(Bevans et al. 2005; De Bellis 2005; Heim et al. 1997a; 1997b; Kaufman & Charney 2001; McEwen 2003). Increased stress may lead to chronic cortical dysfunction and activation of the hypothalamic-pituitary-adrenal axis with associated systemic health detriments including hypercortisolemia, immunosuppression, and elevated blood pressure.

Animal studies have examined the impact of trauma on developing brain function. In rat models, infant stress through maternal separation causes increased basal and stress-induced adrenocorticotropic hormone (ACTH) and corticosterone, increased hypothalamic, amygdala and locus ceruleus noradrenaline and corticotropin activity, reduced gamma amino butyric acid (GABA) tone, and hippocampal atrophy (Ladd et al. 1996). However, ACTH response to air-puff startle decreased with handling or foster mothering (Huot et al. 2004). Similarly, in infant macaques, peer rearing rather than maternal rearing (a model of neglect and abuse) is associated with increased ACTH response to separation. However, serotonin gene promoter polymorphism (5-HTTLPR) moderated this effect: Animals with the l/l allele had a lower ACTH response (Barr et al. 2004). Although the molecular details of how childhood experiences shape mental health in humans is unknown, the model of maternal care as the mediator of experience-dependant changes in gene expression has been the subject of numerous recent studies in rats (Meaney & Szyf 2005). Meaney and colleagues describe a fascinating model, in which the environment shapes the expression of glucocorticoid receptors. Tactile maternal stimulation of the rat pup (licking and grooming) stimulates serotonin release in the hippocampus. This, in turn, increases the second messenger cAMP, which activates protein kinase A and stimulates nerve growth factor 1A (NGF-1A), which increases glucocorticoid receptor expression. In addition, NGF-1A causes long-term cytosine demethylation, and histone acetylation that increases NGF-1A binding into the animal's adulthood. This is likely one of several mechanisms by which cruelty towards infants – in the form of physical, sexual, and neglectful traumatic abuse – has long-term consequences.

The possible mechanisms by which early trauma may shape long-term mental health are beginning to be studied (Bevans et al. 2005) in humans as well. In adults, trauma is associated with a range of measurable changes in the stress-response system including increased CRF and noradrenalin in cerebrospinal fluid (Bremner et al. 1996). In one of the first studies of gene–environment interaction in the manifestation of psychiatric problems in children, Kaufman and colleagues have found that the quality and availability of social supports moderated risk for depression associated with a history of maltreatment and the presence of the short (s) allele of the 5-HTTLPR (Kaufman et al. 2004). Maltreated children with the s/s genotype and poor positive supports had the highest depression ratings – scores that were twice as high as the non-maltreated comparison children with the same genotype. However, the presence of positive supports reduced risk associated with maltreatment and the s/s genotype, such that maltreated children with this profile had only minimal increases in their depression scores. These findings are consistent with emerging preclinical and clinical data, suggesting that the negative outcomes associated with early stress are not inevitable. In fact, it appears that the risk for negative psychiatric outcomes is modifiable through both genetic and environmental factors. Specifically, it appears that the quality and availability of social supports are among the most important environmental factors in promoting resiliency in maltreated children, even in the presence of a genotype expected to confer vulnerability for psychiatric disorder.

Given the debatable benefits of cruelty, especially with the knowledge of the negative psychiatric outcomes, and the predisposition to warlike behavior (as described in the target article) in an age of weapons of mass destruction, it appears fortunate that human adaptability through experience-dependant chromatin plasticity may provide a means to reduce human violence. Perhaps cruelty is preventable through interventions at the earliest stages of human development aimed at eliminating child neglect and abuse. Further studies of the molecular mechanisms may also suggest treatments aimed at older children and adults already affected with approaches that combine pharmacological targeting of those molecules along with psychotherapy aimed at reprogramming the stress response system.

Predation versus competition and the importance of manipulable causes

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Abstract: It is difficult to fully account for (1) cruelty in modern society and (2) female cruelty, referring only to a cruelty-satiation association. Instead it seems likely that cruelty acquires its reinforcing value via association with a range of reinforcers. In addition, when one's goal is violence prevention, it is important to identify causes that can be manipulated.

Nell argues that cruelty is a by-product of predation and suggests that signs of pain, blood, and death come to function as positive reinforcers as a result of their association with satiation. However, in modern society few individuals will have the opportunity to acquire such associations, and yet, as Nell points out, examples of cruelty abound. How then can we account for these? One possible explanation is that signs of pain and death have at some point is our evolutionary history become primary (i.e., innate) reinforcers, on a par with food and sex. This seems inconsistent with the vast numbers of men who find the idea of physical cruelty highly aversive. An alternative explanation is that our predatory heritage has left us predisposed to more readily acquire signs of pain and death as *conditioned* reinforcers (see Seligman [1971] for a similar theory of "preparedness" in relation to phobias). Thus, signs of pain and death would very rapidly come to function as reinforcers but *only* after the individual had associated them with existing reinforcers (e.g., approval or submission; see Skinner 1953). It would be possible to test this hypothesis experimentally, though perhaps a challenge to do so ethically.

However, this cannot account for the data on female aggression. Nell states that, because of its association with hunting, active cruelty is likely to be strongly male-gendered. Yet research shows that while males employ more "direct" or "overt" forms of aggression than females (e.g., physical aggression), females employ more "indirect" or "relational" forms of aggression than males (e.g., excluding someone from a group, spreading rumours) (Bjorkqvist et al. 1992; Crick & Grotpeter 1995; Tapper & Boulton 2004). These indirect forms of aggression are consistent with Nell's definition of cruelty as "the deliberate infliction of physical or psychological pain on a living creature" (target article, sect. 1).

What are the implications of female aggression for Nell's theory? If in our evolutionary history cruelty was a marker for male hunting skills, it would have been adaptive for females to be attracted to males who displayed this trait. In a culture that is reliant on hunting, it is also reasonable to assume that females would not be averse to cruelty and may also derive some pleasure from it. However, given that most hunting would have been carried out by males, one would still expect to find higher levels of cruelty among men. How then can we account for the fact that when it comes to psychological cruelty, the evidence suggests that females are more likely to be the perpetrators?

One possible explanation is that much cruelty is a by-product, not of predation, but of competition for resources. (For females

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this might consist of access to high status partners for oneself and one's offspring.) In this case, signs of victim suffering and/or death would acquire their reinforcing value via repeated association with a wide range of other reinforcers. For example, if Peter frequently hits John, making John cry and give Peter the toys he's been playing with, the sight of John crying may eventually become a conditioned reinforcer because of its association with access to toys. As a result, Peter may start to hit more often, not simply to gain toys, but also to make other children cry (see Patterson et al. 1967).

Additionally, cruelty may arise even in the absence of direct contact with reinforcers. Diamond (2005) argues that a major contributing factor to the Rwandan genocide of 1994 was a rising population that had resulted in land shortages and extreme poverty. He suggests that land and resource redistribution were major incentives for the killings. In this example, individuals may not have had previous experience of gaining land as a result of killing but may have had a cognitive representation of this association. They may also have mentally linked killing to a variety of other positive outcomes, such as notions of justice and retribution. As a result, the act of killing may have become imbued with some of the positive emotions associated with land gain, justice, and so on (see Hayes et al. 2001). Hence, in this example it is not our predatory nature that distinguishes us from other species and accounts for the widespread cruelty, but our cognitive ability to link killing to a range of positive notions and outcomes.

Thus, although predation may help account for the prevalence of physical cruelty, it seems too restrictive to relate all forms of cruelty to predation. Rather, it appears possible to account for cruelty via its association with other reinforcers, many of which may stem from resource competition. Such associations in our ancestors could have contributed towards an innate predisposition to enjoy cruelty (see above). However, even in the absence of any innate predisposition, such associations are still able to account for cruelty in the modern world.

Turning to violence prevention, Nell calls for descriptive data on eliciting triggers to cruelty and the gratifications of perpetrators. This is in accord with the views of aggression researchers who have also argued for more descriptive data (Archer 1995; Tapper & Boulton 2002; 2005). However, when it comes to prevention, we need to identify the most manipulable causes. In this regard, aspects of modern society structure may be more important than insights from our evolutionary history. For example, research indicates that among primary school children certain types of aggression will mainly result in positive responses from onlookers (Salmivalli et al. 1996; Tapper & Boulton 2005). This suggests that the rewards for much school aggression may lie in the responses of onlookers rather than any form of material gain. Attempting to reduce or remove reinforcement from onlookers may therefore be one route to aggression reduction. It is possible that this analysis may also apply to certain types of adult cruelty, such as incidents of prisoner mistreatment. The aggression literature contains many such examples that would usefully inform attempts to collect data on, and make sense of, the more extreme forms of violence referred to by Nell. A research programme of this kind would be invaluable.

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Torturers, horror films, and the aesthetic legacy of predation

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Abstract: A Rousseauist bias towards the study of human aggression has treated it as a regrettable anomaly rather than a volatile reflection of important forces in human evolution. Intrepidly, Nell displays the arc of connection between predation in humans and other animals and the neurophysiological factors that underlie chronic interest in accident, death, and harsh force.

Plus ça change. There is an arc between this excellent and provocatively well-researched essay and Robert Ardrey's *African Genesis* (1961), which was immensely controversial when it first appeared. "Not in Asia and not in innocence was man born . . ." set the stage for a hot debate about the naturalness or not of human aggression (Ardrey 1961). Though Ardrey did not deal with the issue, Nell here innovatively portrays the issue as also an aesthetic one – of the fact that there are brain circuits (not modules, for heaven's sake) that respond to and sustain the extraordinary behavior in which humans and other animals engage and which he describes. It seems clear that a species committed to predation should have a set of positive emotional and physiological correlates to accomplishment of the task. I tried in my book *The Pursuit of Pleasure* (Tiger 1992) to suggest that the push of scarcity and fear had to be accompanied by the pull of pleasure and reward in motivating people. Here, with punctilious and imaginative (in the good sense) scholarship, Nell makes the case for the pull of cruelty as a factor in the human repertoire.

Now, of course, no one likes this, and a large precinct of the academy is devoted to claiming that cruelty and its cousins exist mainly because a few bad people contrive to dragoon many people into bad schemes. The fact that teenagers on budgets will willingly spend 16 or more dollars for two tickets to a horror film is attributed to – what? Years ago I attended a conference in Knoxville at the University of Tennessee, about morbid curiosity. One of the other speakers was a state trooper who described the difficulty his force had in coping with drivers evidently eager to see the content of an accident scene. There is a whole police drill for dealing with this particular aspect of policing, which Nell's analysis illuminates. If nothing else, accident rubberneckers are clearly acknowledging that "there but for the twist of the steering wheel go I," and that it is instructive to know the potential outcome of one's behavioral options.

So, in part, the interest in mayhem, cruelty, and accidents reveals a sensible concern about preparing the self for eventuality. And the worldwide fascination with the natural disasters, which are a staple fare of television and other news providers, is also an index of human awareness of the thin membrane between normality and perilous even fatal disruption of life's patterns. The burgeoning of human populations escalates the number of victims of natural disasters such as floods and earthquakes, which routinely occur. Greater mobility because of the availability of vehicles and energy for personal transport may in fact also increase awareness of the intrinsic risk in any community. Sharp right angles, unyielding metals, and fast-moving large objects are easily perceived potential messengers of personal horror. It is also reasonable to assume that changed technological conditions have produced changed levels of awareness of personal safety. They have possibly even fueled enthusiasm for graphically anti-empirical religious notions of salvation and ecstatically comfortable other-worlds.

Nell is informative about the role of cruelty in politics, which, as we know, ranges from producing genuine amusement for many leaders such as Idi Amin and Saddam Hussein to causing routine beatings by guards and police of human beings under their control and presumably in their care. I have for long wondered when and where are the national and international conventions of torturers – there must be such, even if they consist of covert subsets among broader gatherings of those concerned with policing and warring. The restorative and benign – and puzzlingly popular – response to cruelty and torture is reflected in endless spectacles, from the expert Roman ones Nell describes to the more theoretical ones that

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