

## Sex Differences in Biobehavioral Responses to Threat: Reply to Geary and Flinn (2002)

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Early theories of stress obscured differences in how men and women respond to threat. The tend-and-befriend model attempted to partially redress that oversight by identifying biological and behavioral patterns of stress responses distinctive to females, responses that are markedly social. Although men's behavior under stress may also be social, at least under certain circumstances, extending the tend-and-befriend model to men is premature and potentially flawed, from the vantage points of the underlying biology and the behavioral stress responses it may help to foster.

D. C. Geary and M. V. Flinn (2002) have offered a commentary on our tend-and-befriend theory that provides intriguing extensions to the stress responses of men. We concur with some of their ideas and disagree with others. Nonetheless, we believe this debate will spark constructive attention to the limitations of previous models of stress for understanding the many ways in which both men and women respond socially and biologically to stress.

### Is There Male Tending?

Geary and Flinn (2002) have suggested that male paternal behavior is evidence of "tending," as we have used the term. We do not agree. Men are certainly good fathers, especially when compared with other mammalian fathers. The tend-and-befriend model is not about parenting, however; it is a model of biobehavioral responses to stress. We present evidence that hormones are released under stress that increase maternal tending, and we provide evidence that tending behavior under stress does indeed occur

in human and nonhuman females. Neither Geary and Flinn nor the sources they refer to provide evidence that the hormones or behaviors associated with fight or flight in males are suppressed under stressful conditions to favor male tending instead. Given the different hormones and behaviors identified to date in males' responses to stress, whatever social behaviors males may engage in under threat may well assume quite different form than is true of females.

Male hormonal responses to stress do not appear to support tending responses, but they may lead to alternative patterns of social responding. Testosterone increases in response to some stressors, and vasopressin is also implicated in males' stress responses. Vasopressin's actions are enhanced in the presence of testosterone, and vasopressin has been tied to defense and patrolling of territory in male animal models (e.g., Carter, 1998). Consequently, one could argue for an influence on male protective behavior under stress via vasopressin, a hormone that is structurally very similar to oxytocin. As these hormonal patterns would also imply, aggression in response to stress is also more behaviorally descriptive of males than females (e.g., Mazur & Booth, 1998), suggesting that the "fight" response may better characterize men's than women's responses to threat. We believe that any model of male responses to stress will need to take evidence like this into account.

### Reciprocal Altruism

Geary and Flinn (2002) have suggested that befriending in women is based more on reciprocal altruism than on tending. Reciprocal altruism is a powerful behavioral aspect of social interaction, but it is unclear what its biological underpinnings are. In our tend-and-befriend model, we present neuroendocrine evidence that implicates some of the same neurocircuitries in female friendship as are implicated in maternal tending. On this basis, we

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argue that befriending among women may have piggybacked onto the maternal neurocircuitry, a position initially suggested by Keverne and colleagues (Keverne, Nevison, & Martel, 1999). This is a conjecture on our part, not a central argument of our theoretical position, but we present empirical neuroendocrine and behavioral evidence to support this conjecture. Geary and Flinn have made a reasonable descriptive case for reciprocal altruism as a mechanism underlying tending, but it is unsupported by empirical evidence.

We believe that our argument, namely that befriending may have coevolved or been a consequence of the tending response, and Geary and Flinn's position, with respect to reciprocal altruism, are not fundamentally incompatible because they address different levels of theory. Reciprocal altruism is a broad principle that attempts to explain how, among other things, altruism gets into selfish genes. Our explanation is at the level of the neurocircuitries and specific behaviors through which befriending may occur. To set two such different levels of analysis against each other is to miss the point that these two theoretical vantage points address fundamentally different questions.

### Befriending in Men and Women

Contrary to Geary and Flinn (2002), we suggest that the patterns of affiliation under stress among men and women are quite different. Females seek and give social support at levels that are markedly, robustly, and qualitatively different from those of men (see Taylor et al., 2000, for a review). Contrary to Geary and Flinn's characterization of our position, we drew not only on evidence from Western cultures to make this assertion, but also on evidence from 18 additional cultures that found substantially the same thing (Edwards, 1993; Whiting & Whiting, 1975). If the accumulation of cultural evidence on affiliation ultimately demonstrates that men are more affiliative under stress than women, then we are prepared to be proven wrong on this point. However, the cultural evidence to date clearly demonstrates that women are the more affiliative sex under stress by a large margin.

### Philopatry

Which sex leaves the natal group to migrate to another group is certainly an important factor that influences social behavior. Among chimpanzees, bonobos, and humans—all of whom are very closely related genetically—female rather than male dispersal appears to be the typical pattern (Nishida & Hiraiwa-Hasegawa, 1987; Wrangham, 1987; although the evidence for early humans is largely conjectural). However, this issue may have little relevance for processes of tending and befriending under stress, except in one respect: When females are the migrators, befriending is likely to occur among nonkin rather than among kin.

Bonobos, who leave their natal troop to join a new one, represent an example. Several investigators have documented the strong nonkin bonds formed among female bonobos in their new troops (e.g., Parish & de Waal, 2000). These strong ties are thought to be one reason why bonobos largely escape the abuse by males that female chimps (whose bonds in the wild are weaker) typically incur from males. Consistent with this argument, in captive populations or populations under stress, female bonds among chimpanzees are stronger, perhaps because they need more protection in geographically tight or stressful situations (Boesch, 1991; de Waal,

1993). In the cross-cultural literature in humans, the evidence suggests that when women emigrate and are unable to form alliances with other women, they are at heightened risk for abuse (e.g., Mitchell, 1990; Wolf & Witke, 1975). Geary and Flinn (2002) pointed out that “men's coalitions provide a protective social ecology” (p. 748) for women's tending and befriending. But only to a point. Women's ties with others also serve to shelter themselves and their infants from abuse by males; both animal and human data clearly show the relation between strong female ties and lower rates of abuse by males.

In summary, we view philopatry as a moderating condition that does not fundamentally alter the existence of tending and befriending among females under stress but that may somewhat alter their form, as noted above.

### Men's Befriending

Geary and Flinn (2002) suggested that male coalition formation is a counterpart to female befriending. Men do indeed form coalitions, but the extensive literature on this issue suggests that it is largely for purposes of building or maintaining a position in a dominance hierarchy, warding off or defending against aggression by other males, and protecting or creating resources that facilitate access to females. There are examples in the primate literature of females forming coalitions for some of the same purposes. However, befriending also involves activities related to child care, to food distribution, and to protection in times of threat. Coalition formation is not synonymous with befriending, nor are male coalition formation and female befriending—especially under conditions of stress and threat—likely to be guided by the same neurocircuitry and psychological mechanisms.

### Women's Befriending

We have few concerns regarding Geary and Flinn's (2002) characterization of female same-sex egalitarian relationships as opposed to the dominance hierarchies related to affiliation that is characteristic of males. However, some qualifications may be in order. Geary and Flinn argued that female friendships require more investment and are more readily disrupted than are men's friendships. The empirical evidence does not support these assertions (Maccoby, 1998). There is no evidence that female friendships require more investment than male coalitions. Female activities are more likely to end when there is conflict than is true of males, but conflict is also less common among groups of females than among groups of males (e.g., Maccoby, 1998).

### Female–Female Competition

Geary and Flinn (2002) credited us with the assertion that “there is not a strong evolutionary foundation for female-on-female aggression in humans” (p. 748), and they disagree with that statement. So do we. We never made such an assertion, nor did we make any statement that should be construed as support for such an implication. That female ties exist in the context of forces that also breed competition goes without saying. Competition characterizes both male ties and female relationships, and it exists in all primate species that have been studied.

### Biological Model

Geary and Flinn's (2002) extensions to the tend-and-befriend model ignore our proposed neuroendocrine mechanisms. The neuroendocrine model does not, indeed cannot, apply to men: It draws on estrogen, which exists in very small quantities in men; oxytocin, which appears to be enhanced by estrogen and antagonized by testosterone (a hormone that increases in men in response to many stressors); and endogenous opioid peptides, which appear to have different effects on the social behaviors of men and women (e.g., Jamner, Alberts, Leigh, & Klein, 1998). These points question whether it is scientifically defensible to look at men's social behavior under stress through the biobehavioral perspective we have developed for women.

More generally, we have been concerned by the degree to which some social scientists commenting on our model have ignored the biological evidence and the data from animal models that underlie it, favoring, instead, constructions of what early humans might have been like. Such constructions are risky in the absence of direct evidence, and not surprisingly, they have varied dramatically from decade to decade (see Rose & Rose, 2000). We are not opposed, in theory, to such reconstructions—many valuable insights have come from them (e.g., Barkow, Cosmides, & Tooby, 1992). However, to ignore biological evidence and continuity among animal models for understanding the origins of human development is to eschew very important sources of scientific knowledge. We believe that scientific progress will come only with willingness to integrate biological and behavioral evidence. In this context, we note that both Geary and Flinn have been in the vanguard of efforts to integrate biology and behavior in masterful ways in their prior and current work. Our disagreements with them on some specific issues we discuss here do not challenge our genuine admiration of their research legacy and its biobehavioral focus. In fact, it is this form of scientific analysis that we had hoped our model would encourage.

### Conclusion

We developed the tend-and-befriend position because we believed that the existing models of stress (Cannon, 1932; Selye, 1956) obscured important biological and behavioral differences between the sexes and overgeneralized evidence from men to women, who have faced quite different selection pressures throughout human evolutionary history. In our article (Taylor et al., 2000), we illustrated how a general model, fight-or-flight, is insufficiently precise to account for specific neuroendocrine and behavioral stress responses characteristic of women. We used biological and behavioral evidence to jointly constrain our model. To take the tend-and-befriend theory and try to broaden it to include men without any of the qualifying biological and behavioral precision of the original model would do a disservice to the field. Nonetheless, we agree with Geary and Flinn (2002) that the study of stress will be well served by attention to men's and women's social and biological responses to stress—both the commonalities in their responses and the differences.

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