New book explores relentless evolution in a constantly changing world

April 18 2013

When we look around in nature, most species seem well adapted to their environment. Scientists have found, however, that species evolve relentlessly and that evolutionary changes occur at a surprisingly rapid pace.

How to reconcile these observations is the focus of a new book by John N. Thompson, distinguished professor of ecology and evolutionary biology at the University of California, Santa Cruz. In Relentless Evolution (University of Chicago Press), Thompson argues that species must be able to evolve constantly or they will not persist.

"Evolution is more relentless and often more rapid than we thought as recently as a decade ago," Thompson said.

Populations within species evolve in different ways, adapting to local physical conditions and to a continually changing web of interacting species. Generation after generation, natural selection constantly adjusts the traits of populations. For the most part, however, this relentless evolution is not what most people envision when they think of evolution—it does not lead to the emergence of new species or "directional" change in the traits of a species.

"Much of adaptive evolution does not lead anywhere, yet these small changes are crucially important," Thompson writes. "These continual microevolutionary changes keep populations in the evolutionary game as they interact with other species that are themselves constantly evolving.

These seemingly aimless meanderings are the essential dynamics of evolution, with directional change and speciation as occasional outcomes."

Pathogens and pests that affect people and crops offer some of the most familiar and compelling examples of relentless evolution. Bacteria evolve resistance to antibiotics, insects evolve resistance to pesticides, and plant pathogens evolve to overcome disease-resistant varieties of crops.

In natural systems, biologists have documented hundreds of cases of ongoing evolution in a wide range of species. These examples include changes in morphological and physiological traits, life histories, behaviors, and interactions with other species. Microbial populations can evolve new traits in a matter of weeks, while plants and animals can evolve in detectable ways within a few decades or even a few years.

Relentless Evolution examines the pace and dynamics of evolutionary change and the ecological drivers of ongoing adaptive change in species and populations. It is Thompson's fourth book on evolution, continuing his exploration of the processes that drive evolution and shape the entangled web of life.

"Relentless Evolution is a masterful synthesis of scientific fields that are expanding at astonishing speed," said Carl Zimmer, an award-winning science writer and book author. "Surveying research as varied as lab experiments on bacteria to millions of years of coevolution between insects and flowers, John N. Thompson provides readers with a twenty-first century view of evolutionary change, unfolding all around us and shaping our world."

Provided by University of California - Santa Cruz