females busy eating it while sperm are transferred. Males providing larger gifts therefore gain a larger proportion of fertilizations.

In a careful dissection of experiments on a variety of species, Gwynne concludes that the paternal-investment hypothesis has received the more support; in many katydids, the ampulla is completely empty long before a female has finished her gelatinous meal.

Nevertheless, much remains to be discovered about katydids. Indeed, one of the book's strengths is the prevalence of ideas for further research — there's a possible dissertation project on virtually every page. Why, for example, have so few katydid species lost acoustical function, compared with their equally musical relatives the crickets? What favoured the occasional evolution of parthenogenesis in this unlikely-seeming group? Why do some katydids mate only once? The section on risks and survivorship is particularly dramatic: "in nature, death usually comes from a plethora of hostile forces", including parasitoid flies that home in on the male's calling song, horsehair worms that burst from the body cavity like lethal spaghetti, as well as bats, frogs, birds and fungi.

One can quibble with any work of this magnitude, and I did my share. The references on a few topics, such as the role of sexual selection in speciation, were curiously outdated. Sexual-conflict theory — the conflict between males and females over mating — is a relatively new, hot topic in sexual selection, but is mentioned rather briefly; its explicit incorporation into ideas about spermatophylax evolution might have been fruitful. Gwynne draws a distinction between so-called passive and active female choice, a dichotomy I have always disliked. These bits of carping aside, *Katydid and Bush-Crickets* is a book to share with all students and professionals in ecology and evolutionary biology — and, who knows, maybe also with a few relatives at Christmas. ■

Marlene Zuk is in the Department of Biology, University of California, Riverside, California 92521, USA.

More biology

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Science in culture

Scope for sentiment

Joseph Wolf's illustrations of animals in action.

Martin Kemp

There seems to be a sharp contrast between the Victorian fondness for sentimental depictions of anthropomorphized animals and the hard objectivity of professional natural history in the mid-nineteenth century. Little apparently links the tough impersonality of darwinian 'natural selection' and the personalized beasts of Sir Edwin Landseer, famed for such paintings as *The Monarch of the Glen*. When we find these two poles represented in the work of one artist-illustrator, Joseph Wolf, we may wonder how he was able to accommodate such visual schizophrenia. I believe his work actually points us towards a reassessment of both the sentiment and the science.

Born and educated in Germany, Wolf enjoyed an immensely successful career in London from 1848 to 1899. He collaborated with some of the great naturalists of his day, including John Gould, Philip Gosse, Herman Schlegel and Daniel Elliot, providing them with great coloured lithographs of striking precision, and he long served as the chief illustrator for the *Proceedings of the Royal Zoological Society*. Yet his paintings, exhibited at the Royal Academy in London, tell affectingly emotional stories of the struggles between predator and prey in often-hostile environments, and his popular-book illustrations verge on animal capers.

The peak of Wolf's popularity came with *The Life and Habits of Wild Animals*, published in 1873 as a grand picture book with 20 woodcuts. *Inquisitive Neighbours* is typical of both the narrative quality of the illustrations and their humanizing titles. When we realize that the text — no less evocative and vivid in bringing the characters of the animals to life — was by the eminent American naturalist Daniel Elliot, for whom Wolf had previously undertaken five suites of illustrations, the schism between popular art and observational science is less clear cut.

Wolf himself claimed that, to depict creatures in lifelike action and interaction, the artist needed an accurate knowledge of the structures that give rise to their motion. He was scathing of those who know only "the map of an animal", such as those "ornithologists who don't recognize nature — don't know a bird when flying. A specimen must be well dried before they recognise it."

Even the apparently 'arty' expressions join seamlessly with scientific concerns, in particular with Wolf's engagement as one of the illustrators for Darwin's *The Expression of the Emotions in Man and Animals*, published just a year before his own *Wild Animals*. Darwin provides unexpected succour for those who sensed a similarity between the way human and animal emotions are manifested:

"No doubt as long as man and all other

animals are viewed as independent creations, an effective stop is put to our natural desire to investigate as far as possible the causes of expressions. With mankind some expressions, such as the bristling of the hair under the influence of extreme terror, or the uncovering of the teeth under that of furious rage, can hardly be understood except on the belief that man once existed in a much lower animal-like condition."

When we react with empathy to the threatened dove's puffed out chest and the alertly raised 'eyebrows' of the intruding squirrels, we are playing precisely to the kind of basic expressions for which Darwin was defining the mechanisms.

If the more sentimentalizing aspects of Wolf's art can be shown to adhere to scientific research, so we might surmise that Darwin's own picture of a nature in full-blooded interaction is unthinkable without the Romantic vision of those earlier artists, such as George Stubbs and Eugène Delacroix, who precociously delighted in vicious competition between the powerful and the weak, and the armed and the defenceless. ■
Martin Kemp is in the Department of the History of Art, University of Oxford, Oxford OX1 2BE, UK.

Visualizations: The Nature Book of Art and Science is a collection of essays edited by Martin Kemp (published by Oxford University Press and the University of California Press; £20, \$35).

Wolf's *Inquisitive Neighbours*, typical of his evocative depiction of animals.