What first comes to mind when you think about the special characteristics of spiders? Perhaps that they spin silken threads (the Old English word from which “spider” is derived means “spinner”). But anyone who has observed a spider keeping watch over its web may think of something else: that vibrations play a very important role in their behavior. The world in which spiders live is a world full of vibrations, and their vibration sense is correspondingly well developed. Take a blade of grass, use it to pluck gently on one strand in the web, and the spider will come running, expecting to find a captive meal. The many spiders that do not use webs to catch prey are equally sensitive. In later chapters (XVIII to XX) concerned with the details of prey capture and courtship, we shall see that spiders not only detect vibratory signals but also produce and transmit them as a means of communication.

First, however, some general functional principles of the spiders’ vibration sense must be clarified if we want to understand the behavior it controls. This is especially important because we humans, although also surrounded by vibrations, pay little attention to them and hardly respond at all to them on an emotional level. Which, by the way, makes it rather curious that the term “good vibrations” should have become so widely understood as an expression that things are going well (in German, similarly, a feeling of compatibility can be expressed as “having a good wire” to someone, although in this case there appears to be a reference to the undeniable significance of the telephone). For a spider, to speak of good vibrations would be perfectly reasonable. We shall understand this as we delve into their world, strange as it may be to our own experience.

The Metatarsal Vibration Sense Organ

The windows through which a spider’s nervous system sees its vibratory surroundings are extremely sensitive vibration receptors on the legs. Of particular interest is the so-called metatarsal organ, a lyriform organ so constructed and arranged that it is a very good detector of vibrations of the substrate. Furthermore, the metatarsal organ is the best example of an exteroceptive slit sense organ. Its sensitivity to vibration has been known since the early publications of Walcott and van der Kloot (1959) and Liesenfeld (1961) on web spiders. We ourselves then took a closer look at the metatarsal organ of Cupeniunus in 1972 and 1982 and succeeded, for the first time, in obtaining electrophysiological recordings of the activity of single slits. The dedicated work of Geethabali from Bangalore, India, who was visiting our laboratory at the Goethe University in Frankfurt am Main on an Alexander von Humboldt scholarship, greatly assisted this project (Barth 1972a,b; Barth and Geethabali 1982).

Position and Structure

In all spiders, the metatarsal organ is situated behind a cuticular ridge at the distal end of the metatarsus. Two features distinguish it from all other lyriform organs and slit sensilla: its position in the middle of the dorsal surface and the orientation of its slits, which are perpendicular to the long axis of the leg. Both of these contribute substantially to its high sensitivity (Fig. 1). The upward movement of the tarsus produced
Fig. 1 a-f. The metatarsal lyriform organ of *Cupiennius salei*. 

a Position of the organ distally on the metatarsus of all legs (see arrowhead, leg 4). b Scanning electron micrograph of metatarsal organ (arrow) in dorsal view. Me Metatarsus; Ta tarsus. c Length and arrangement of slits and site of the dendrite attachment to the covering membrane (see thickening). Arrow points distal toward the tarsus. d Lateral view of the joint between metatarsus and tarsus, showing the location of the metatarsal organ (see circle); am articular membrane. 

e Longitudinal section through the tarsus-metatarsus joint region. 2 (3) Distal (proximal) end of metatarsus (tarsus); sc sensory cells innervating the metatarsal organ, ne leg nerve. 

f View of cuticle at the site of a metatarsal organ from inside (exuvia). (Barth and Geethabali 1982; a photo E.-A. Seyfarth)