Chapter 4
Sexual Conflict and the Dilemma of Stereotyping the Sexes

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In a world bursting with information, an important human capacity is the ability to stereotype. Stereotyping enables us to quickly draw conclusions and is in many cases more beneficial than a time-consuming evaluation. As an example, we may consider snakes to be dangerous and avoid them, although careful evaluation would lead to the more correct conclusion that some snakes in fact are harmless. Although an important ability, stereotyping can also be an obstacle in other societal circumstances as well as in scientific research.

Some of Western society's most common stereotypes regard gender, ethnicity, and age. The issue of stereotyping these groups has been discussed, for example, with respect to job interviews. Research in social psychology has shown that an interviewing employer tends to draw stereotyped conclusions about the job seeker, which may reduce the possibility of finding the most suitable employee. Over the past 50 years, gender equity questions have been extensively discussed in Western societies. Massive criticism has been raised concerning how men and women are expected to behave and organize their lives in accordance with a traditional, and stereotypic, pattern. Although society is changing regarding gender issues, most of us still have a learned view of gender roles established since early childhood, and we may find it difficult to become aware of this stereotype.

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Among the general public, there is a stereotyped view of biology and what is "natural" male and female behavior. For instance, it is regarded as "natural" for women to stay at home with their children. Yet such statements rarely find support in biological science. Nature is too diverse and multifaceted to draw any simplified conclusions about what is "natural" in all cases, it simply depends on the circumstances. Besides, what is present in nature is certainly not always inherently good or something we wish to establish in our society.

Due to our capacity for stereotyping and because of the gender stereotypes present in our society, we believe that human stereotypic gender roles are also used in biological research, which not only affects the research but also reinforces the societal stereotypic view of biology as a science. In biological science, studies of mating behavior and reproduction are well established. Deeper knowledge in this area is crucial to answering central and complex questions in biology, such as how ecological and evolutionary processes influence living organisms. These processes may lead to evolution of new traits and eventually to speciation, explaining why we see so many different life forms in nature. It is often particularly important to examine differences between the sexes and their interactions. Here, the problem of stereotyping the sexes becomes obvious. Therefore, it is important both to elucidate this problem and to consider how the sexes are conceptualized in research.

Here, we address how gender stereotypes may affect research on the biological sexes, and also how a constrained view of biological science may reinforce sex stereotypes in society. First, we will give a short introduction to evolutionary biology, and more precisely sexual selection and sexual conflict, because we believe a basic understanding of evolution is a prerequisite for following our line of reasoning. Then, we will highlight how culturally gendered stereotypes are transmitted to biological studies related to the sexes. Finally, we will suggest how to avoid stereotyping in our research field and discuss what both the research itself and society can gain from increased open-mindedness and a broader perspective.

4.1 What Is Evolution?

Theories of sexual selection and sexual conflict are part of evolutionary theory, which Charles Darwin presented in 1859 [1]. The recognition of evolution and how it affects all life forms enlightened the biological sciences and provided a general theory that is useful for investigating diversity in nature. In essence, evolution means that a population, a restricted group of individuals, changes genetically over time. The evolutionary process is thus based on variation among individuals that is genetically heritable. Individuals that are more successful (with respect to surviving and producing offspring) – and thus better adapted – will pass on their variation to a larger extent and their genes will be represented to a higher degree in the next generation. Evolution leads to continuous changes within populations without any predestined direction or endpoint. It is truly impossible to know what species will still be around 1,000 years from now.

The main driver of evolution is natural selection. Natural selection concerns the capacity of an individual to survive and to reproduce. Examples of what may affect survival are a well-working immune system or advanced food-finding skills. Selection regarding reproduction, such as the ability of individuals to attract and acquire mates, is referred to as sexual selection [2]. Here, selection operates on characters or abilities that directly result in reproductive advantages.

4.1.1 Sexual Selection: How Traits That Affect Mating Success Will Change with Time

Sexual selection has shaped many of the elaborate traits we see among animals and plants in nature [3]. Two main features of the theory are mate choice and within-sex competition. Within-sex competition may include various means of dominance, for example, fighting, competition for territory, or singing the most attractive song. Mate choice is characterized by individuals of one sex choosing a partner based on certain traits, for example, the colorful plumages and long tails of birds. In the context of mate choice, it is important to realize that choosing a partner does not necessarily involve any cognitive ability. As long as a particular individual is preferred more often than others for whatever reason, this individual will give rise to more offspring. Thus, the genes coding for the trait in question, for example, a colorful plumage, will increase within the population generation by generation.

The sex that predominantly does the choosing or competing depends on the ecology and the demography, and indeed each sex could do both. However, only during the past decade have researchers acknowledged a similarity in male and female sexual strategies. The standard view was that females always choose and males always compete, which indicates that traditional sex roles in human society may have had an impact on biological science. This view does not consider the possibility of flexibility in sexual strategies, which may depend on ecological circumstances; it is more of a fixed rule. As a result, important information regarding *how* sexual selection operates is omitted [4]. Today, we not only know that both sexes are indeed capable of choosing and competing but also that these behaviors may shift during a lifetime. One example in fish is the two-spotted goby, *Gobiusculus flavescens*, where male and female behavior shift over the season depending on the abundance of either sex [5]. Initially males are more competitive while females choose, but as the number of males decreases over the season, the sexual strategies are reversed.

4.1.2 Sexual Conflict Between Males and Females in Relation to Mating

A relatively new research field within evolutionary biology is sexual conflict. This field is centered on the conflicting interests of the sexes in relation to mating. Although the sexes have a common interest in producing viable young, they may

still use different ways of optimizing their own mating success. In a sexual conflict, one sex typically gains an advantage at the expense of the other, such that one sex more successfully mates, while the other is harmed in the process and suffers a mating cost. One example is the bumblebee, where males insert mating plugs in female genitalia, securing paternity of offspring, while the female is prevented from gaining the advantage of remating and producing higher-quality offspring [6].

The theory of sexual conflict was founded in the late 1970s by Geoff Parker [7]. Sexual conflict is not the same as sexual selection; it is rather described as an evolutionary conflict that can generate selection. Sexual selection may lead to sexual conflict, but other selective processes can also create the conflict [8]. As the field differs in major respects from the previously dominating sexual selection theory, several scientists regard sexual conflict as representing a paradigm shift in evolutionary biology [9]. For example, one important difference is the greater emphasis on the differing evolutionary interests of the sexes and also on the physical damage the sexes may impose on each other during their interactions.

Sexual conflict theory has helped to explain some unexpected behavior. One example is in bedbugs. Male bedbugs penetrate females with their penises anywhere on the female [10]. This behavior leads to higher mating success for the male and injury or risk of infection for the female. Another peculiar behavior that makes sense in the light of sexual conflict is exhibited in the penduline tit. In this bird, both males and females may desert the nest, although this will be detrimental to the present offspring [11]. Each sex will benefit if the other sex invests most in feeding the offspring, and more importantly, deserting behavior makes it possible to invest more in future offspring.

The theory of sexual conflict is broad and can be applied to all sexually reproducing organisms, as well as to plants and hermaphrodites (in which both male and female organs co-occur in the same individual), as the conflict always will arise when genomes from two individuals are necessary for producing offspring [12].

4.2 Active Males and Reactive Females: Gender Stereotypes in Sexual Conflict Research

Almost since the time Darwin [2] first presented his theory of sexual selection, it has been questioned and debated from a gender perspective. For instance, Darwin's theory has been criticized for focusing primarily on male reproductive success, as it often has been the variation among males and male traits that has been investigated, while females have been considered as a "limiting resource" for male mating [13]. The theory has also been criticized for describing male roles in active terms and female roles in passive terms [14]; traditionally the focus has been on female mate choice and male-male competition. That is, males have been active and operative, while females observed and chose them. Moreover, the terminology has been criticized because many terms describing the sexes' behavior have had human stereotyped and provocative connotations [13–15]. Females have often been described,

for example, as "coy," and "rape" has been used to refer to forced copulation in animals, although rape in human society has numerous implications – social, psychological, and legal – that may not be present in nature [15]. Sexual selection research has become less stereotyped as a result of this criticism and perhaps also due to scientific progress and deeper understandings of the subject. For example, male mate choice and female-female competition have been detected in an increasing number of species and the terminology has improved.

However, the important gender discussion in sexual selection research, as outlined above, has not yet been incorporated into the research field of sexual conflict. Indeed, sexual conflict research has produced a more neutral view of the sexes, highlighting that each sex is evolutionary favored by increasing its own reproductive success despite the cost to the partner [16]. Nevertheless, each sex is still described with sex-specific terminology and assigned sex-specific characters. Even though a conflict trait always confers negative effects on the other sex, male behavior is described using active and offensive terms (harassment, manipulation, persistence), while female behavior is described using reactive and defensive terms (resistance, avoidance, reluctance) [17], (see Table 4.1).

Table 4.1 Terminology used to describe behavior in scientific articles on sexual conflict, which sex the term was for and its value connotation. The summary is based on the 30 most cited sexual conflict articles (in 2009) and the connotation of terms is classified by two independent researchers [17]

Terminology	Sex	Connotation
Adaptation	Both	Neutral
Counteradaptation	Both	Reactive
Resistance	Females	Reactive
Avoidance	Females	Reactive
Reluctance	Females	Reactive
Accept	Females	Reactive
Defense	Females	Reactive
Refusal	Females	Reactive
Response	Females	Reactive
Decreased mating rate	Females	*
Reduction	Females	*
Delay	Females	*
Intimidation	Males	Active
Manipulation	Males	Active
Coercion	Males	Active
Enticement	Males	Active
Exploitation	Males	Active
Force	Males	Active
Forced copulation	Males	Active
Harassment	Males	Active
Intimidation	Males	Active
Persuasion	Males	Active

(continued)

Table 4.1 (continued)

Terminology	Sex	Connotation
Seduction	Males	Active
Stimulation	Males	Active
Imposed cost	Males	Neutral
Persistence	Males	*
Increased mating rate	Males	*
Enforcement	Males	*
Harm	Males	*

* denotes terms that the evaluating researchers classified differently

A similar pattern of active males and reactive females is found in mathematical models, that is, important mathematical investigations of the theory conducted to generate testable hypotheses. Here, it is generally more common for females than for males to be assigned costs, that is, negative effects [17]. Presumably as a consequence of this bias, the experimental research has focused much more on female costs than on male costs. Male mating costs, however, can be found in nature. One example of males obviously suffering a cost comes from spider behavior, where females typically cannibalize males in connection with mating. Instead of reproducing, the male may be eaten – indeed a cost for the male. As an adaptation to this cannibalistic behavior, males have developed conflict traits allowing them to escape from the female, such as long legs, agility, and vigilance [16]. Another example of a negative male mating cost is in the African topi antelope, where females enhance their probability of mating with favored males through aggression toward mating pairs. This behavior causes the male to counterattack and resist the mating attempt, at the cost of losing energy (i.e., suffering an energetic cost) [18]. Few empirical studies on sexual conflict have considered the costs to both sexes in the same study. However, Holland and Rice [19] examined how both sexes were affected by a conflict over mating rate. Interestingly, though the authors find that there is a cost of sexual conflict to both sexes, male traits are still referred to as "harmful," while female traits are referred to as "resistance." Recalling that sexual conflict theory states that either sex will strive to increase its own mating success at a cost to the opposite sex, this antagonism ought to be reflected both in the subjects investigated and in the language used. As this is not the case, it seems as if sexual conflict research, too, has adopted sex stereotypes and a traditionally gendered terminology.

The terminology used for describing behavior and traits may further affect the choice of study species. Thus far, only a few studies have investigated sexual conflicts in organisms outside the group of animal species with separate sexes. This is unfortunate, as a general theory should not be based on only a few examples. Active actions, such as force, may be difficult to envisage in plants and hermaphroditic

animals, and the gendered terminology may limit the choice of research organism. That is, sex-stereotypic terms, such as harass and resist, certainly give a picture of one male and one female engaged in reproduction, excluding sexual systems not easily associated with such terms. If we exclusively select study species to which sex-stereotypic terms are easily applied, then sex stereotypes will be reinforced – not because they are general but because the selection of study species is biased and they are the only alternatives investigated.

4.3 Stereotyping in Sexual Conflict Research: Problems for Science and Society

The dilemma of generalizing and stereotyping is a never-ending story. As much as we are aware of the problems it can cause, we still need to categorize information. In this process, many mistakes of stereotyping will be made. Here, we have focused on the use of stereotypic portrayals of sexual strategies in biological research. Researchers, like everyone else, are influenced by societal norms. It is not that difficult to find parallels between stereotypic views of women and men and the ways in which females and males have been described in the sexual selection research. This has been noted in the field of sexual selection. However, when sexual selection theory developed into the new field of sexual conflict, the discussion on gendered terminology was somehow lost. Instead, this new theory created its own sex stereotypes, involving active males and reactive females.

The gendered terminology of sexual conflict may in fact have affected the development of the theory of sexual conflict, especially regarding how the cost of mating is assumed to influence either sex. Apparently, costs are imposed by active traits (of males) on an individual (female) possessing conflict traits or behavior that has a more vulnerable resonance (e.g., resistance). Thus, only active terminology implies that a trait should infer costs. In this case, the scientific language used could be an important factor in shaping the gender bias as regards costs. In turn, this could strongly affect which experiments are conducted and thus which research results are available to consider. What would the sexual conflict research look like today if neutral terminology had been used? Perhaps we would know more about the male costs of mating, reproduction in hermaphrodites and in plants, and perhaps "new" behaviors in males and females would have been discovered. More importantly, we would probably have a better general knowledge base in the area of sexual conflict. Our research to date has shown that stereotyping may indeed have limited the research questions, leading to a constrained view of sexual selection/sexual conflicts in nature. We argue that the continued use of stereotypic terminology and a narrow interpretation of the theory should be avoided as far as possible.

4.3.1 How Can Researchers Avoid Using Sex-Stereotypic Terminology?

The next question will then be how we can avoid using sex-stereotypic terminology in research. One first step for researchers is to be aware of their own most common generalizations. We suggest that one way to start thinking about these issues is to reflect on them more regularly, and not only on specific occasions. It would then be easier to reach a level of awareness where neutral terms and open-mindedness about what sex implies are the norm, and gender stereotyping is acknowledged as a problem. If this problem is not acknowledged, it will be difficult to publish critique both because such critique will not be regarded as important and because the content will be misunderstood. As a result, we will not be able to reach other scientists to discuss these issues. Ultimately, the scientific bias caused by stereotypic gender conceptions should be treated in the same way as scientists treat other confounding factors. This is particularly important because scientific theories are continuously changing, as is the case of sexual selection theory, and awareness of gender issues will increase the quality of theory development.

Indeed, sexual conflict theory has a great potential to explain biological diversity. By avoiding stereotypic thinking, sexual conflict researchers may make important discoveries that can improve sexual conflict theory. One way to minimize our prenotions about sexual strategies is to ask the same question for both sexes or to conduct the same experiments on both sexes [20]. This method would allow us to explore how each sex evolves but in a neutral fashion. However, for practical reasons this is not possible in all species. We suggest that hermaphrodites may be particularly appropriate subjects for conducting symmetrical experiments and challenging stereotypic reasoning in sexual conflict research.

4.3.2 Improved Communication and Possibilities to Kill Myths

What effect does the use of sex-stereotypic terminology in biological research have outside the scientific community? One problem is that the general public might assume that stereotypic descriptions of males and females are "natural," especially when new knowledge is unintentionally framed in terminology referring to coy females and competitive males. The risk is that this kind of stereotyping will reinforce gender stereotypes. If older stereotypes are to fade away, researchers must not only perform unbiased research but also be more active in *correctly* communicating up-to-date research to the public. It may not always be possible to change gender-stereotypic views and what is perceived as natural through information about new research results, as many of our gender preconceptions are affected by strong feelings related to learned values. Even so, scientific research is expected to provide the public with scientific knowledge that can be utilized when needed, such as for challenging myths.

Biology is sometimes stressed as an argument for explaining and justifying patterns we see in society, for example, traditional human sex roles. This is based on an inaccurate and limited view of what biological sex actually entails. Recall the penduline tit, a bird species in which both parents may desert the nest. This kind of information has the capacity to kill myths. In nature, it may be very "unnatural" for females to assume greater responsibility for parental care, as in fishes where males commonly provide unipaternal care.

If anything, biology and evolutionary science can help explain the fact that flexibility and adjustment to ecological circumstances are important capacities, and that individuals, in a wide array of species, do change their sexual strategies. Biological research does indeed confirm that nature is much more flexible than what is typically described.

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