

New clues found linking larger animals to colder climates

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Armed with an industrial vacuum cleaner, Chuan-Kai Ho, a 2008 Ph.D. graduate from UH's department of biology and biochemistry, went about collecting insects from marsh vegetation along the East Coast. This was done in an effort to find a new solution to a 163-year-old puzzle explaining why animals grow bigger in the cold. His collaborators were his dissertation adviser and UH professor Steven Pennings and Thomas Carefoot from the University of British Columbia. Credit: Amanda Thronson

Thanks to a pair of University of Houston researchers who found a possible new solution to a 163-year-old puzzle, ecological factors can now be added to physiology to explain why animals grow bigger in the cold.

Their results were published in the February issue of the [American](#)

[Naturalist](#), offering new insight to Bergmann's rule that animals grow larger at high, cold latitudes than their counterparts closer to the [equator](#). While traditional explanations have been based on body temperature being the driving force of this phenomenon, this group of community ecologists hypothesize that better food makes high-latitude [animals](#) bigger.

Chuan-Kai Ho, a Ph.D. graduate from UH in ecology and evolution, his adviser and UH professor of biology and biochemistry Steven Pennings, and their collaborator Thomas Carefoot from the University of British Columbia opened up a new line of study into Bergmann's rule. The research program in Pennings' lab over the last decade has offered the most extensive work done on the general problem of latitudinal variation in plant-herbivore interactions. This latest finding from Pennings' groundbreaking research at UH on this subject came from one of Ho's doctoral dissertation chapters.

"Because the *American Naturalist* is one of the top journals in our field, publishing at this level is a mark of great success for a Ph.D. student," Pennings said. "It's also a reflection of the strength of our graduate program in the ecology and evolution division of UH's department of biology and biochemistry."

Ho, now a postdoctoral student at Texas A&M at Galveston's Armitage & Quigg Laboratory, also has another chapter from his UH dissertation on salt marsh food webs published in *Ecology*, another top journal in the field. Pennings received a doctoral dissertation improvement grant for Ho in 2007-2008 from the National Science Foundation that provided funding for Ho to run chemical analyses on leaves from different latitudes to assess their nutritional content.

Studying three different plant-eating species - grasshoppers, planthoppers and sea snails - collected from along the Atlantic coast to

Japan, respectively, the researchers fed these herbivores plants from both high and low latitudes and found that they all grew better when fed plants from the higher latitudes. This indicates that Bergmann's rule could reflect that plants from high latitudes provide better food than those from low latitudes. These latest findings, according to Ho, indicate that studies of Bergmann's rule should consider ecological interactions in addition to the more traditional theories of physiology based on responses to temperature.

Over the years, work in Pennings' lab has shown that, although low-latitude plants are less nutritious and better protected by chemical defenses, they experience heavy damage from herbivores, which are more abundant at low latitudes. Future study, Pennings adds, should focus on why there are more herbivores at lower latitudes despite the lower-quality food sources. A likely explanation is that herbivore populations are limited at high latitudes by a short growing season and high death rates during cold winters.

"While the explanations discovered in our current study only apply to herbivores, it may be that carnivores and omnivores also might grow larger as a consequence of eating larger herbivores," Ho said.

"Examining such patterns and underlying mechanisms in nature will help us understand what currently is going on and what might happen down the line to our ecosystems."

Provided by University of Houston

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