Bugs get into spots, and out
Patterns, color come from a single ‘wingless’ gene

By Dan Vergano
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How did the butterfly get its spots?
A clever “pattern gene” turned them on, a study suggested Wednesday in the journal Nature.

Researchers studying fruit flies found that bug wings most likely have such a gene, and so it might have been easier than scientists previously thought for bugs to evolve exotic color schemes or mimic those of other bugs.

“We’re all fascinated by animal colors and patterns,” says evolutionary biologist Sean Carroll of the University of Wisconsin-Madison, senior author of the study. “We found this one kind of fruit fly with polka-dot wings and decided to investigate.”

Normal lab fruit flies have plain wings, but the variety used in this study has 16 spots and four lines on each wing. Carroll and his colleagues expected to find that each spot and line had a different gene switch controlling its appearance. But the versatile wingless gene, which plays a role in insect nervous system, gut and wing development, also appears to have the leading role in putting the spots on bugs.

“What’s interesting is the mechanism they found for the generation of color,” says developmental biologist Nicholas Baker of the Albert Einstein College of Medicine in the Bronx, N.Y., who was not on the team. “The same mechanism might hold true for many other species, not just fruit flies, but leopards, cheetahs, tigers and many others.”

In the study, the team traced the “fire” of genes in fruit fly wings, first finding one gene protein seemed tied to polka dots’ locations on the wing. “One important hint emerged from a set of aberrant flies that arose spontaneously in our large (fruit fly) laboratory,” the researchers write. The aberration was a mutant bug with spots centered on the veins in its wings.

When the researchers compared gene switches in the mutant with other spotted and non-spotted flies, they found that a protein produced by the wingless gene acted as a switch to create spots.

The versatility of gene switches, which are activated to act as signals in the body’s growth and in the evolution of new species, is a recurrent finding of developmental evolutionary biology, or “evo-devo.” A key point of evo-devo is that a new gene doesn’t have to evolve to explain every feature of a new species, because genes signals, especially ones that are key to embryonic growth, can be recycled endlessly to yield evolutionary changes.

In insects, including butterflies, the study suggests, wingless gene switches tied to the development of wing veins appear to have been co-opted so that “modern wing patterns have been ‘painted’ onto ancient wing landscapes,” Carroll says.