GENETICS

The Marmorkrebs model

Nature Ecology and Evolution **2**, 567–573 (2018)

In his lab at the German Cancer Research Center in Heidelberg, Frank Lyko studies epigenetics, how the environment can change an organism's phenotype without altering its underlying DNA. About 15 years ago, a colleague introduced him to the marbled crayfish, a triploid, clonal, parthenogenic, and only very recently speciated invertebrate that's proven to be quite the invasive pest across the globe. At the time, the Marmorkrebs (as it's known in German) didn't register in Lyko's research plans. But recently, he began thinking about alternative models. Classical laboratory animals, like mice, worms, and fruit flies, "always have the same phenotype, and if you induce a genetic mutation you get one aberrant phenotype normally," he explains. "This is super helpful if you do genetic research but it's not necessarily good for describing what's going on in epigenetics." He tried honeybees, but found them challenging to keep in the laboratory. His lab wasn't fond of another potential epigenetic model, the African desert locust, either. "These were really big animals and they were always escaping and flying around, so that was a mess," he recalls. "Then I remembered my old conversation with Günter Vogt."

His latest publication sequences the genome of the marbled crayfish and documents its rapid spread, despite its clonality and lack of genetic diversity. To confirm the genetic findings, he'd like to sample more populations and to compare the marbled crayfish genome to that of its close relative, the sexually reproducing slough crayfish found in Florida, but in the meantime the lab thinks they've found a more tractable model for their work than those they've tried before. Vitor Coutinho, working with the laboratory colonies, explains that marbled crayfish are robust, quick to reproduce, and quite tolerant of stress—not a surprise given the diverse environments they have come to inhabit in the wild.

Lyko mentions two criteria to really establish a new model system: "You need the genome sequence, which we have now, and you need a protocol to manipulate the genome, which has become much easier with the availability of CRISPR." Lead author Julian Gutekunst is currently working on improving the genome assembly; from there, the lab plans to characterize the epigenetic machinery of the crayfish and its role in adaptation. There's also a potential thread to pull for cancer research. "Clonal genome evolution is a key feature of human tumors," Lyko says; this is likely similar to how the marbled crayfish population evolved from a single female in a German pet shop. Neurobiologists, evolutionary biologists, and developmental biologists might also have something to learn from these unique clones. "The genetics were the basics that were required for further studies, and now we can start working on all these other topics," says Gutekunst.

The future may be marbled.

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Published online: 26 March 2018
https://doi.org/10.1038/s41684-018-0030-y