples, with no sex effect observed in the carcass, but a clear effect in the gonads.
Further investigation is needed to determine if repression mechanisms are indeed less active in older flies than in younger ones.

SUMMARY
TE in adaptation contributes to the survival capacity of flies. The TE are a good tool to study and have a better knowledge of invasive processes.
TE expression differs with age, but they need further studies.

Q&A
The most challenging bioinformatic was doing chipseq, the first one she saw.
Chipseq it's a lab tech to study protein-DNA interactions obtaining it from a immunoprecipitate chromatin. It offers higher resolution, less noise and greater coverage than ChIP-chip (the Chipseq predecessor). It's cheap and indispensable to study gene regulation and epigenetic mechanisms.

Fellowships are important to take them abroad mainly here in Spain, in other countries they don't care as much as here. It's important if you've been abroad to have job opportunities.

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