

Without Bugs, We Might All Be Dead

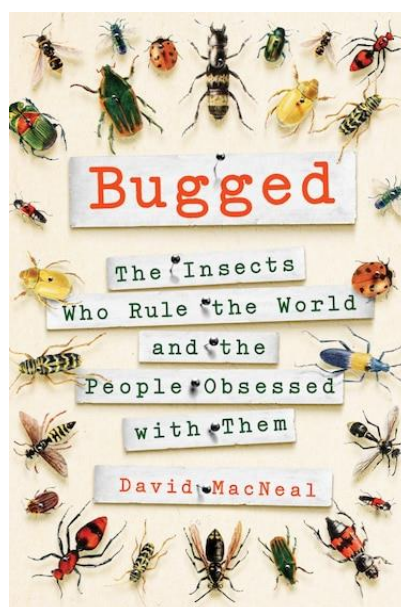


Honeybees are crucial for growing crops like almonds and watermelons.

There are 1.4 billion insects per person on this planet and we need (almost) every one of them.

There are 1.4 billion insects for each one of us. Though you often need a microscope to see them, insects are “the lever pullers of the world,” says [David MacNeal](#), author of [Bugged](#). They do everything from feeding us to cleaning up waste to generating \$57 billion for the U.S. economy alone.

Today, many species are faced with extinction. When National Geographic caught up with MacNeal in Los Angeles, he explained why this would be catastrophic for life on Earth and why a genetically engineered bee could save hives—and our food supply—worldwide.



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I think, like me, most people regard bugs as, well, bugs—annoying little critters that sting us or spoil our picnics. Why are you so enchanted by them?

Individually, insects are not incredibly interesting, unless you get down on the ground or view them under a microscope to look at their complexity. But they are the invisible force working throughout the world to keep it running.

Almonds in California or watermelons in Florida wouldn't be available if it were not for bees. Insects also return nutrients to the earth. If they weren't around, the amount of decay and rot all over the place would be terrible.

We don't notice these services because insects are so small and we often see them as this nuisance. But they are [the lever pullers of the world](#).

You suggest bugs actually do billions of dollars of work. Unpack that for us.

Mace Vaughan and John Losey, two entomologists, did in-depth research on [how much insects contribute economically to the U.S.](#) What they found was, it's about \$57 billion, not including pollination. Most of this comes from wildlife, which insects keep going along because they are the base of the food chain for fish, birds, or mammals. Pest controlling insects add a further half billion. And there is no way to account for how much it costs to recycle a dead body or decompose plant life.

You say that 2,086 species of insect are eaten by 3,071 different ethnic groups in about 130 countries. Give us some highlights from that global menu—and your own experience in Japan.

[Laughs] If you go to Mexico, they are selling chapulines—grasshoppers—in brown paper bags filled with spices. In Borneo, they eat rice bugs blended with chilies and salts, cooked in hollow bamboo stems. Caterpillars are very popular in Africa and are a great source of zinc, calcium, iron, and potassium. On Sardinia and Corsica, they eat “crying cheese”—*Casu Marzu*—that literally has maggots inside it.

In Japan, we went to three restaurants in Tokyo and Shinjuku. At the first, they had these bamboo caterpillars that you could tell had obviously been dead for a while. They got caught in the back of my throat. [Laughs] I needed a swig of beer to get them down.

The next place we went to had a smorgasbord of various insect species. One was this locust that ate rice leaves. It was cooked with soy, with a nice glaze, and because it ate rice leaves, when you ate the insect, you got this crunch, followed by this bright herbal taste that was unique. I've never experienced an ingredient like that.

Wasp larvae tasted like the white raisins you get in couscous. They were sweet, had a little pop as you ate them. When chefs regard insects as an ingredient filled with potential, you end up getting *fantastic* things.

SHOULD WE EAT MORE BUGS?

More than a quarter of the world's population eats insects, and the rest of us have plenty of reasons to join in.

If humans went extinct tomorrow nothing too much would happen to the planet, but insect extinction could be cataclysmic. Explain why.

Bug extinction is one of the most extensive extinctions on the planet. It's scary because you don't notice it until it's too late. Migration patterns are shifting due to climate, and insects offer a great way of looking at that. A collector went to the Antioch Dunes in California, in the 1960s, and caught a range of bugs. When scientists returned decades later, they found many species were gone, and the host plants with them. These creatures rely on plants and certain weather patterns and temperatures, an adaptive power they've gained over the past 400 million years.

Twenty years ago you could have seen one billion monarch butterflies migrate to Mexico. The latest count is 56.5 million. To combat the decline, the Obama Administration, working with Fish & Wildlife, enacted this migration highway running from Texas to Minnesota. They planted milkweed along the way, which is the host plant for monarch butterflies, hoping to quadruple that 56.5 million by 2020. I am an optimistic cynic, so I feel that insects will outlive us, if we haven't totally screwed the planet.

In bygone days, leeches were used in medicine. Tell us about how insects are being used to cure us today.

In human clinical trials in the U.S. and Australia they are looking at “[tumor paint](#),” a venom derived from deathstalker scorpions, which attaches to tumors, like a magnet. Biologists have paired it with fluorescents so now, during brain surgery, instead of relying on an MRI chart, you can actually see the tumors fluoresce in someone's brain. Brain surgeons can see exactly where they need to cut so they are not cutting away healthy tissue. In some cases, other parts of the brain light up, where you might have missed a tumor. It's revolutionizing brain surgery.

Cockroaches are helping scientists resolve antibiotic resistance. They love *shit*! They live in some of the filthiest areas although they themselves are very clean, and so they have developed a resistance to many infections. Instead of looking at plants and fungi for new cures, scientists are finally starting to look at insects.



Grasshoppers are eaten around the world. They were served fried at this Brooklyn insect-tasting dinner.

E.O. Wilson has called leafcutter ants, “Earth’s ultimate superorganisms.” Tell us about these amazing creatures—and what social organization in ants can tell us about our own societies.

We used to think that there was this class-based structure with ants. You had the worker, the soldier and, sitting above it all, the queen. However, entomologists today are finding that a lot of it is self-governance and that ants are communicating to each other at great speeds. You’ll have ants passing each other along a trail, making antennal taps, like Morse code: Hey, we gotta go this way, or go here for foraging.

[Deborah Gordon](#) is doing this fantastic research into a species of ants that crawls along the leaves of the trees where they reside. She found that if a leaf suddenly broke, the ants team together and rapidly repair it, using a sort of algorithm pattern, where they’re communicating at rapid speed. From that we might be able to study ways of repairing systems or mapping brains, and finding connectivity. Along with honeybees, ants are some of the most intelligent beings on the planet, along with dolphins and humans.

Bees have been making honey for us since Egyptian times. But currently there is a global crisis known as colony collapse disorder (CCD). What are its causes? And tell us about exciting work being done in the U.K. on “hygienic bees.”

CCD was this big alarm that went off in the mid-2000s. Entomologists have known there has been an issue with bees since [varroa mites](#) spread across the world in the 1980s-90s. But it is still a mystery as far as the cause is concerned. A lot of scientists now figure that the cause has probably been underneath their noses the whole time: varroa mites and stress factors from trucking hives across huge distances for pollination, which happens here in the U.S. but less in the U.K. and Europe. One scientist likens the varroa mites to having a rat attached to your body, leaching life from you.

Incredible work is being done on [hygienic bees](#) at the University of Sussex, in England. Naturally, evolution would favor varroa-resistant bees. So at the lab in Sussex, they are

breeding that particular trait, using queens that are varroa-resistant. Beekeepers in the States and across the world are seeking out these varroa-resistant, or hygienic, bees.



Monarch butterfly populations are declining and scientists can't pinpoint why.

You end your journey on the Greek island of Ikaria. What took you there? And how did writing this book change your life?

That's a good question! I'm just a stupid, curious individual. [Laughs] When I see something that interests me, I pursue it to its end. So, when I heard about this specific type of honey, to which local villagers attribute their longevity—on Ikaria it is common for people to live into their late 90s and 100s—I was fascinated. There is this honey called reiki, which is as thick as peanut butter and full of vitamins and nutrition. Of course, there are other factors that explain the islanders' longevity, like sociability. At the annual summer solstice celebration, they gather in their villages, play music and drink wine, then dance in a circle, with their arms linked. There's just love everywhere!

This journey's been something else! I went from being this jackass who, as a teenager, emptied almost a can of Raid on a spider, to discovering we are surrounded by these small, incredible things. Now I go around with my neck craned towards the ground. [Laughs] I have learned to stop and observe and appreciate. We're only here for a short amount of time. So it's comforting to know that there is something that will outlive us for millions of years.