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Biology's Obsession with *Drosophila melanogaster*: Your Everyday Fruit Fly— Or is it?

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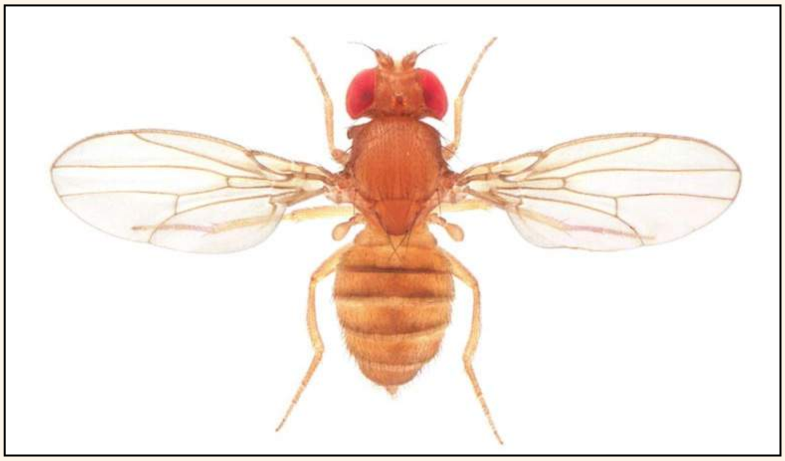
Your Everyday Fruit Fly— Or is it?



By Purba Tyagi

"[Tax] dollars go to projects that have little or nothing to do with the public good — things like fruit fly research in Paris, France. I kid you not." – Sarah Palin

Although scientists often mock Sarah Palin for this quote, it is not immediately clear to many non-scientists why it was such a faux pas. While working with fruit flies, or *Drosophila melangoaster* (the Linnaean name for fruit-flies which translates from Greek to 'dark-bellied dew sipper'), several summers ago, it was hard for me to understand how studying a creature so different from humans in such intense detail could be useful for understanding our biology.

However, fruit flies are one of the most prominent model organisms used in the field of biology right now. Biologists have used them as a model of multicellular organisms for over a hundred years, and the field has only expanded since then. It turns out that *Drosophila* are a vastly important proxy for understanding many of the mechanisms that govern our lives, especially the ones that rely on genetics (which are nearly all of them).

The genetic code found in *Drosophila* is made up of the same DNA as found in humans and almost all other living organisms. Due to this universality of genetic code, principles of heredity, sex-linkage, protein synthesis and transportation can all be studied in the fruit fly and extrapolated in ways that are relevant to human biology.

It is true that other organisms more closely related to humans, mammals like rats, rabbits and chimps, share these characteristics as well. However, fly-research is hugely more cost efficient relative to using other living biological models. Fruit flies are easy and cheap to maintain, reproduce quickly, and produce a great deal of offspring, making them successful genetic model organisms. Additionally, they are large enough to be examined often with the naked eye or which the help of a rudimentary, light-microscope, which can make them easily accessible to scientists.

Thomas Hunt Morgan, a Nobel Prize-winning professor, is credited with being the first to use *Drosophila* in genetic experiments. He and a group of graduate students with magnifying glasses conducted genetic experiments in a dark Columbia University laboratory which came to be known as the first 'fly room.' The results of their work laid the foundation for the science of modern genetics. Mendel's ideas about inheritance had been around for many years, but there was no evidence of a physical mechanism until Morgan's work in the early 1900s. Morgan bred a number of different fly strains together, analyzed the characteristics of their offspring, and was able to form a number of theories which are still accepted today. Additionally, as Morgan began to discover, many of the genes present in *Drosophila* are similar to, or "homologues" of, those found in humans. Indeed, many of these homologues have similar functions in *Drosophila* as they do in humans.

For example, *Drosophila* produce molecules similar to insulin to regulate their blood sugar levels. Loss of this molecules results in elevated blood sugar, a common condition with diabetics. This allows researchers to study the mechanisms of this disease and explore possible treatments all using the flies. The hugely varied research being done in the field is made possible in large part because it's cheap to conduct.

Fly research has been integrated into scientific fields across the spectrum from behavioral neuroscience to biotechnology development.

Huge leaps have been made especially in research exploring the fly brain. Taiwanese researchers are half-way through a process that will ultimately yield a complete map of the wiring and connectivity of the fly brain. At the end of this process, no other nervous system will have been explored in such detail as the *Drosophila*'s. Despite the fact that the *Drosophila* brain is quite a lot smaller than that of a human (they have 100,000 neurons on average while we have 100 billion), scientists see this map as the first step to really understanding the complex connectivity in human brains. This project has already revealed commonalities between the nervous system of the fly and the human. The two species have at least six neurotransmitters in common, both have brains which divided into two connected hemispheres, and the basic construction of both nervous systems is organized with local clusters of neurons working in tandem with long-range connections.

Dr. Olaf Sporns, a computational cognitive neuroscientist has found this research to be especially compelling and says that future researchers "may now be able to pinpoint how information flows through the fly brain network to accomplish certain goals." If a complete atlas of each wiring in the fly's brain is created, researchers could test their theories of how information flows through the synapses in the brain via computer models. The primary investigator of this research, Dr. Ann-Chyn Chiang, sees scientists being able to one day use programs to input information into the virtual atlas and receive a virtual output that would essentially mimic the brain's response. Dr. Sporns goes further with this idea saying: "It's not out of the question that if we had a complete cellular map and a good database, that we could create virtual organisms."

And you thought fruit flies were just kitchen pests.