Why do human populations differ? Fruit fly study aims to provide genetic answers

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(PhysOrg.com) -- Charles Aquadro, professor of molecular biology and genetics, researches how fruit flies provide clues to humans' own genetic footprints of adaptation.

Evolution is a continuing process, affecting all organisms, humans among them. Indeed, humans continue to adapt to their environment. But how does this adaptation take place, and how do genes vary within a population? To find the answers, researchers have long hoped that fruit flies will provide clues to humans' own genetic footprints of adaptation.

Charles Aquadro, Cornell professor of molecular biology and genetics, was recently granted almost $700,000 in federal stimulus funding through the American Recovery and Reinvestment Act (ARRA) to continue this 20-year line of research.

The primary goal of the new study is to detect "footprints in the sands of the genome," which are particular patterns or distributions of DNA sequence variation that occur in a species. Aquadro hopes that knowing how a footprint corresponds to genetic variation in Drosphila melanogaster (fruit flies) will provide clues as to why certain genetic sequences vary in humans and other higher organisms.

"The genome is like an opera. You have an array of actors and actresses, but who sings and when can influence what it sounds like when the voices are pulled together," explained Aquadro. "We don't always know how to read the sheet music. We don't even always know all the notes.

Identifying genetic footprints is an important step in seeing the full musical score."

Aquadro plans to use computational methods and statistical tests to identify the location of genetic footprints in large collections of genetic sequence information for fruit flies. This information will tell him what genes or sequences that change gene expression are at the footprint location.

Aquadro has already shown that a particular genetic footprint in fruit flies corresponds to a gene that influences the fruit fly immune system. It is possible that understanding how this gene varies within a population could change what we know about the human immune system.

An important reason for conducting this study in fruit flies is that while they originated in Africa, they have moved around the world. This fact allows Aquadro to consider the differences between geographically distinct populations. Knowing those differences is critical to learning the process by which organisms change in response to a particular environment, and whether their fitness for survival is affected by moving to a new environment.

For example, Aquadro cites breeding programs set up with the idea of eventually releasing captive animals into their natural environment. "But we don't know what genetic changes occur in a captive breeding environment," said Aquadro. Knowing those changes could make the difference between an animal's success and failure once it is released.

The stimulus funding, provided through the National Institutes of Health, will allow Aquadro to continue to fund a full-time research support specialist as well as multiple graduate and undergraduate students. It will also provide significant income to Cornell's core DNA sequencing and microarray facilities.