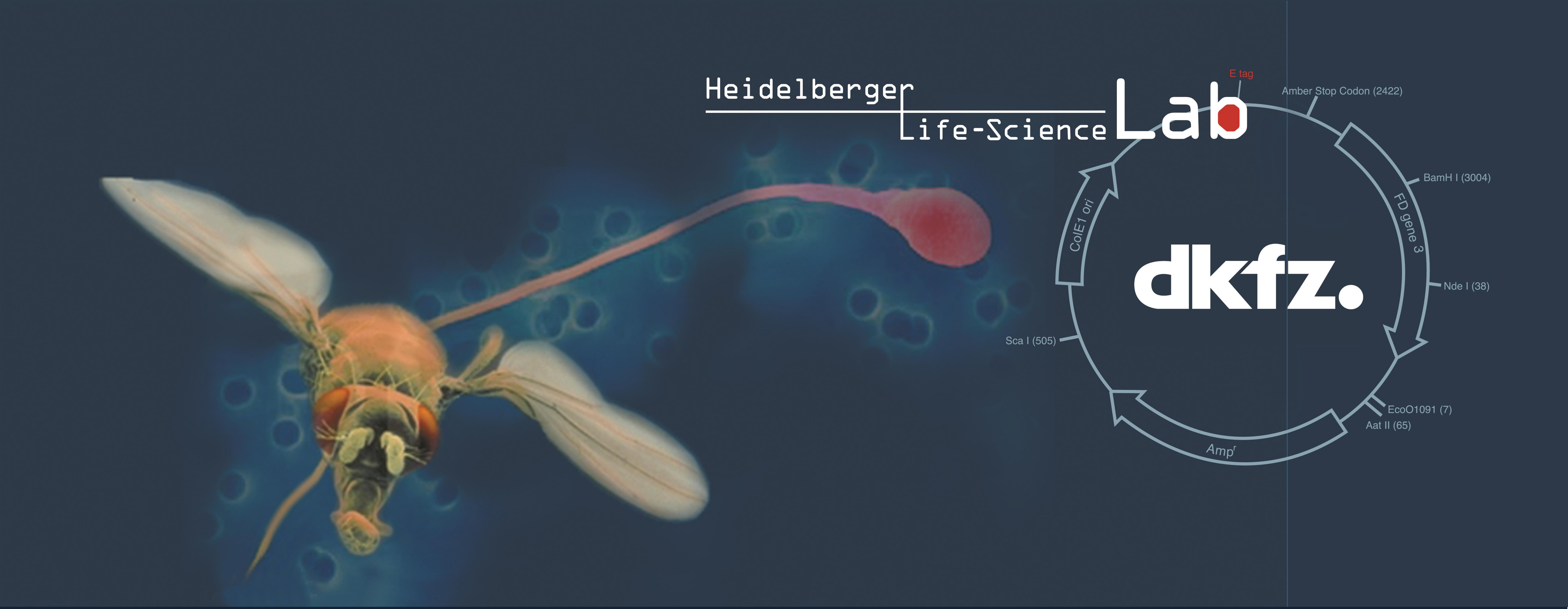


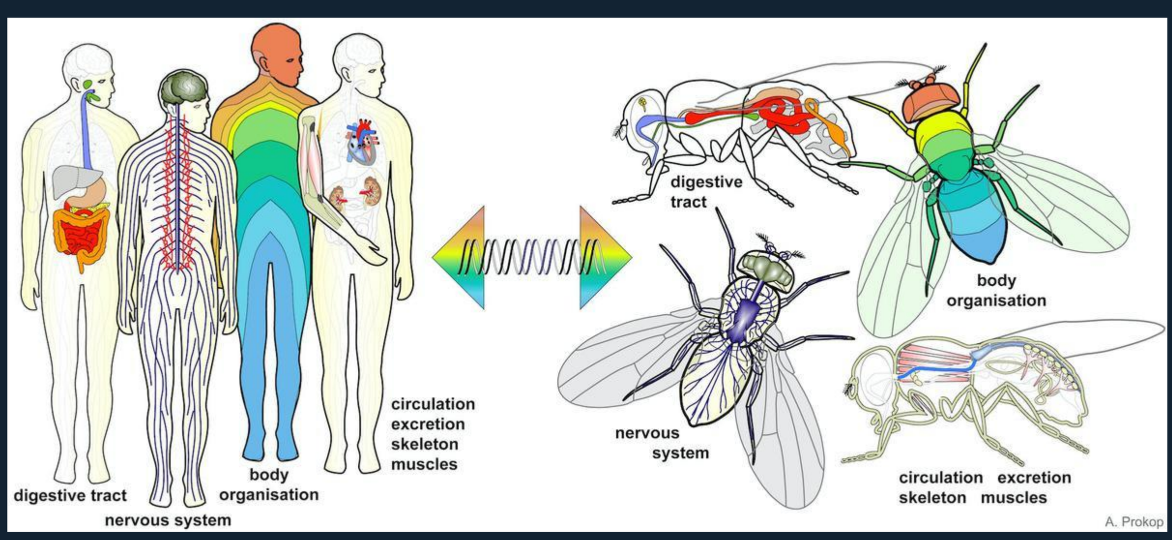
Heidelberger Life-Science Lab

dkfz.

Genetics and Drosophila AG

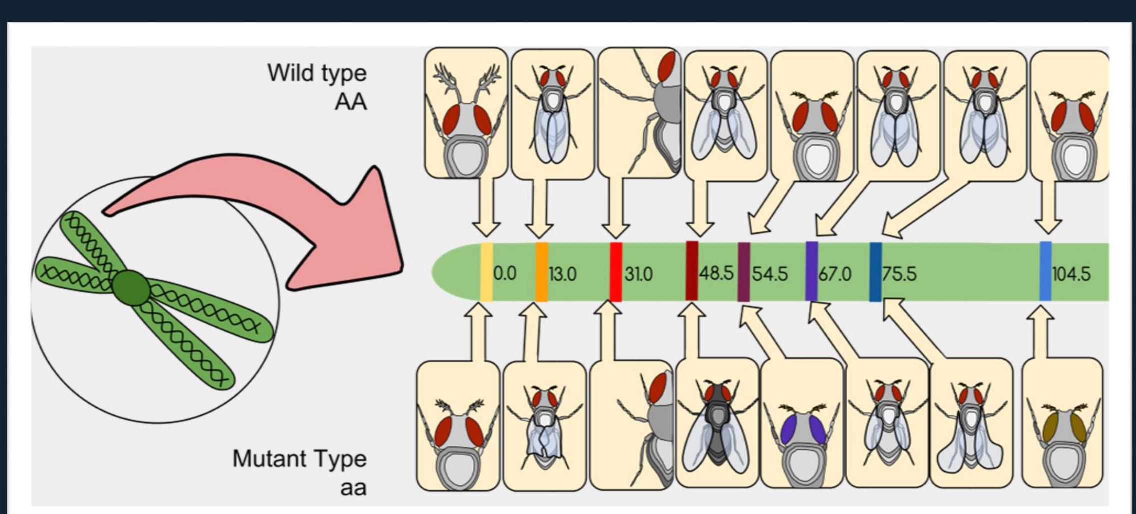
Did you know that half of everything we've learned about genetics so far is thanks to one small insect – the common fruit fly (die Fruchtfliege), lat. *Drosophila melanogaster*? We owe this model organism a great debt already, and its importance in basic research happening today is still just as strong. After all, *Drosophila* is in the very logo of the Life Science Lab for a reason!

Even though it's a small invertebrate, as different from a human as an animal can be, 60% of the fruit fly's genome carries the same genes that our genome does. Many of its organ systems are also similar enough to ours that we can use it to study such things as cancer and genetic mutations which are important for human health and medical research down the line.



Human and fruit fly organ systems are remarcably similar *(Source: Andreas Prokop, University of Manchester)*

Drosophila is a perfect model organism to learn the basics of Mendelian genetics, dominant and recessive gene traits and the connection between genes and protein function. What makes the fruit fly even better for research, however, is that is perfect for many advanced genetic techniques as well, such as visualizing proteins in tissues, screening the whole genome for protein function and genome editing using CRISPR.



In this AG, we will learn the basics of working with *Drosophila melanogaster* in a laboratory setting, including:

- handling flies by studying their physical characteristics, setting crosses and studying organs by dissecting flies at different life stages.

Physical characteristics are tied to gene function - wing shape and eye color are used as markers for genes and balancer chromosomes *(Source: Joe Jimbo)*

We will learn basic genetic techniques and how this knowledge is useful in fruit fly research, including:

- the Gal4/UAS system of gene over-expression, CRISPR system for mutagenesis, and RNA interference for protein depletion.

This year, we will use this knowledge to study evolution and population genetics including:

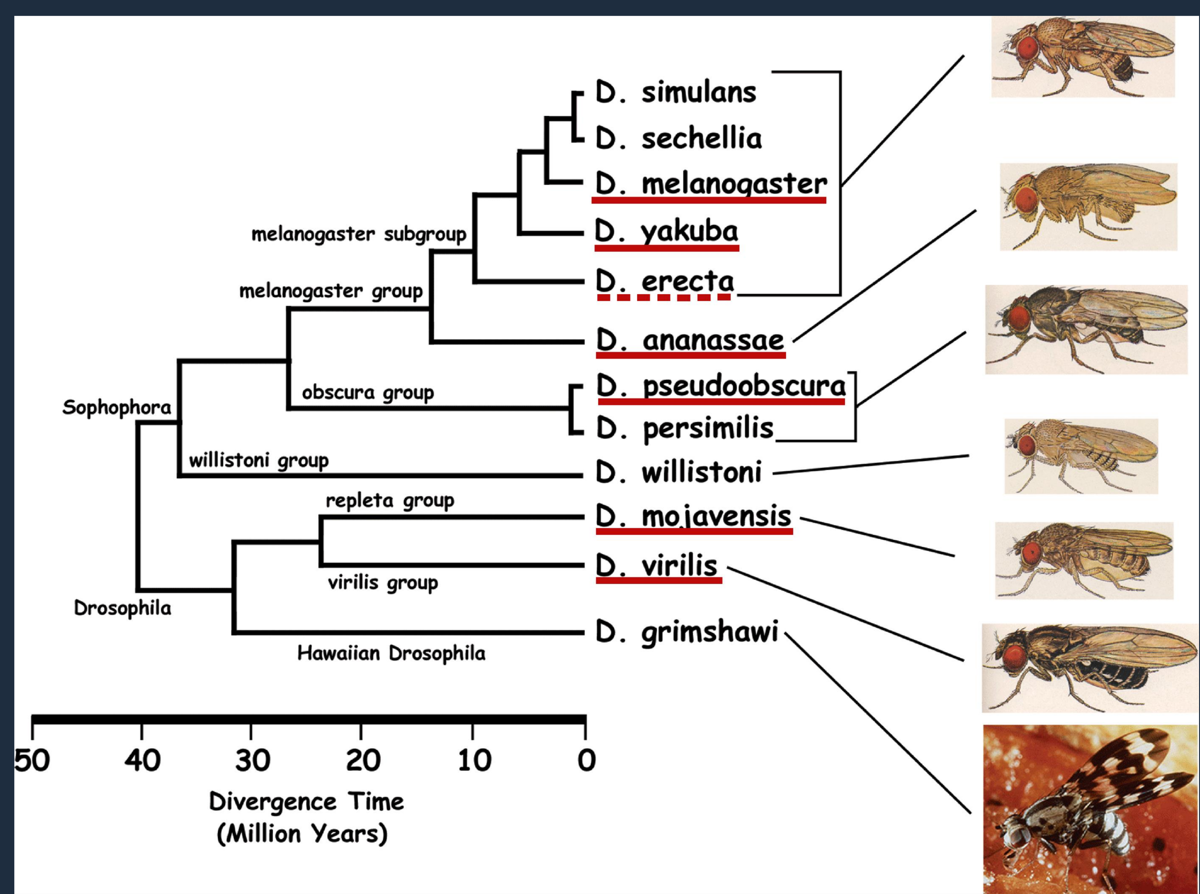
- leaning about different species of *Drosophila* and how they differ between each other (generalist vs specialist species, feeding preferences, preferred environment and niche, etc);
- how the different *Drosophila* species evolved and what drives their evolution on a genetic level;
- interbreeding and what behavior allows or prevents it from happening when different species live in the same space;
- why these differences are important for humans (*D. suzukii* is a pest species of *Drosophila* causing damage to European agriculture, while *D. melanogaster* isn't).

Fruit fly was used to establish the first gene map, determining the location of genes and their degree of recombination in sexual reproduction *(Source: Wikipedia, Gene mapping)*

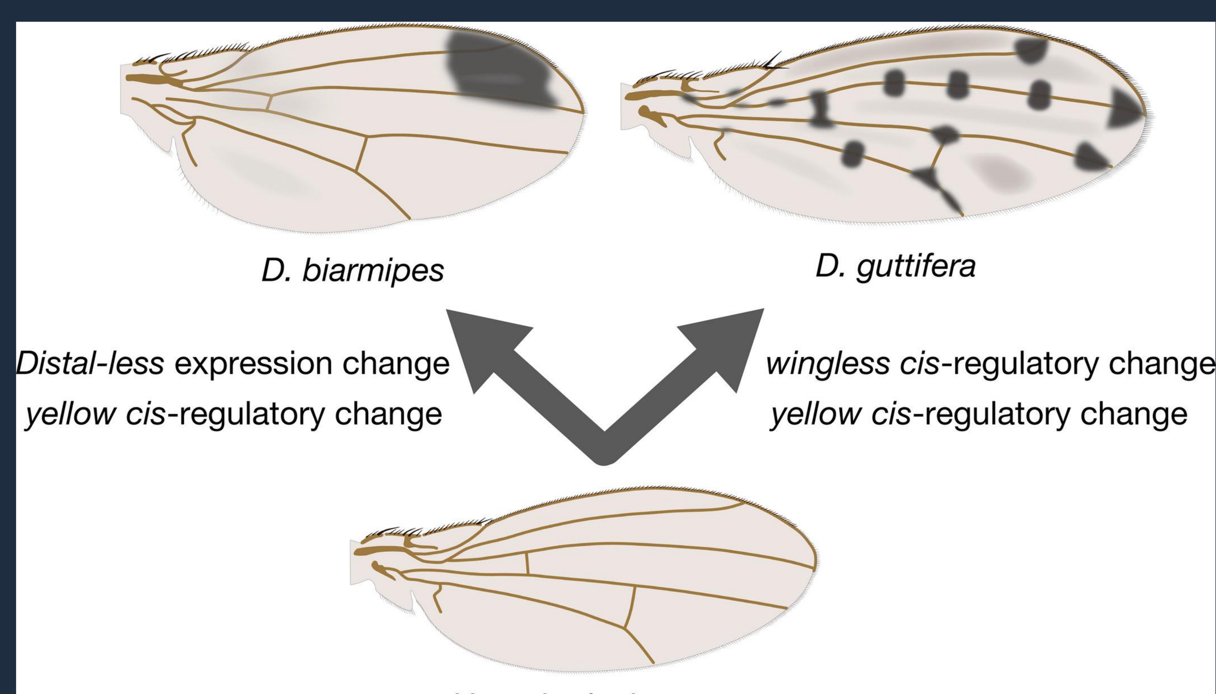
Mentors:

Dr. Bojana Pavlović
b.pavlovic@dkfz-heidelberg.de

Dr. Vaishali Grewal
vaishali@dkfz.de



Phylogenic tree of some *Drosophila* species. There are over 1600 described *Drosophila* species, living in almost all areas of the world. They can be generalist or specialist (which food they eat), may live worldwide or just in certain climates, and can be either beneficial for humans or pests. *Drosophila* family has existed for over 50 million years. *(Source: Grün et al., 2005, PLOS)*



We can study the differences in the looks and behavior of various *Drosophila* species (wings are a great example) to learn what causes these differences on a molecular level. To do this, scientists look at the fly genes (whether they're shared by all species, and whether the gene sequences themselves are the same) and at how these species regulate their gene expression. This can give us insight into not just appearance but also behavior and allows for the study of evolution in general. *(Source: Koshikawa, 2020, DGD)*