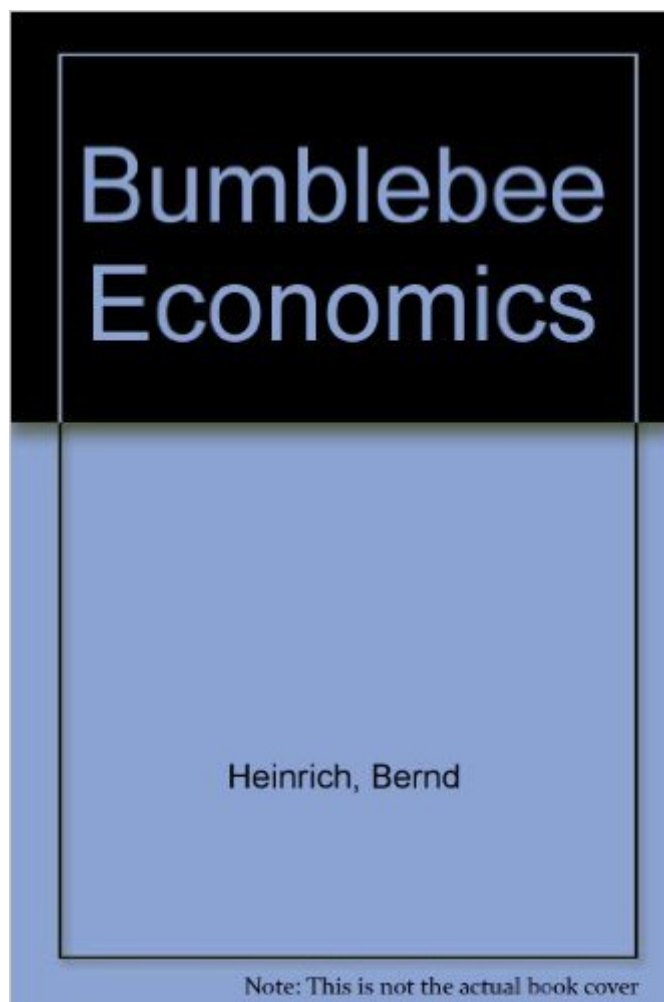


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# Bumblebee Economics



## Synopsis

In his new preface Bernd Heinrich ranges from Maine to Alaska and north to the Arctic as he summarizes findings from continuing investigations over the past twenty-five years--by him and others--into the wondrous "energy economy" of bumblebees. --This text refers to an alternate Paperback edition.

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## Customer Reviews

I thoroughly enjoyed this book. Heinrich presents relevant and well-considered research and experimental design in an accessible and easy-to-understand fashion. Having come off a bio class in which we did an extensive lab portion on population structure and evolution, I really enjoyed seeing such fascinating data on social insects. I was not, until having read Heinrich's book, familiar with the very major differences between honey and bumblebees. This book not only presents an excellent overview of how bumblebee's function (thermoregulation of flight muscles and suchforth) but also the economic factors (in pollen and nectar) that form the trade-offs that dictate behavior. Heinrich's observation that bumblebees develop 'major and minor' flower specialties that they exploit preferentially is a fascinating bit of information that synthesizes two commonly concieved as different fields. I'd highly recommend this book as not just beach reading for scientists but as a brilliant and accessible book on a very common pollinator.

The author explains that Bumble-bee queens (which are not accompanied by a swarm of workers

as are Honey-bees), must by themselves select and furnish a nest site, lay eggs and brood the resulting larva and then forage for pollen and nectar - whose sugar provides the energy needed for flying and nest warming. Heinrich brilliantly contrasts the foraging strategies of the bumble-bees with those of the plants which provide nectar and pollen and are in return cross-pollinated. He also explains how the bees control the heat flow from their thorax which contains the flight muscles, depending on whether they need to fly which requires a relatively high thorax temperature, or need merely to crawl, which allows them to dissipate less energy. The book concludes with a large set of references to the entomological literature at the time of publication, and a set of color plates to help in identifying about fifty North and Central American species of Bumble bees.

The bumblebee spends its days gathering the resources needed by the hive -- honey for energy and pollen for protein. This endeavor requires expenditure of nearly all the energy resources that the bee is capable of acquiring. Living on the edge as they do, energy requirements inform every aspect of the bees' lives -- from the way they choose flowers to harvest all the way to the way that blood flow may be redirected between the muscles of the thorax and the lower abdomen. It may sound as dry as an economics text when I tell it, but the author transports you to his summer home in Maine, where he sits and watches the bees and then devises simple but elegant experiments to tease out the subtle relationships between energy, anatomy and behavior, and the energy balances between the individual and the hive, and between the adults and the newborns.

The commercial use of honeybees has diverted attention from their generally larger and wilder cousins, the bumblebees. Overcoming the suspicions of his Maine neighbours, Heinrich applied modern technology and immense patience to learn about bumblebee lifestyles in local bogs and fields. What he learned overturned many assumptions about how these insects deal with the environment. He soon concluded that the life of the bumblebee is tied firmly to issues of dynamic energy balance. That balance is, in turn, related to the pollination needs of the plants they forage. In this illuminating and thoughtful presentation, the author provides a captivating picture of the bumblebee's role in Nature. In so doing, he demonstrates the interaction of different species to explain the process of co-evolution of different species. As a "social insect", the bumblebee reflects its evolutionary roots. It also seems to provide many "lessons" humans express the wish to emulate. Being in nearly constant motion during daylight hours, it appears "industrious". It also appears "frugal" in the acquisition and preservation of resources. Heinrich stresses how evolution has conditioned these behaviour traits, using human economic scenarios to explain the seeming

parallels. In order to survive a variety of environmental conditions, the bumblebee must engage in various cost-benefit scenarios. These include the individual bee's energy regulation, as well as the transfer of resources to meet the colony's needs. From the outset, the author notes how the lessons derived from bumblebee studies may be applied to broader ecological questions. He opens with the colony cycle, with a single queen launching a new brood-site. Development of the colony follows with individual bees making specific contributions. Bumblebees, unlike their honeybee cousins, perform their role as individuals. There's no "bee dance", which would be a wasteful exercise. Instead, the bumblebee, starts its day with a self-generated "warm-up" exercise, giving it the advantage of an earlier start than honeybees, which must be warmed by sunlight. Heinrich learned about these energy-related activities through precise measurements. Bumblebees were studied in free and tethered flight, their thermoregulatory mechanisms revealing surprising new forms. He further determined how bumblebees locate prime resource providers and how the insects can identify the best nectar producers. Heinrich ably combines tightly detailed evidence with its implications for the broader scope of Nature's mechanisms. Bumblebees are sometimes fooled by plants that have learned how to entice them to the pollen stalks without expending energy in generating a nectar reward. This revelation leads to a discussion of the likely path of bumblebee-plant coevolution. Plants, like the insects, must expend the minimal amount of energy to achieve pollination. The result is two, highly complex, interactive lifestyles each struggling to achieve the same end - reproductive success. Plant-bumblebee interactions have granted the insects a range that surpasses that of the honeybee. Bumblebees are found within 900 km of the North Pole and south into Tierra del Fuego. While the plants found in these sparse regions are few and far between, the efficient flight energy budget of the bumblebees provide the means for nectar recovery and plant pollination. It's a finely balanced system, the author notes, but works sufficiently well for both parties even in harsh environments. Heinrich's long experience in tracking, measuring and analysing bumblebee life cycles is carefully and expressively presented in this book. The exhaustive details are smoothly integrated into the larger picture of Nature's panorama. He has no illusions about this volume being "the last word" on this fascinating creature. Much remains to be learned, and threats to bumblebee resource areas are increasing, particularly as a result of the onset of rapid climate change. An Appendix explaining how to raise bumblebees is an aid to those wishing to contribute enlargement of the information on them. Excellent graphics, including maps of foraging patterns are a useful guide for those wishing to study bumblebees in their own areas. With a list of species and their ranges, illustrated with wing and body shapes, and colouration indicators, the student of these fascinating creatures is well-launched. Maintaining the continuity of his study is

the greatest compliment this author could receive. And he deserves many for this book and the work underlying it. [stephen a. haines - Ottawa, Canada]

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