Research Article

Why Egalitarianism Might Be Good for Your Health

Physiological Thriving During Stressful Intergroup Encounters

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ABSTRACT—*We compared how evaluations by out-group members and evaluations by in-group members affected participants' stress responses—their neuroendocrine reactivity, cognitive appraisals, and observed anxiety—and how participants' implicit racial bias moderated these responses. Specifically, White participants completed measures of racial bias prior to the experiment. During the experiment, participants performed speech and serial subtraction tasks in front of White or Black interviewers. Several saliva samples were obtained, and they were assayed for catabolic ("breaking down") and anabolic ("building up") hormones. Interviewers' race and participants' racial bias interacted in predicting stress responses. When interviewers were Black, lower racial bias was linked with more salutary stress responses: lower threat appraisals, less anxiety, and increased levels of anabolic hormones. When interviewers were White, no effect was found for threat appraisals or anabolic hormones, and the reverse effect was observed for anxiety. Egalitarianism may have physical and psychological benefits for people living in a diverse society.*

Social interactions with people of different races can produce threat, anxiety, and even fear (Mendes, Blascovich, Lickel, & Hunter, 2002; Olsson, Ebert, Banaji, & Phelps, 2005; Richeson & Shelton, 2003; Stephan & Stephan, 2000). For example, a growing body of research has shown that White participants' responses to Black people might be more negatively toned than their responses to White people; their negative responses to Black people can include malignant cardiovascular reactivity (Mendes et al., 2002), increases in amygdalar activation (Hart, Whalen, Shin, McInerney, & Fischer, 2000), and sustained conditioned-fear responses (Olsson et al., 2005). Furthermore, individuals with greater racial bias exhibit more negative reactions than do those with more egalitarian racial attitudes (Phelps et al., 2000; Vanman, Paul, Ito, & Miller, 1997). From this observed link between racial bias and malignant responses, researchers often conclude that racial bias may have negative consequences for the self and for social interactions with members of a different race.

The investigation we discuss in this article focused on the extent to which intergroup context and racial bias are linked to one of the primary stress systems, the hypothalamic-pituitary-adrenocortical (HPA) axis. We examined interracial and intraracial interactions within a highly stressful laboratory paradigm known to reliably activate the HPA axis (Dickerson & Kemeny, 2004). This context allowed us to investigate whether racial bias (or egalitarianism) exacerbates (or attenuates) stress responses during interracial interactions. To address this question, we examined the influence of White participants' racial attitudes on their stress reactions—neuroendocrine responses, cognitive appraisals, and observed anxiety—while they performed an evaluative task in the presence of either in-group (White) or out-group (Black) interviewers.

Not all stress responses are created equal. Some stress profiles are believed to be detrimental to physical health and performance, whereas others are believed to benefit health and performance (Dienstbier, 1989; Epel, McEwen, & Ickovics, 1998; McEwen, 1998; Mendes, Reis, Seery, & Blascovich, 2003). We

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focused on the distinction between malignant stress responses and benign or salutary stress responses by examining the end products of HPA-axis activation, specifically, changes in catabolic and anabolic hormones. These hormones, individually and combined, can provide indications of how well one is coping with an acute stressor. Cortisol, a catabolic hormone, has been shown to rise in response to psychological stressors that are perceived as effortful, frustrating, or mildly aversive (Lovallo & Thomas, 2000). Less studied, but of growing interest, are anabolic hormones, which can counterregulate catabolic hormones. Anabolic hormones often indicate more adaptive coping with stressors and have been linked to physical and psychological thriving (Epel et al., 1998). One anabolic hormone of particular interest—dehydroepiandrosterone (DHEA) and its bound form, DHEA sulfate, or DHEA(S)—is excreted by the zona reticularis of the adrenal cortex in response to adrenocorticotropic hormone (ACTH), and thus is often released during acute stress, presumably conferring protection from catabolic aspects of the stress response (Wolf et al., 1997).

DHEA(S) has many salutary effects, achieved in part because it serves as a precursor to estrogen and androgens (Labrie et al., 2000). Epidemiological data have revealed that low levels of DHEA(S) are often associated with adiposity, cardiovascular disease, and depressive symptoms (Wolkowitz et al., 1999; Yaffe et al., 1998) and that DHEA(S) supplementation can reverse age-related disease factors (Baulieu et al., 2000). In addition, DHEA(S) may counter the effects of cortisol on target tissues, so that lean tissue and bone are built or maintained, rather than broken down (Labrie et al., 2005; Minetto et al., 2004).

Anabolic balance, or the ratio of anabolic to catabolic hormones, can provide additional information regarding stress responses because it indicates the net anabolic versus catabolic effects of stress on the body. Anabolic balance thus provides a more sensitive indicator of well-being than measures of either DHEA(S) or cortisol alone (Epel et al., 1998; Epel, Wolkowitz, & Burke, 2007; Wolkowitz, Epel, & Reus, 2001). In a prospective study using military personnel completing survival training, greater increases in anabolic balance, in the form of the ratio between DHEA(S) and cortisol, were related to fewer stress-induced dissociative symptoms and greater improvement in military performance (Morgan et al., 2004). In clinical samples, higher anabolic balance is related to a more positive mood (Rasmusson et al., 2004) and lower severity of symptoms of posttraumatic stress disorder (Yehuda, Brand, Golier, & Yang, 2006). Therefore, though stressful situations should increase cortisol production, a "healthy" or thriving stress response would also be characterized by increases in anabolic hormones and thus increased anabolic balance.

We examined these relative changes in hormones as a function of the intergroup context of the stressful situation and participants' racial bias. In measuring racial bias, one obstacle to overcome is the difficulty of accurately assessing attitudes toward out-group members in a way that does not allow for conscious correction or distorted responses. A variety of implicit measures of racial attitudes have been created to circumvent this problem and provide relatively uncontaminated assessments (Greenwald, McGhee, & Schwarz, 1998). We used an implicit measure of racial bias, the Implicit Association Test (IAT; Nosek, Greenwald, & Banaji, 2005), to examine the moderating role of racial attitudes on participants' reactions to in-group versus out-group interviewers.

In the following experiment, we examined the extent to which a socially evaluative situation increased stress reactions in White participants as a function of interviewers' race, participants' implicit racial bias, and their interaction. We predicted that White participants who exhibited less racial bias (more egalitarian attitudes) would be more likely to show a healthy stress response—increases in anabolic relative to catabolic hormones—following a stressful evaluation by Black interviewers than would White participants who held more racially biased attitudes. Racial attitudes were not expected to predict stress responses when the interviewers were White, and thus in-group members.

METHOD

White participants completed a stressful laboratory task (the Trier Social Stress Test; Kirschbaum, Pirke, & Hellhammer, 1993) in which they were evaluated by a dyad of either White or Black interviewers. Participants' neuroendocrine responses and threat appraisals were assessed at several points during the experiment. At least 48 hr prior to the lab visit, participants completed a Web-based version of the IAT (Greenwald et al., 1998).

Participants

We recruited Boston-area men and women between the ages of 18 and 55 through newspaper and on-line ads, direct recruitment, and the Harvard University study pool. Only participants who identified themselves as White-Caucasian are included in the analyses reported here. Participants were prescreened and excluded for conditions affecting endocrine products, as well as for social anxiety.

The final sample ($N = 78$) was fairly well educated, with 59% of the participants having at least a B.A. degree. The sample was also diverse in terms of their annual income; 23% (mostly students) had incomes below $30,000, 46% had incomes from $30,000 to $80,000, and 31% had incomes above $80,000. The sample was evenly distributed in gender (53% female), and was on average just past young adulthood (mean age = 31.0 years, $SD = 10.4$, range: 20–55).

Procedure

IAT

Once recruited, participants were given instructions for completing the IAT on-line. Those who did not have access to a

computer were instructed to use one in our lab a few days before the scheduled session.

Laboratory Session

All participants were scheduled for afternoon appointments because cortisol typically reaches its diurnal nadir during the afternoon hours. After providing initial consent, participants viewed a nature documentary video that was intended to help them acclimate to the environment and allowed 30 min of quiet rest, after which the first (baseline) saliva sample was collected.

Introduction of Stressor. Next, the experimenter informed participants about the stress task and obtained a second consent; describing the stress task prior to obtaining the first saliva sample might have elevated baseline hormonal responses. Specifically, participants were told that they would be asked to prepare and deliver an 8-min speech to a panel of interviewers, and that the speech would be videotaped. They were instructed to imagine that they were interviewing for a desirable job and should describe the qualities that made them well suited for the job.

Introduction to the Interviewers. At this point, the interviewers entered the room. Depending on the intergroup context (same-race condition vs. different-race condition) to which a given participant was assigned, he or she was evaluated by either two White or two Black interviewers (one male, one female). The interviewers were introduced as researchers who had extensive training in speech evaluation. We trained the interviewers to behave neutrally, that is, to be polite, but to avoid providing either positive or negative feedback during the task. After the brief introduction, both interviewers and the experimenter left the room, and the participant prepared the speech.

Speech Delivery. After 2 min elapsed, the experimenter returned to the room and administered a cognitive-appraisal measure of the upcoming speech task. Next, the interviewers reentered the room and instructed the participant to begin his or her speech.

Math Task. Following the speech, the interviewers explained the serial subtraction task. The participant was told that he or she would be given a three-digit number and should serially subtract backward from it in steps of 7. After receiving these instructions, the participant completed a cognitive-appraisal measure regarding the math task and then began the serial subtraction task. This task lasted 5 min, after which the interviewers left the room and completed ratings of how anxious the participant appeared to have been. The experimenter then obtained the second (reactivity) saliva sample.

Recovery. After 30 min had passed, the participant provided a final (recovery) saliva sample and was thoroughly debriefed, paid, and thanked.

Measures

IAT

Racial preferences were assessed using a five-block customized IAT (Nosek et al., 2005). The IAT required participants to classify images of White or Black adults and words with positive or negative connotations (e.g., *evil*, *joy*, *agony*, *glorious*) as quickly as possible by pressing one of two response keys. In one critical block, images of Whites and positive words shared a response key, and images of Blacks and negative words shared another key. In another critical block, the associations were reversed. These two blocks were presented to participants in counterbalanced order, and participants received no feedback regarding their scores. IAT scores were calculated such that positive scores indicate greater implicit preference for Whites over Blacks (Greenwald, Nosek, & Banaji, 2003).

Neuroendocrine Measures

Neuroendocrine samples were obtained with IBL (Hamburg, Germany) SaliCap sampling devices, which require participants to expectorate 1 ml of saliva into a cryovial via a plastic straw. Saliva samples were stored immediately at −80 °C until they were shipped overnight on dry ice to a laboratory in Dresden, Germany, where they were assayed for salivary free cortisol and DHEA(S) using commercial immunoassay kits (IBL, Hamburg, Germany). Intra- and interassay coefficients of variance were less than 10%.

Cognitive Appraisals

Following previous research (e.g., Mendes, Blascovich, Major, & Seery, 2001), we measured participants' cognitive appraisals prior to the speech and math tasks by probing perceived demands and perceived resources to cope. The response scales ranged from 1 (*strongly disagree*) to 7 (*strongly agree*). Six questions tapped demand appraisals (i.e., "this task is demanding," ". . . is stressful," ". . . is distressing," ". . . is threatening"; "I am uncertain how I will perform"; "this task requires a lot of effort") and yielded acceptable alphas (prespeech $\alpha = .79$, premath $\alpha = .70$). Five questions assessed resource appraisals (i.e., "I have the abilities to perform well," "I have the expectations to perform well," "performing well is important to me," "this task is a positive challenge," and "I am the type of person who does well on these tasks") and also yielded acceptable alphas (prespeech $\alpha = .79$, premath $\alpha = .84$). We averaged responses to the demand questions and responses to the resource questions before each task (prespeech and premath) and created a threat index by calculating the demands/resources ratio.

Interviewers' Ratings

At the end of each interview, the two interviewers independently completed a questionnaire on the participant's behavioral reactions. Specifically, they used a 9-point scale (−4 to +4) to

report how anxious the participant had appeared to be during the speech task and also during the math task.

RESULTS

Data-Analytic Strategy

Our analytic strategy included a series of moderated regression analyses in which we entered the two primary independent variables, IAT (racial bias, centered) and interviewers' race, and their interaction, along with appropriate covariates, into a single regression model (Aiken & West, 1991). Covariates for cognitive appraisals and interviewers' ratings of anxiety included participants' age and education. Analyses examining hormonal responses were restricted to men and a subset of women who were in the follicular stage of their menstrual cycle (0 to 10 days after onset of menstruation), to minimize potential effects of fluctuations in sex hormones (Symonds, Gallagher, Thompson, & Young, 2004). Thus, 22 women were excluded from the analyses of the hormone data (10 from the same-race condition and 12 from the different-race condition). Covariates for analyses examining hormonal responses included age, education, waking time on the morning of the experiment, and baseline hormonal responses. We tested the ability of this model to predict neuroendocrine reactivity, pretask cognitive appraisals, and interviewers' ratings of participants' anxiety.

Neuroendocrine Responses

Analyses of the neuroendocrine data focused on changes in cortisol, DHEA(S), and anabolic balance. As expected, cortisol levels increased significantly after the stressor ($\Delta M = 2.05$ nmol/L), $t(52) = 2.18$, $p_{rep} > .90$, $d = 0.60$, and this effect did not differ as a function of intergroup context. DHEA(S) increased from baseline to the reactivity period for participants assigned to same-race (White) interviewers ($\Delta M = 1.56$ ng/ml), but not for those assigned to different-race (Black) interviewers ($\Delta M = -0.69$ ng/ml); however, the effect of intergroup context was not reliable, $F(1, 53) = 2.21$, $p_{rep} > .78$.

Next, we tested our primary predictions regarding the moderating role of racial bias (Table 1). No interaction effects were observed for cortisol reactivity or recovery; however, the regression model predicting DHEA(S) reactivity yielded the predicted Racial Bias × Intergroup Context interaction, $t(46) = -2.14$, $p_{rep} > .89$, effect size (ES) $r = .30$. In Figure 1a, we plotted the interaction with bar graphs to best represent relative increases and decreases in DHEA(S) responses. Among participants evaluated by Black interviewers, lower racial bias was associated with increased DHEA(S) reactivity ($b = -6.48$, $p_{rep} > .88$). The relationship between racial bias and DHEA(S) reactivity was not significant for participants paired with White interviewers. DHEA(S) recovery also yielded a reliable interaction, $t(46) = -1.72$, $p_{rep} > .82$, ES $r = .25$. Again, among participants paired with Black interviewers, there was a negative relation between racial bias and DHEA(S) recovery, such that the lower the racial bias, the higher the level of DHEA(S), $b = -4.85$, $p_{rep} > .88$ (see Fig. 1b).

To examine changes in anabolic balance, we converted the measures of neuroendocrine products to a common unit (nmol/L) using molar transformations. The regression equations yielded a significant Racial Bias × Intergroup Context interaction for anabolic-balance reactivity, $t(44) = -2.80$, $p_{rep} > .956$, ES $r = .39$, and recovery, $t(44) = -2.91$, $p_{rep} > .964$, ES $r = .40$ (see Figs. 2a and 2b). The pattern of results was similar to that for

TABLE 1

Summary of the Interactive Effects of Racial Bias and Intergroup Context

Outcome variable	t (df)	p_{rep}	b_W	b_B	ES r
Neuroendocrine responses					
DHEA(S): reactivity	−2.14 (46)	.891	1.64	−6.48*	.30
DHEA(S): recovery	−1.72 (46)	.828	0.55	−4.85*	.25
Cortisol: reactivity	−0.59 (45)	n.s.	—	—	.08
Cortisol: recovery	−0.89 (45)	n.s.	—	—	.13
Anabolic balance: reactivity	−2.80 (44)	.956	0.39	−3.88***	.39
Anabolic balance: recovery	−2.91 (44)	.964	0.51	−4.33***	.40
Appraisals					
Threat ratio: prespeech	2.27 (72)	.915	−0.15	0.30*	.26
Threat ratio: premath	1.53 (72)	.788	0.08	0.75**	.18
Resources: prespeech	−2.92 (72)	.967	0.45	−0.98**	.325
Resources: premath	−2.95 (72)	.968	0.50	−1.50**	.33
Demands: prespeech	0.08 (72)	n.s.	—	—	.01
Demands: premath	−0.92 (72)	n.s.	—	—	.11
Interviewers' ratings					
Participants' anxiety: speech task	2.47 (72)	.936	−1.84†	1.65†	.28

Note. DHEA(S) = dehydroepiandrosterone sulfate; b_W = unstandardized slope for participants evaluated by White interviewers; b_B = unstandardized slope for participants evaluated by Black interviewers; ES = effect size.
†$p_{rep} > .82$. *$p_{rep} > .88$. **$p_{rep} > .95$. ***$p_{rep} > .99$.

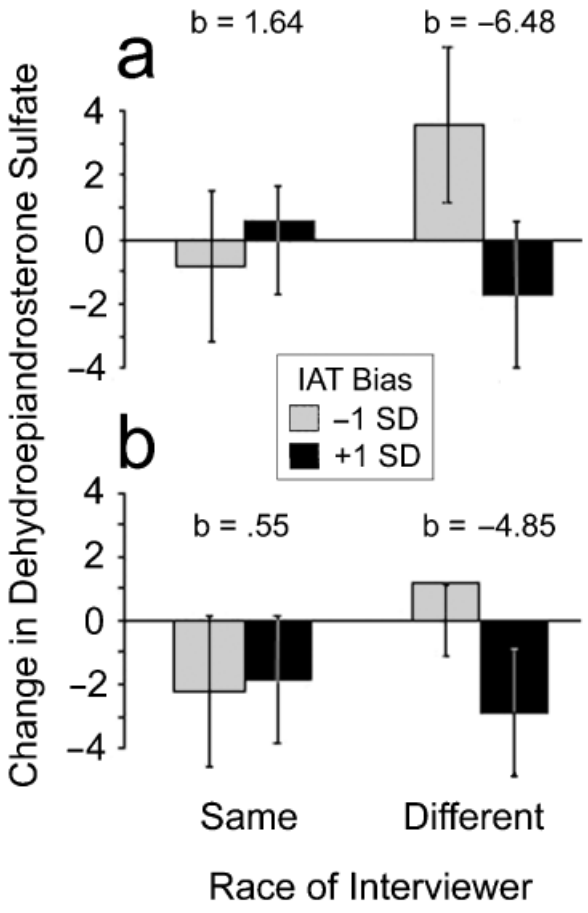

Fig. 1. Changes in levels of dehydroepiandrosterone sulfate (ng/ml) as a function of intergroup context, plotted at ±1 *SD* from the mean score on the Implicit Association Test (IAT). The two graphs present the change (a) from baseline to immediately after the stressful task and (b) from baseline to the recovery period. Error bars indicate standard errors.

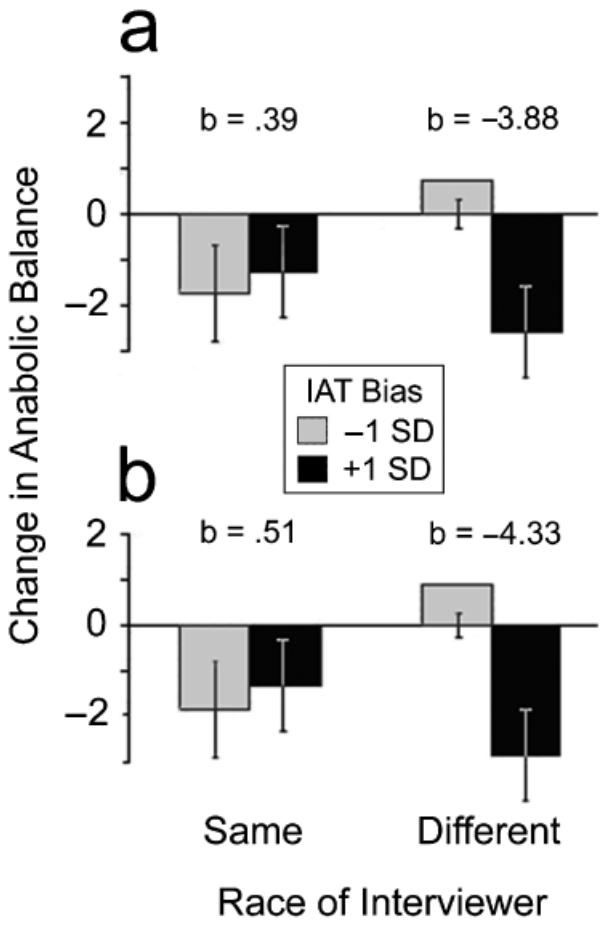

Fig. 2. Changes in anabolic balance (nmol/l) as a function of intergroup context, plotted at ±1 *SD* from the mean score on the Implicit Association Test (IAT). The two graphs present the change (a) from baseline to immediately after the stressful task and (b) from baseline to the recovery period. Error bars indicate standard errors.

DHEA(S): Among participants who were evaluated by Black interviewers, the lower the participants' implicit racial bias, the greater their increase in anabolic balance (reactivity: $b = -3.88$, $p_{rep} > .99$; recovery: $b = -4.33$, $p_{rep} > .99$). The linear relationships between racial bias and changes in anabolic balance were not reliable among participants evaluated by White interviewers.

Cognitive Appraisals

We then tested the ability of this model to predict participants' threat ratios. Prior to the speech task, racial bias and intergroup context had an interactive effect on threat ratios, $t(72) = 2.27$, $p_{rep} > .91$, ES $r = .26$ (see Fig. 3a). Participants anticipating evaluation by Black interviewers showed a positive relation between IAT score and threat ratio, such that the greater the racial bias favoring Whites over Blacks, the higher the threat ratio ($b = 0.30, p_{rep} > .91$). In contrast, participants anticipating evaluation by White interviewers did not show a reliable relation between racial bias and threat ratio ($b = -0.15, p_{rep} > .60$). For the premath threat ratios, there was a similar interactive effect, $t(72) = 1.53$, $p_{rep} > .78$, ES $r = .18$; participants about to complete the math task in the presence of Black interviewers showed a positive relation between their premath threat ratios and IAT scores ($b = 0.75, p_{rep} > .95$).

Further analyses revealed that these patterns were driven by perceived resources, rather than by perceived demands. Both regression equations predicting perceived resources (prespeech and premath) yielded significant interactions, prespeech: $t(72) = -2.92, p_{rep} > .96$, ES $r = .325$; premath: $t(72) = -2.95, p_{rep} > .96$, ES $r = .33$. When participants were evaluated by Black interviewers, lower racial bias predicted greater perceived resources (prespeech: $b = -0.98, p_{rep} > .95$; premath: $b = -1.50$, $p_{rep} > .95$); the relationships between perceived resources and IAT scores were not reliable when the interviewers were White. The regression models predicting perceived demands were not significant.

Interviewers' Ratings of Participants' Anxiety

To determine the extent to which participants exhibited anxiety that could be detected visually, we asked the interviewers to rate

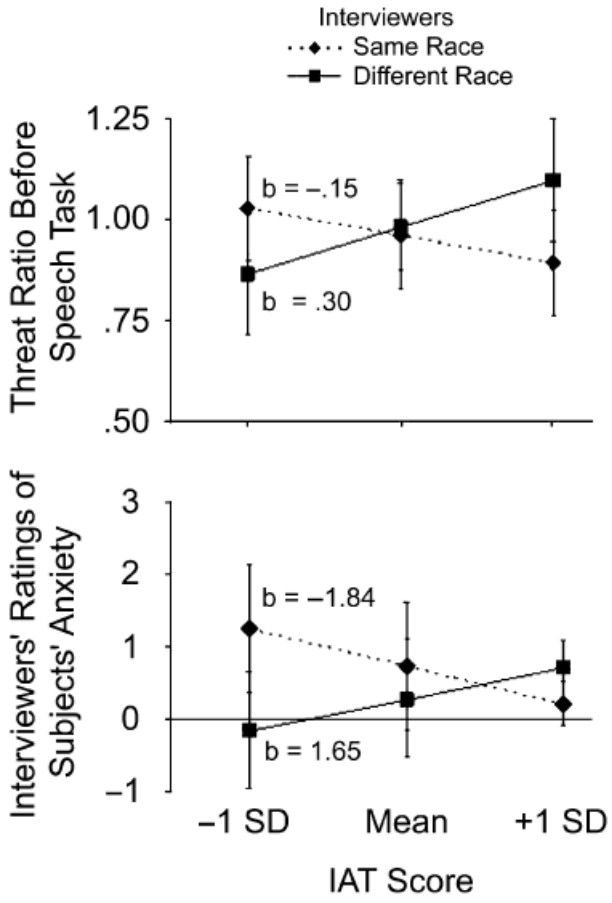

Fig. 3. Threat appraisals prior to the speech task (a) and interviewers' ratings of participants' manifest anxiety (b) as a function of intergroup context and racial bias (measured by the Implicit Association Test, or IAT). Standard errors are shown.

how anxious participants appeared during the speech and math tasks. Though, on average, female interviewers rated participants as more anxious than male interviewers did, the male and female interviewers' ratings were highly correlated (speech anxiety: $r = .54$, $p_{rep} > .99$; math anxiety: $r = .67$, $p_{rep} > .996$); thus, we averaged the male and female interviewers' anxiety ratings. Interviewers' ratings of how anxious the participants appeared during the speech task yielded a Racial Bias × Intergroup Context interaction, $t(72) = 2.47$, $p_{rep} > .936$, ES $r = .28$ (see Fig. 3b). Black interviewers rated participants who scored lower on the IAT (i.e., less racial bias) as appearing less anxious during the speech ($b = 1.65$, $p_{rep} > .82$). Interestingly, this pattern was reversed when participants were evaluated by White interviewers ($b = -1.84$, $p_{rep} > .86$); that is, White interviewers rated participants with greater racial bias (and thus more implicit preference for White over Black faces) as appearing less anxious. Observed anxiety during the math task did not yield a significant interaction.

Relationships Among the Outcome Variables

Finally, we examined the relationships among our outcome variables: cognitive appraisals, neuroendocrine reactivity, and manifested anxiety. Higher prespeech resource appraisals were related to increases in DHEA(S) reactivity, $r = .29$, $p_{rep} > .91$, and anabolic-balance reactivity, $r = .33$, $p_{rep} > .93$. The correlations between threat ratios and neuroendocrine reactivity were smaller and not significant, $r = -.13$ for DHEA(S) and $r = -.10$ for anabolic balance. We also observed a reliable relation between manifested anxiety and anabolic balance, $r = -.29$, $p_{rep} > .88$, and to a lesser extent DHEA(S), $r = -.17$. Though these relationships were in the predicted direction, it is important to note that the correlations were small to moderate in magnitude. These findings underscore the importance for studies to include measures that differ in the extent to which they are consciously controlled, because different measures may provide unique information.

DISCUSSION

This experiment revealed strong associations between implicit racial bias and stress responses when White participants were evaluated by Black interviewers: The lower participants' racial bias (and thus the more egalitarian participants were), the more adaptive their stress responses. Specifically, lower racial bias was associated with lower threat appraisals, less observed anxiety, and higher levels of salutary neuroendocrine products. Egalitarian attitudes were associated with positive stress responses when participants interacted with Black interviewers, but not when they interacted with White interviewers. Specifically, in interracial situations, less racial bias was associated with greater increase in DHEA(S) reactivity and also a higher ratio of DHEA(S) to cortisol. In the intraracial context, racial bias did not predict neuroendocrine responses, though arguably if participants had been primed with an interracial context, greater preference for the in-group might have been associated with more salutary responses. Furthermore, White participants lower in racial bias also reported lower threat appraisals in anticipation of the interracial context, primarily because they perceived themselves as having greater resources to cope with the stressor. We also measured behavioral signs of anxiety by asking the interviewers to report how anxious participants appeared to be during each task. The predicted interaction was observed for the speech task, which requires more verbal engagement and eye contact with interviewers than the serial subtraction task. Black interviewers perceived White participants who were lower in racial bias as less anxious than those who were higher in racial bias. Note that the interviewers had no knowledge of the participants' racial-bias scores (and did not know that the participants had completed racial-bias measures).

To our knowledge, this is the first demonstration linking racial bias to behavioral anxiety and neuroendocrine responses within an intergroup context. It was surprising that cortisol, the traditional marker of threat, was not linked to bias, whereas DHEA(S), our presumed marker of more salutary stress responses, was. Thus, less racial bias (i.e., more egalitarian attitudes) appeared

to promote the more adaptive stress responses. It appears that the stressful context (completing an interview) activated the HPA axis for everyone, resulting in cortisol increases in both conditions and regardless of participants' racial bias; however, participants who were paired with Black interviewers and had relatively low racial bias showed the salutary stress response as well. We suggest that the contextual cue (i.e., Black interviewers) may have served as an affirmation of nonbiased participants' racial attitudes, and hence engendered a positive response in addition to the primary stress response. Hence, it is especially noteworthy that the relationship between threat ratios and IAT scores was driven by perceived resources, not perceived demands.

Cortisol is responsive to social evaluative threats and threats to the self. Further research is needed to test the possibility that cortisol is more responsive to situational threats, and anabolic hormones, such as DHEA(S), are more responsive to individual differences and attitudes, as the current data suggest. Cortisol and DHEA respond to the same secretogogue (ACTH), and thus tend to be cosecreted to a certain degree in acute stress conditions. However, there are other, unknown neural, hormonal, and physiological factors that control DHEA(S) and cortisol secretion, resulting in the observed variability in DHEA and cortisol changes. In this study, cortisol and DHEA(S) were not significantly correlated (baseline: $r = -.19$; reactivity: $r = .19$; recovery: $r = .09$), a result that underscores the independence of these two hormones. This is one of the first studies to examine differences in the eliciting conditions for cortisol and DHEA(S), particularly with regard to racial bias. Our results suggest that measuring both the catabolic and the anabolic stress responses may be more revealing than measuring only the negative, or catabolic, response, as is traditionally done.

It is also important to note that racial bias was found to have effects on cognitive appraisals early in the experiment, after minimal interaction with the interviewers, at a point when the interviewers' actual or perceived behavior had limited influence on participants. Mere awareness of and brief introduction to the Black interviewers resulted in greater threat ratios (and lower perceived resources) when individuals were higher in racial bias. This suggests that racial bias likely shapes stress appraisals and coping expectations in interracial settings independently of the actual experience of interacting with members of a different race.

In addition to neuroendocrine responses and cognitive appraisals, manifested anxiety showed an interaction between racial bias and intergroup context. The greater participants' racial bias, the more anxious Black interviewers perceived them to be during the speech task (see also McConnell & Leibold, 2001). We observed the opposite effect for participants speaking to White interviewers; the greater their racial bias (in favor of Whites), the less anxious interviewers rated them. It is unclear what specific cues the participants were "leaking" that led interviewers to detect anxiety differences based on racial bias. However, this effect demonstrates the importance of examining less consciously controlled measures (implicit attitudes, nonverbal behavior, etc.), in addition to explicit, consciously controlled measures, to understand the dynamic interplay that occurs during intergroup encounters.

The health implications of transient increases in DHEA are still unclear. Individuals with higher basal DHEA report more positive mood and well-being, have healthier body composition with lower adiposity, and show increased insulin sensitivity (Epel et al., 1998; Wolkowitz et al., 1999). Very few studies have examined DHEA reactivity of the adrenal. In one study, higher DHEA response to stimulation was related to lower symptom severity in women with posttraumatic stress disorder (Rasmusson et al., 2004). In the current study, cortisol increased regardless of bias or intergroup context, a result reflecting the common underlying feature of the task, social evaluation. In contrast, DHEA(S) significantly increased from baseline levels in the most egalitarian participants and decreased in participants with higher racial bias. If one consistently has the more salutary stress-response profile, one might achieve long-term health benefits as a result of a relatively high anabolic balance. Thus, if egalitarian attitudes, coupled with living in a racially diverse society, consistently lead to salutary psychological and neuroendocrine stress responses over time, egalitarianism may, indeed, be good for your health.

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REFERENCES

Aiken, L.S., & West, S.G. (1991). *Multiple regression: Testing and interpreting interactions*. Newbury Park, NJ: Sage.

Baulieu, E.E., Thomas, G., Legrain, S., Lahlou, N., Roger, M., Debuire, B., et al. (2000). Dehydroepiandrosterone (DHEA), DHEA sulfate, and aging: Contribution of the DHEAge study to a sociobiomedical issue. *Proceedings of the National Academy of Sciences, USA*, *97*, 4279–4284.

Dickerson, S., & Kemeny, M.E. (2004). Acute stressors and cortisol responses: A theoretical integration and synthesis of laboratory research. *Psychological Bulletin*, *130*, 355–391.

Dienstbier, R.A. (1989). Arousal and physiological toughness: Implications for mental and physical health. *Psychological Review*, *96*, 84–100.

Epel, E.S., McEwen, B.S., & Ickovics, J.R. (1998). Embodying psychological thriving: Physiological thriving in response to stress. *Journal of Social Issues*, *54*, 301–322.

Epel, E.S., Wolkowitz, O., & Burke, H. (2007). The psychoneuroendocrinology of aging: Anabolic and catabolic hormones. In C.M. Aldwin, C.L. Park, & A. Spiro (Eds.), *Handbook of health psychology and aging* (pp. 119–141). New York: Guilford Press.

Greenwald, A.G., McGhee, D.E., & Schwarz, J.L.K. (1998). Measuring individual differences in implicit cognition: The Implicit Association Test. *Journal of Personality and Social Psychology*, *74*, 1464–1480.

Greenwald, A.G., Nosek, B.A., & Banaji, M.R. (2003). Understanding and using the Implicit Association Test: I. An improved scoring

algorithm. *Journal of Personality and Social Psychology*, *85*, 197–216.

Hart, A.J., Whalen, P.J., Shin, L.M., McInerney, S.C., & Fischer, H. (2000). Differential response in the human amygdala to racial outgroup vs. ingroup face stimuli. *NeuroReport*, *11*, 2351–2355.

Kirschbaum, C., Pirke, K.M., & Hellhammer, D.H. (1993). The 'Trier Social Stress Test'—a tool for investigating psychobiological stress responses in a laboratory setting. *Neuropsychobiology*, *28*, 76–81.

Labrie, F., Luu-The, V., Bélanger, A., Lin, S.-X., Simard, J., Pelletier, G., & Labrie, C. (2005). Is dehydroepiandrosterone a hormone? *Journal of Endocrinology*, *187*, 169–196.

Lovallo, W.R., & Thomas, T.L. (2000). Stress hormones in psychophysiological research: Emotional, behavioral, and cognitive implications. In J.T. Cacioppo, L.G. Tassinary, & G.G. Berntson (Eds.), *Handbook of psychophysiology* (2nd ed., pp. 342–367). New York: Cambridge University Press.

McConnell, A.R., & Leibold, J.M. (2001). Relations among the Implicit Association Test, discriminatory behavior, and explicit measures of racial attitudes. *Journal of Experimental Social Psychology*, *37*, 435–442.

McEwen, B.S. (1998). Protective and damaging effects of stress mediators. *New England Journal of Medicine*, *338*, 171–179.

Mendes, W.B., Blascovich, J., Lickel, B., & Hunter, S. (2002). Challenge and threat during social interactions with white and black men. *Personality and Social Psychology Bulletin*, *28*, 939–952.

Mendes, W.B., Blascovich, J., Major, B., & Seery, M.D. (2001). Challenge and threat responses during downward and upward social comparisons. *European Journal of Social Psychology*, *31*, 477–497.

Mendes, W.B., Reis, H., Seery, M.D., & Blascovich, J. (2003). Cardiovascular correlates of emotional expression and suppression: Do content and gender context matter? *Journal of Personality and Social Psychology*, *84*, 771–792.

Minetto, M., Reimondo, G., Osella, G., Ventura, M., Angeli, A., & Terzolo, M. (2004). Bone loss is more severe in primary adrenal than in pituitary-dependent Cushing's syndrome. *Osteoporosis International*, *15*, 855–861.

Morgan, C.A., III, Southwick, S., Hazlett, G., Rasmusson, A., Hoyt, G., Zimolo, Z., & Charney, D. (2004). Relationships among plasma dehydroepiandrosterone sulfate and cortisol levels, symptoms of dissociation, and objective performance in humans exposed to acute stress. *Archives of General Psychiatry*, *61*, 819–825.

Nosek, B.A., Greenwald, A.G., & Banaji, M.R. (2005). Understanding and using the Implicit Association Test: II. Method variables and construct validity. *Personality and Social Psychology Bulletin*, *31*, 166–180.

Olsson, A., Ebert, J.P., Banaji, M.R., & Phelps, E.A. (2005). The role of social groups in the persistence of learned fear. *Science*, *309*, 785–787.

Phelps, E.A., O'Connor, K.J., Cunningham, W.A., Funayama, E.S., Gatenby, J.C., Gore, J.C., & Banaji, M.R. (2000). Performance on indirect measures of race evaluation predicts amygdala activation. *Journal of Cognitive Neuroscience*, *12*, 729–738.

Rasmusson, A.M., Vasek, J., Lipschitz, D.S., Vojvoda, D., Mustone, M.E., Shi, Q., et al. (2004). An increased capacity for adrenal DHEA release is associated with decreased avoidance and negative mood symptoms in women with PTSD. *Neuropsychopharmacology*, *29*, 1546–1557.

Richeson, J.A., & Shelton, J.N. (2003). When prejudice does not pay: Effects of interracial contact on executive functioning. *Psychological Science*, *14*, 287–290.

Stephan, W.G., & Stephan, C.W. (2000). An integrated threat theory of prejudice. In S. Oskamp & W. Crano (Eds.), *Reducing prejudice and discrimination* (pp. 23–45). Mahwah, NJ: Erlbaum.

Symonds, C.S., Gallagher, P., Thompson, J.M., & Young, A.H. (2004). Effects of the menstrual cycle on mood, neurocognitive and neuroendocrine function in healthy premenopausal women. *Psychological Medicine*, *34*, 93–102.

Vanman, E.J., Paul, B.Y., Ito, T.A., & Miller, N. (1997). The modern face of prejudice and structural features that moderate the effect of cooperation on affect. *Journal of Personality and Social Psychology*, *73*, 941–959.

Wolf, O.T., Neumann, O., Hellhammer, D.H., Geiben, A.C., Strasburger, C.J., Dressendörfer, R.A., et al. (1997). Effects of a two-week physiological dehydroepiandrosterone substitution on cognitive performance and well-being in healthy elderly women and men. *Journal of Clinical Endocrinology and Metabolism*, *82*, 2363–2367.

Wolkowitz, O.M., Epel, E.S., & Reus, V.I. (2001). Stress hormone-related psychopathology: Pathophysiological and treatment implications. *World Journal of Biological Psychiatry*, *2*, 115–143.

Wolkowitz, O.M., Reus, V.I., Keebler, A., Nelson, N., Friedland, M., Brizendine, L., & Roberts, E. (1999). Double-blind treatment of major depression with dehydroepiandrosterone. *American Journal of Psychiatry*, *156*, 646–649.

Yaffe, K., Ettinger, B., Pressman, A., Seeley, D., Whooley, M., Schaefer, C., & Cummings, S. (1998). Neuropsychiatric function and dehydroepiandrosterone sulfate in elderly women: A prospective study. *Biological Psychiatry*, *43*, 694–700.

Yehuda, R., Brand, S.R., Golier, J.A., & Yang, R.K. (2006). Clinical correlates of DHEA associated with post-traumatic stress disorder. *Acta Psychiatrica Scandinavica*, *114*, 187–193.

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