

Prologue

You must neither be discontented with yourself, which is weak spirited, nor self-satisfied, which is folly.

Balthasar Gracián 1637

Writing is a hard job. Long experience with the production of scientific texts leaves me with no doubt: selection pressure toward developing this skill has obviously been very low; evolution was much better at teaching our brains other things. When an author nevertheless undertakes the labor of writing a scientific book, a special *motivation* must be behind it.

Spiders are wonderful creatures, and do not deserve the bad reputation they often have. Their varied and complex behavior relies on highly developed sensory systems and is eminently well matched to the conditions in the habitat — as is evident from their evolutionary success. Since receiving my doctorate in 1967 I have never really stopped being preoccupied with the sensory systems of spiders. The main object of my attention has been *Cupiennius salei*, a large spider of Central America, and it is also the leading character in this book. I have been acquainted with *Cupiennius* for over three decades now. That is a long time. It seems an awfully long time if one places the work of all these years before the bar of public opinion, but also a delightfully long time when I think of the many things we have learned and experienced and how enthralling the voyage of discovery has been. No spider has ever been as extensively studied as *Cupiennius*. It not only showed us the path toward an understanding of many peculiarities of a spider's world, but also served as a kind of model animal, again and again raising questions of more general biological interest.

Two crucial questions underlie every page of this book: how do the various sensory systems of spiders work, and what role do they play in behavior? Four hundred million years of evolutionary history, extending back into the Devonian period, have equipped the spiders with a formidable array of biosensors. The first thing that fascinates physiologists like me is their “technical” perfection and complexity; but the subject matter here is much broader. Perfection and adaptation of sensory systems are not isolated phenomena; they are integrated into species-specific behavior in a species-specific habitat. The selection pressures operating in evolution are not exerted on individual sensory cells, neurons or ion channels, but on the phenotype of the animal in its entirety. What behaves and survives is the whole organism. The overarching context is thus not technological, but biological. Here the fit between environment and sense organs and the selectivity of the senses, as an interface between environment and behavior, play a dominant role. I hope that the twenty-five chapters of the book will make that clear.

The attempt to do *neurobiology* in this sense is also the reason why this book is not only the product of laboratory experiments on sensory physiology and neuroethology. Field observations and a quantitative assessment of the stimuli the animals encounter in their Central American habitat proved highly

relevant to an approach that may well be termed sensory ecology. Even questions about the taxonomic position and the geographic distribution of the various species of the genus *Cupiennius*, or about their daily activity rhythms, call for answers if the mechanisms of reproductive isolation, for example, and how they involve sensation are to be understood. In addition, woven throughout the fabric of the book is a simple conviction that Vogel and Wainwright (1969) once expressed in these words: "Structure without function is a corpse; function without structure is a ghost."

Some of the following 25 chapters, I fear, will be a little harder to assimilate than the reader in a hurry will find comfortable; but before becoming impatient, please remember that *details* are sometimes just as important as the principles they are meant to elucidate. Often detail is like wine: it must be savored at leisure if it is to be truly enjoyed. Moreover, I have tried not only to allow readers to share the experience of specialized research but also to encourage them time and again by providing a broader vista.

After 30 years, someone who has been involved all along begins to acquire a *comprehensive view* that is very difficult to piece together by brief or intermittent surveys of the many odds and ends in the specialized literature. In this book I am trying to convey something of this comprehensive view, in the hope of giving the next generation of sensory biologists and arachnophilic zoologists a useful foundation for further questioning and investigation. We live in a time of continual headlong progress in biology and also of a rapid shifting of interest; and we live in a time when analytical work seems all-important. To pause occasionally for synthesis and taking stock is not a luxury but a necessity.

Through all these many years, of course, we have been enthusiastic hunters of experimentally confirmable facts and causal relationships. That is of the essence of the natural sciences. The more facts became available, the more often it seemed to me as though the story we were deciphering took, for the initiated, a genuinely poetic turn. Struck by wonder, we enjoyed ever more moments in which time seemed to stand still, in which research was not simply being done but celebrated, and in which research trips were rightly dignified by calling them expeditions. I should be especially happy if readers of my book were now and then to perceive even a little of this special charm of the work of a biologist, who does not pursue an ordinary profession but makes his profession a way of life.

Incompleteness and *prematurity* are two inescapable attendants of even scientific work. I have tried at many points to highlight this fact. Sometimes we are deeply troubled by them, but then we should bear in mind that they are important forces, driving us to keep on pushing forward and wanting to know more. We are well advised to agree at least a little with Ed Ricketts, the biologist of Monterey, whose wisdom and way of life John Steinbeck's book *The Log from the Sea of Cortez* anchored in the world's literature: "Number one and first in importance we must have as much fun as we can with what we have." Knowing our goal only in part, and being only somewhat familiar with the route, we make many detours and wrong turns. Sometimes we must fall back on the insight of the cameleer: "He who goes into the desert cannot turn back. When there is no turning back, we must find the best way possible to go forward" (Paulo Coelho in *Der Alchimist*, Diogenes 1996). Anyone who has had as many enthusiastic companions as I on this long journey must count himself fortunate.

Without them, the “expedition” into the sensory world of the spiders would have been impossible. The reader will find names of my fellow wanderers on nearly every page.

The German (DFG) and later the Austrian (FWF) Science Foundation generously supported our research through many years. I thank Johannes Halbritter and Heidemarie Grillitsch for their help with the preparation of many of the figures and Maria Wieser for secretarial help. I am obliged to Ann Biederman-Thorson for her competent and careful translation from the German and to the Austrian Academy of Sciences for a grant making this translation possible. Collaborating with Dieter Czeschlik, Ursula Gramm, and Karl-Heinz Winter of Springer-Verlag was a pleasure and I much appreciate their effort to turn my manuscript into a handsome book.

My most profound thanks go to my wife for her understanding and tolerance.

Lofer and Vienna, Spring 2001

FRIEDRICH G. BARTH

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