Preface

Nowadays the word "pheromone" is well known. However, the popular image of pheromones usually involves some mysterious, invisible chemicals that make people attracted to the opposite sex perhaps because of the use of the word in the names of some perfumes. Pheromones have many functions. Indeed some of them function as attractants between the sexes, and some stimulate aggression between members of the same sex, especially in males. The function that perhaps is not yet well known is their affect on the reproductive status of others. In this context, males' pheromones stimulate females' reproductive status and females' pheromones stimulate males' reproductive status. Although studies in mice have progressed substantially, mechanistic clarification of these phenomena may provide valuable applicability to humans as well.

The study of olfactory communication in mice advanced dramatically during the last half of the twentieth century, beginning with the first observation findings on physiological changes in females in the 1950s to the chemical identification of the responsible pheromones that followed in the 1980s. The first observations were of the influences of conspecific odors on the estrous cycles and establishment of pregnancy in female mice, effects that came to be called Lee-Boot effect, Whitten effect, Bruce effect, and Vandenbergh effect (Chap. 3). These influences of conspecific odors on physiological conditions are called "primer effects," whereas the influences of conspecific odors on behaviors are called "releaser effects." In this book, I will focus on the primer effects, other than in Chap. 4 Identification of Pheromones, where I described about some releaser effects in explaining the pheromones that had been identified so far.

In the 1990s, olfactory neuroscience research produced a transition of the investigation of olfactory communication from classic behavioral biology studies to studies using the techniques in molecular biology and/or neuroscience, studies that included the use of transgenic mice. My own studies at college included animal psychology and I became interested in the field of ethology, the evolution of animal behaviors and their adaptive functions. I subsequently obtained my Ph.D. in Ethology and I later studied cell biology and the reproductive physiology of sperm

cells as a postdoctoral fellow at the University of Tokyo in the laboratory of Prof. Shinji Kamimura (currently at Chuo University, Japan). I found that sperm density in the males exposed to female-soiled bedding is enhanced and that sperm motility in the subordinate males is suppressed compared to dominant males (see Chap. 3).

My training in cell biology opened my eyes to microscopic studies of cells, a major transition from my earlier macroscopic studies of social behaviors in mice using mazes or encounter boxes. Following that, I expanded my professional training to neurogenesis and studies of mammary glands. That led to two additional new findings, an enhanced development of mammary glands in female mice by exposure to a male murine pheromone, and an enhanced cognitive function in the next generation of these females (both discussed in Chap. 5). I also identified the pheromones that stimulate adult neurogenesis (Chap. 5). In summary, my studies and collaborations with the people working in these diverse fields led me to discover four new primer effects that will be the main topics of this book: effects on sperm motility, sperm density, mammary glands, and enhanced cognitive function in the next generation.

I have intentionally included in this book the information that is difficult to write in academic papers. Examples include the details of mouse biology that may affect odors of mice and their responses to odors of other mice, as well as the key steps in the scientific endeavor that led to exciting results in successful experiments, or that led to negative results, which sometimes give us important information as well. This information may be important for students and for junior scientists. I believe that the ability to include such information is one of the benefits in writing a book.

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