Model organism Drosophila

The cooled incubator in genetics

Even if the fruit fly Drosophila melanogaster only measures about 3 millimetres, it has been an integral part in genetics since the beginning of the 20th century. Besides the mouse, the zebrafish, the domestic chicken and the African crawled frog, it is an important animal model organism.

At the University of Veterinary Medicine, Vienna (Vetmeduni Vienna), the Drosophila is the secret star – cultivated in Memmert cooled incubators ICP.

On the track of Darwin's theory of evolution

In the face of the discussion about climate change, researching the survival mechanisms that a population (a group of creatures that can reproduce among themselves) uses to adapt to specific environmental conditions, has become more topical than ever before. Population genetics, which emerged in the 1920s, present new findings that cultivate the science of genetics and evolutionary theory on a daily basis.

Evolution in fast motion

So why do members of one population differ from each other? Why are some populations more able to adapt than others? Which common genetic basis do populations have and to which extent has adapting to the environment affected their genotype? There are enough questions to justify a new series of experiments with the Drosphila at the Institute of Population Genetics (IMP) at Vetmeduni Vienna. But what makes the fruit fly so interesting as a model organism? Well, it is easy to keep and has very short generation cycles, which makes it possible to study evolution in fast motion and ensures a high number of descendants. In addition to this, the fruit fly only has four chromosome pairs. Thus, the genomeis quite manageable, as it only has about 14,000 genes. By directly manipulating particular genes, researchers can substantiate their theses regardless of the field that is being examined: metabolic processes, mating behaviour, ageing, obesity or reactions to pathogens or climatic changes.

Professor Christian Schlötterer from Vetmeduni Vienna in front of "his" Memmert cooled incubators, in which millions of fruit flies are cultivated

The world's largest "fly stock"

Even today, sequencing (the process to determine a genome's basic DNA building blocks) still is complex and costly. If one wants to examine the interaction of genes or the reasons for genetic modifications, sequencing before and after the experiment is always necessary. Therefore, the high-throughput method for inexpensive and quick DNA sequencig Next Generation Sequencing is used at the Vetmeduni Vienna. The world's largest "fly stock", which comprises more than 22,000 fly strains and was started by the IMP and the Viennese Institute of Molecular Biotechnology, also is indispensable for the researchers at the Institute of Population Genetics. In each of these fly strains, exactly one single gene can be turned off. This enables the researchers to study how this gene works exactly.

Memmert cooled incubators ICP to cultivate Drosophila

Different temperature conditions in the cooled incubator

In the 21 Memmert cooled incubators ICP at Vetmeduni Vienna, researchers mainly examine to what extent changes in the climatic conditions can influence the frequency of already existing gene mutations. In a series of tests, groups of animals with different genetic versions are alternately exposed to unusually high and low temperatures. These tests are performed by day and night for many generations of flies. As the flies are kept in feed containers on as many layers as possible, the light strip is mounted on the rear panel. This guarantees a consistent distribution of light in the interior. Meanwhile, some Drosophila populations have evolved for more than 100 generations. Compared to the populations that were not evolved, sequencing the genomes of every single fly generation answers the following questions: On which gene section do changes occur? Which gene variant will prevail under which temperature conditions? Which features will be passed on to the next generation and

how will the animals change externally? As we share 70% of our gene pool with the Drosophila, these findings are also interesting for human beings. The multi-annual project is financed by the European Research Council with the highly coveted ERC Advanced Grant and the Austrian Science Fund FWF.

An overview of the main topics

- Fruit fly Drosophila melanogaster
- Population, gene, genome
- Model organism mouse, zebrafish, Drosophila
- Institute of Population Genetics
- Vetmeduni, University of Veterinary Medicine, Vienna
- Development biology, genetics
- Cooled incubator
- Memmert

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Further information: Vetmeduni Vienna

Sources and further reading:

[1] Massive Habitat-Specific Genomic Response in D. melanogaster Populations during Experimental Evolution in Hot and Cold Environments

[2] OROZCO-terWENGEL et al. (2012) Adaptation of Drosophila to a novel laboratory environment reveals temporally heterogeneous trajectories of selected alleles

[3] Franssen et al. (2014) Patterns of Linkage Disequilibrium and Long Range Hitchhiking in Evolving Experimental Drosophila melanogaster Populations

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