A global model for the origin of species independent of geographical isolation

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(PhysOrg.com) -- The tremendous diversity of life continues to puzzle scientists, long after the 200 years since Charles Darwin's birth. However, in recent years, consistent patterns of biodiversity have been identified over space, time organism type and geographical region.

Two views of the process of "speciation" -- the evolutionary process by which new biological species arise -- dominates evolutionary theory. The first requires a physical barrier such as a glacier, mountain or body of water to separate organisms enabling groups to diverge until they become separate species. In the second, an environment favors specific characteristics within a species, which encourages divergence as members fill different roles in an ecosystem.

In a new study, "Global patterns of speciation and diversity," just published in *Nature*, Les Kaufman, Boston University professor of biology and associate director of the BU Marine Program along with a team of researchers from The New England Complex Systems Institute, have collaborated and found a way to settle the debate which deals with the origin of species independent of geographic isolation.

They demonstrated, using a computer model, how diverse species can arise from the arrangement of organisms across an area, without any influence from geographical barriers or even natural selection. Over generations, the genetic distance between organisms in different regions increases, the study noted. Organisms spontaneously form groups that can no longer mate resulting in a patchwork of species across the area.

Thus the number of species increases rapidly until it reaches a relatively steady state.

"Our biodiversity results provide additional evidence that species diversity arises without specific physical barriers," the study states.

The computer simulations, the authors, note showed the distribution of species formed patterns similar to those that have occurred with real organisms all around the world.

"The model we put forward in the paper lays the groundwork for more powerful tests of the role played by natural and sexual selection, as well as habitat complexity in shaping the patterns of biological diversity that we see around us today," said Kaufman. Our insights can be applied to the immense challenge that we now face -- not only to prevent the extinction of a large chunk of life, but also to prevent ourselves from quenching the very forces that fuel the continuous creation of new life forms on earth."

This study is also the fourth in a series from The New England Complex Systems Institute on the role of complexity in species coexistence and evolutionary diversification.

"One can think about the creation of species on the genetic level in the same way we think about the appearance of many patterns, including traffic jams," said Yaneer Bar-Yam, president of The New England Complex Systems Institute and a senior author of the study. "While the spatial environment may vary, specific physical barriers aren't necessary. Just as traffic jams can form from the flow of traffic itself without an accident, the formation of many species can occur as generations evolve across the organisms' spatial habitat."

Source: Boston University Medical Center