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Gene–Culture Interaction: Oxytocin Receptor Polymorphism (*OXTR*) and Emotion Regulation

Heejung S. Kim[1], David K. Sherman[1], Taraneh Mojaverian[1], Joni Y. Sasaki[1], Jinyoung Park[2], Eunkook M. Suh[2], and Shelley E. Taylor[3]

Abstract

Research has demonstrated that certain genotypes are expressed phenotypically in different forms depending on the social environment. To examine sensitivity to cultural norms regarding emotion regulation, we explored the expression of the oxytocin receptor polymorphism (*OXTR*) rs53576, a gene previously related to socioemotional sensitivity, in conjunction with cultural norms. Emotional suppression is normative in East Asian cultures but not in American culture. Consequently, we predicted an interaction of Culture and *OXTR* in emotional suppression. Korean and American participants completed assessments of emotion regulation and were genotyped for *OXTR*. We found the predicted interaction: Among Americans, those with the GG genotype reported using emotional suppression less than those with the AA genotype, whereas Koreans showed the opposite pattern. These findings suggest that *OXTR* rs53576 is sensitive to input from cultural norms regarding emotion regulation. These findings also indicate that culture is a moderator that shapes behavioral outcomes associated with *OXTR* genotypes.

Keywords

emotion regulation, culture, genetics, *OXTR*

Considerable research has shown that the environment can moderate the effects of genes (e.g., Bakermans-Kranenburg & van IJzendoorn, 2006; Caspi et al., 2002, 2003; Eisenberg, Campbell, Gray, & Sorenson, 2008; Kim et al., 2010a, 2010b; Kim-Cohen & Gold, 2009; Taylor et al., 2006; although controversies exist as to the form of the moderation e.g., Risch et al., 2009; but see also Karg, Burmeister, Shedden, & Sen, 2011; Uher & McGuffin, 2010). For example, children with the 7-repeat allele of the dopamine receptor gene (DRD4) who were exposed to insensitive maternal care were more likely to develop externalizing behavior problems than children with other genotypes (Bakermans-Kranenburg & van IJzendoorn, 2006). In these Gene–Environment interaction studies, ''environment'' has been commonly discussed as *personal* life experiences, for instance, environmental resources that differ in quality (e.g., different degrees of stressful life events or supportiveness of the social environment; Kim-Cohen & Gold, 2009). In the present research, we broaden the notion of environment from personal life environment to include culture.

Culture influences the development of psychological tendencies by presenting specific norms, practices, and institutions for how to act properly and be a good person (Kitayama, 2002). However, in explaining cultural differences, the question remains as to whether there are genetic bases of such differences, as many psychological differences have some genetic basis (e.g., Plomin et al., 1992). A consideration of genetic influences on behavior is needed to fully understand the interplay between genetic and cultural influences.

The present research is based on the assumption that culture is not only constrained by genetics but also influences the behavioral expression of genes and can thus moderate the psychological and behavioral expressions of genotypes. We propose that genes may affect phenotypic expression in the form of underlying psychological tendencies, but how and whether these tendencies are manifested in actual behavioral patterns may be shaped by sociocultural factors. The present research examines a Gene–Culture interaction in shaping emotion regulation, focusing on comparisons between European Americans and Koreans and targeting the oxytocin receptor

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gene (*OXTR* rs53576). *OXTR* rs53576 is a polymorphic site in the oxytocin receptor gene, which is localized in a single copy to chromosome 3 of the human genome (Gimpl & Fahrenholz, 2001). Although its neural mechanisms are still unknown, *OXTR* rs53576 has been linked to differences in hypothalamic-limbic structure and function among humans (Tost et al., 2010). In terms of behavioral phenotype, people homozygous for the G allele of *OXTR* rs53576, relative to those with the AG/AA genotype, exhibit more sensitive parenting behavior (Bakermans-Kranenburg & van IJzendoorn, 2008), greater sensitivity to infant crying (Riem, Pieper, Out, Bakermans-Kranenburg, & van IJzendoorn, in press), and greater empathic accuracy (Rodrigues, Saslow, Garcia, John, & Keltner, 2009). In the studies that examined three genotypes separately, people with the GG genotype, relative to those with the AA genotype, report being less lonely (Lucht et al., 2009) and have more prosocial temperament (Tost et al., 2010); those with the AG genotype fall between the two homozygous genotypes. We thus explored the possibility that *OXTR* rs53576 may be sensitive to social input in the form of culture-specific socioemotional norms.

Culture and Emotion Regulation

Emotion regulation is defined as "the ways individuals influence which emotions they have, when they have them, and how they experience or express them" (Gross, 2008, p. 711). Two well-studied emotion-regulation strategies are suppression and cognitive reappraisal. Research has identified the psychological, biological, and health costs of suppressing emotions (e.g., Gross & John, 2003). Emotional suppression is associated with decreased memory, decreased likeability within one's social group, reduced receipt of social support, and increased physiological reactivity (Gross, 2008; Richards & Gross, 1999; Srivastava, Tamir, McGonigal, John, & Gross, 2009).

Yet, cultures differ in the value they place on suppressing emotions, and emotional suppression is a more common emotion-regulation strategy among Asians than European Americans (Gross & John, 2003; Tsai & Levenson, 1997). These cultures vary in their value orientations regarding interpersonal relationships, such as individualism/collectivism and power distance, and these value orientations implicate cultural norms regarding emotion regulation (Matsumoto et al., 2008). For instance, in more collectivistic cultures, the expression of emotions is practiced with concern for negatively affecting social relations, whereas in more individualistic cultures, the expression of thoughts and feelings is valued as a sign of an independent self (Kim & Sherman, 2007; Matsumoto et al., 2008). In contrast to suppression, the use and effect of cognitive reappraisal, that is, construing a situation in a way that changes its emotional impact (Gross, 2008), does not seem to differ between Asians and European Americans. As it is an emotion-regulation strategy that is internal and nonobservable to others, cultural groups do not differ in using cognitive reappraisal (Gross & John, 2003; Matsumoto et al., 2008). Thus, reappraisal provides a compelling emotion-regulation strategy that is not moderated by culture.

Gene – Culture Interaction

We theorize that genes may shape predispositions for certain biological and psychological tendencies, but culture may influence how these tendencies are expressed through behaviors. More specifically, based on the research findings on the association between *OXTR* and socioemotional sensitivity, we predicted that *OXTR* might be associated with socioemotional sensitivity, but that culture would prescribe how socially sensitive people should behave in social contexts. Social interactions would provide an individual with culture-specific social feedback to behavior in such a way that would reinforce culturally appropriate behaviors and discourage inappropriate behaviors. In our previous research, we found that culture can moderate the relationship between *OXTR* rs53576 and emotional support seeking (Kim et al., 2010b). Among people experiencing high distress, for European Americans, for whom seeking support is culturally normative (Kim et al., 2008), those with more socioemotionally sensitive *OXTR* genotypes (i.e., G allele carriers) sought more social support than those with less socioemotionally sensitive genotypes (i.e., AA). By contrast, for Asians, for whom seeking support is not culturally normative, there was no relation of support seeking to *OXTR* (Kim et al., 2010b).

Following the same reasoning, we hypothesized that in a culture in which emotional suppression is normative (e.g., Korea), the same genetic predisposition for socioemotional sensitivity may lead to greater emotional suppression. By contrast, in a culture in which expression is normative and suppression is discouraged (e.g., the United States), those who are genetically predisposed for socioemotional sensitivity may engage in less emotional suppression than people with other genotypes.

In the present study, Korean and American participants indicated their tendency to regulate their emotions using suppression and reappraisal, and they were genotyped for *OXTR*. Based on prior research (e.g., Butler, Lee, & Gross, 2007, 2009; Kim & Sherman, 2007; Lee, Suh, Chu, Kim, & Sherman, 2009), we predicted that Koreans would report suppressing emotion more than Americans. More importantly, we predicted that there would be an interaction between *OXTR* and Culture on emotional suppression. Specifically, we predicted that Americans with the GG genotype (higher socioemotional sensitivity) would suppress emotion less than Americans with the AA genotype because suppression is not a normative coping response in the United States. In contrast, Koreans with the GG genotype would suppress emotion more than those with the AA genotype because suppression is a normative coping response in Asian cultures. We predicted that those with the AG genotype would fall between the other two genotypes. We did not hypothesize these differences to emerge with respect to emotion reappraisal because these cultural groups do not differ in its use (Gross & John, 2003).

Method

Participants

Participants were 99 Koreans (58 females and 41 males; mean age = 22.42) and 152 Americans (92 females and 60 males;

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mean age = 19.31), including 45 East Asian Americans and 107 European Americans. The Korean participants were recruited in Korea, and their ethnicity was confirmed by their indication of Korea as the country of birth as well as by their name at recruitment. American participants were recruited in the United States based on their self-categorized ethnicity from options of six ethnic groups (i.e., Asian American, European American, African American, Latino American, Native American, Native Pacific Islander), but an ''other'' category was provided for those who do not clearly fit into these categories or for those with mixed ethnicities. Those who identified themselves as Asian Americans were asked to specify their country of origin. Only participants who indicated that their family was from East Asian countries (i.e., Korea, Japan, and China) were included as East Asian Americans in the analyses. Participants were recruited through the psychology department participant pool and class announcements. Participants received either course credit or payment ($10 or 10,000₩ for students) for their participation.

Procedure and Measure

Participants completed the Emotion Regulation Questionnaire ([ERQ] Gross & John, 2003). The ERQ is designed to assess individual differences in the habitual use of two emotion-regulation strategies: cognitive reappraisal and emotional suppression (Gross & John, 2003). The ERQ consists of four suppression items (e.g., ''I keep my emotions to myself,'' ''I control my emotions by *not expressing them*,'' $\alpha = .73$ for Americans and $\alpha = .71$ for Koreans) and six reappraisal items (e.g., ''I control my emotions by *changing the way I think* about the situation I'm in,'' $\alpha = .84$ for Americans and $\alpha = .82$ for Koreans). Participants responded to the ERQ on a scale from 1 (*not at all*) to 7 (*very much*). A bilingual research assistant translated the scales developed in English into Korean, and another independent bilingual research assistant translated the Korean scales back to English to ensure the accuracy of the translation for Korean participants.

These questionnaires were administered as a part of a large packet of questionnaires. Participants completed the scales alone in a lab on a computer. After completion of the scale and demographics, participants provided saliva samples for genetic analyses.

Genotyping

After the completion of questionnaire measures, participants provided a saliva sample. Oragene Saliva kit OG-500 was used for collecting saliva. DNA was extracted as per manufacturer recommendation (DNA Genotek, Ontario, Canada). DNA was quantitated using A260/A280 ratio.

The *OXTR* rs53576 polymorphism was genotyped using a 5′ nuclease assay to discriminate between the two alleles (Taqman SNP Genotyping Assay *OXTR*-C-3290335_10, Applied Biosystems Inc., Foster City, CA). Polymerase chain reactions were performed using 5-μL reaction volumes in 384-well plates with 5 ng of DNA. The standard protocol provided with the kit was followed. End point reads of fluorescence levels were obtained with an ABI 7900HT Sequence Detection System.

Results

OXTR *Distribution*

There was a higher proportion of the A allele of *OXTR* among Koreans (50 AA, 40 AG, and 9 GG) than among Americans (33 AA, 68 AG, and 51 GG), $\chi^2(2, N = 251) = 30.31$, $p < .001$. These genotypes did not deviate from Hardy-Weinberg equilibrium in either cultural group, $\chi^2(2, N = 99) = 0.06$, $p = .970$ for Koreans, and $\chi^2(2, N = 152) = 1.30$, $p = .549$ for Americans. These distributions are comparable to the *OXTR* genotypic distributions from previous studies with ethnically similar samples (Kim et al., 2010b).

Gene–Culture Interaction on Emotion Regulation

To examine the Gene–Culture interaction with respect to emotion regulation, we conducted a series of 2 (Culture: Koreans vs. Americans) by 3 (*OXTR*: AA vs. AG vs. GG) analyses of variance (ANOVAs). Entering gender as a factor or controlling for gender or age did not significantly impact the results, and thus, we do not mention these variables further.

Emotional suppression. There was a significant main effect of culture, $F(1, 245) = 10.61$, $p = .001$, $\eta^2 = .040$ with respect to emotional suppression, but no main effect of *OXTR*, $F(2, 245) = 0.51$, $p = .602$, $\eta^2 = .004$. As predicted, Koreans ($M = 3.89$, $SD = 1.20$) reported suppressing their emotion more than Americans ($M = 3.34$, $SD = 1.01$). The main effect of culture was qualified by the predicted interaction between Culture and *OXTR*, $F(2, 245) = 5.62$, $p = .004$, $\eta^2 = .042$ (see Figure 1).[1] Planned pairwise comparisons show that Americans with the GG genotype ($M = 3.04$, $SD = 1.06$) reported suppressing emotion less than those with the AA genotype ($M = 3.68$, $SD = 0.92$), $p = .008$, Cohen's $d = 0.64$. Americans with the AG genotype ($M = 3.31$, $SD = 0.98$) were between the homozygous genotypes, $p = .173$ with GG and $p = .105$ with AA. Koreans with the GG genotype ($M = 4.42$, $SD = 0.80$) reported suppressing emotion more than those with the AA genotype ($M = 3.54$, $SD = 1.16$), $p = .025$, Cohen's $d = 0.88$. Koreans with the AG genotype ($M = 3.72$, $SD = 1.29$) were also between the homozygous genotypes, $p = .079$ with GG and $p = .433$ with AA.

As Figure 1 suggests, the cultural difference in emotional suppression was driven primarily by G allele carriers. Additional pairwise comparisons revealed that among those with the GG and AG genotypes, Koreans reported more emotional suppression than Americans, $p = .001$ for GG and $p = .058$ for AG, Cohen's $d = 1.47$ and 0.36, respectively, whereas there was no cultural difference among those with the AA genotype, $p = .556$, Cohen's $d = 0.13$.

Cognitive reappraisal. As expected, there was neither a significant main effect of culture, $F(1, 245) = 0.62$, $p = .431$, $\eta^2 = .003$, nor a main effect of *OXTR*, $F(2, 245) = 0.79$,

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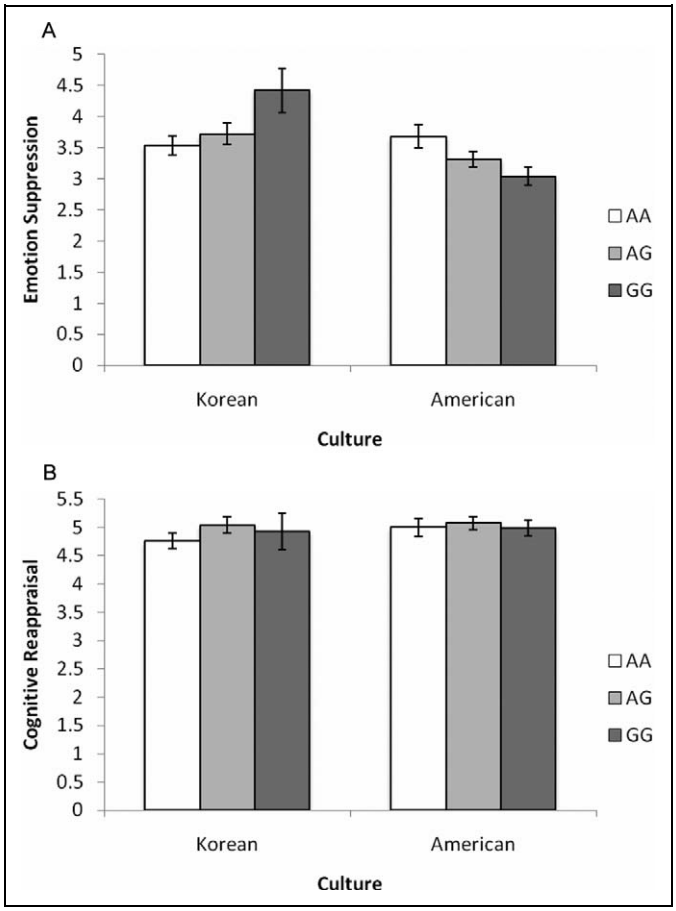

Figure 1. The interaction between culture and *OXTR* on emotional suppression (A) and cognitive appraisal (B)

$p = .456$, $\eta^2 = .006$. There was also no interaction between Culture and *OXTR* on cognitive reappraisal, $F(2, 245) = 0.28$, $p = .755$, $\eta^2 = .002$ (see Figure 1).

Supplemental Analysis of East Asian Americans

Koreans and Americans differ not only in terms of culture but also in the makeup of genes other than the gene examined in the present study, which means that Gene–Gene interactions (Kaufman et al., 2006) are a potential alternative explanation for the present results regarding *OXTR* and culture. Thus, in addition to the main analyses, we separated East Asian American participants (26 females and 19 males; mean age = 19.65) and European Americans (66 females and 41 males; mean age = 19.05) for supplemental analysis to examine the role of cultural exposure. These analyses were conducted to compare European Americans and Koreans with East Asian Americans. East Asian Americans would be relatively similar in genetic makeup to Koreans compared to European Americans but more culturally "Americanized." If culture moderates the relationship between *OXTR* and emotion regulation, the Americanized East Asian Americans' pattern should resemble the pattern of European Americans more than the pattern of Koreans.

East Asian Americans' *OXTR* distribution (24 AA, 18 AG, and 3 GG) did not differ from Koreans, $\chi^2(2, N = 144) = 0.27$, $p = .88$, but differed significantly from European Americans (9 AA, 50 AG, and 48 GG), $\chi^2(2, N = 152) = 43.54$, $p < .001$. Thus in terms of *OXTR* genotype distribution, East Asian Americans were more similar to Koreans than European Americans. East Asian Americans' genotype distribution did not deviate from Hardy-Weinberg equilibrium, $\chi^2(2, N = 45) = 0.02$, $p = .99$.

Two separate analyses were conducted: one comparing East Asian Americans to Koreans and the other comparing East Asian Americans to European Americans in the ANOVA analyses testing the Gene–Culture interaction in their use of emotional suppression. In the comparison between East Asian Americans ($M = 3.63$, $SD = 0.83$ for AA, $M = 3.54$, $SD = 1.03$ for AG, and $M = 2.50$, $SD = 0.66$ for GG) and European Americans ($M = 3.83$, $SD = 1.19$ for AA, $M = 3.23$, $SD = 0.96$ for AG, and $M = 3.07$, $SD = 1.07$ for GG), there was no main effect of culture, $F(1, 146) = 0.39$, $p = .533$, $\eta^2 = .003$, but a significant main effect of *OXTR*, $F(2, 146) = 3.586$, $p = .030$, $\eta^2 = .046$ ($M = 3.68$, $SD = 0.92$ for AA, $M = 3.31$, $SD = 0.98$ for AG, and $M = 3.07$, $SD = 1.06$ for GG). There was no interaction effect, $F(2, 146) = 1.22$, $p = .299$, $\eta^2 = .02$, as the association between genotype and emotion suppression was the same for European Americans and East Asian Americans. In the comparison between East Asian Americans and Koreans, there was a significant main effect of culture, $F(1, 138) = 5.61$, $p = .019$, $\eta^2 = .04$ ($M = 3.69$, $SD = 1.20$ for Koreans and $M = 3.51$, $SD = 0.92$ for East Asian Americans), but no main effect of *OXTR*, $F(2, 138) = 0.09$, $p = .911$, $\eta^2 = .001$. The interaction was significant, $F(2, 138) = 3.21$, $p = .043$, $\eta^2 = .04$. Taken together, this analysis indicates that the East Asian Americans' pattern is more similar to the culturally similar European Americans than to the genetically similar Koreans.

Discussion

The present study provides evidence that culture and genes interact to influence emotion-regulation tendencies, specifically in the form of a predicted interaction effect between culture and *OXTR* on emotional suppression. Emotional suppression was most clearly observable among Koreans with the *OXTR* GG genotype, those characterized as more socioemotionally sensitive, compared to those with AA genotype. Among Americans, the pattern was reversed, such that those with the GG genotype engaged in *less* emotional suppression, compared to those with the AA genotype.

This finding linking *OXTR* with culturally normative emotion-regulation patterns adds to the growing body of literature linking *OXTR* with other forms of socioemotional sensitivity, such as empathic accuracy (Rodrigues et al., 2009) and more sensitive parenting (Riem et al., in press). For Americans who are from a culture in which emotional expression is encouraged and emotional suppression has negative consequences (Gross & John, 1997), those who are predisposed to socioemotional sensitivity may avoid a culturally

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discouraged emotion-regulation strategy compared to those without the same predisposition. For Koreans, who come from a culture in which emotional suppression is commonly practiced with relatively positive consequences (Butler et al., 2009; Kim & Sherman, 2007; Lee et al., 2009), those who are predisposed to socioemotionally sensitivity report suppressing their emotions to a greater extent than those without the same disposition. What binds the Americans and the Koreans together in the present study is that those who were more socioemotionally sensitive (i.e., GG people) exhibited the culturally normative strategy to a greater extent than those with less socioemotionally sensitive genotypes. These findings suggest that there are genetic bases for sensitivity to socioemotional input in the form of culture-specific social and emotional norms.

Two additional findings yielded important information related to these primary results. First, with respect to cognitive reappraisal which is intrapersonal rather than social in nature and shows no cultural difference (Gross, 2008; Matsumoto et al., 2008), there was no Gene–Culture interaction. This suggests that the Gene–Culture interaction with *OXTR* may not apply to regulating emotions in general, but rather, to how people regulate emotions in a culturally normative way within social contexts. This finding also suggests a potential boundary condition for specific psychological tendencies associated with *OXTR*. That is, *OXTR* is specifically associated with cultural sensitivity for social and emotional psychological processes. Consistent with this idea, a previous study from our own laboratory has shown that culture is a significant moderator of the association of a serotonin receptor polymorphism (5-HTR_{1A}) when the psychological outcome (locus of attention) was cognitive in nature (Kim et al., 2010a).

Second, East Asian Americans, who were more culturally ''Americanized'' but shared a more similar genetic makeup with the Koreans produced a pattern of results more similar to the European Americans than to Koreans. This suggests that it is culture moderating the effect of the gene, rather than an additional (unmeasured) gene producing the Gene – Culture interaction (see also Kim et al., 2010a, 2010b). We utilized this strategy of including East Asian Americans to triangulate on the pivotal importance of culture. This strategy is necessary as cultural groups differ genetically, and there is a distinct possibility of interactions among different genes. As the ability to survey multiple genes increases, there should be further examinations of the complex interactions among various genes along with culture.

There are some limitations to this study. The present findings are based on the relatively small sample size. In particular, given the skewed distributions among the ethnic groups, certain genotypes (i.e., GG genotype for Koreans and Asian Americans) include only a small number of participants. Thus, the inference from the results should be made with caution. However, it is also important to note that the present results are highly consistent with previous findings from an independent sample on emotional support seeking (Kim et al., 2010b) which involved a similar behavior of emotional disclosure. The present study utilized a self-report measure of emotion regulation. Although the scale is a validated and widely used instrument, it is important to examine the phenomenon looking at actual behavioral indications of emotion suppression.

Implications for Emotion Regulation

The present findings have implications for understanding the costs and benefits of different emotion-regulation strategies and the relationship between emotion regulation and other behaviors, such as seeking social support (Sherman, Kim, & Taylor, 2009). Asking for help, particularly for emotional problems, leads people to reveal their emotions. Cultural differences in emotion-regulation strategies, then, could account for observed cultural differences in support seeking (Kim et al., 2008). Thus, the *OXTR* Gene–Culture interaction in emotional suppression observed in the present study may be related to understanding the *OXTR* Gene–Culture interaction observed in social support seeking among those experiencing psychological distress (Kim et al., 2010b).

Moreover, the present study examined differences in the use of emotional suppression as a strategy but not the effects of that strategy. It is important for future research, then, to examine the role of genes in moderating the costs that people from different cultures experience when they suppress or express their emotions. For European Americans, emotional suppression leads to negative cognitive, social, and physiological consequences (e.g., Gross & John, 2003; John & Gross, 2004; Richards & Gross, 1999), but Asian Americans do not appear to experience the same costs of emotional suppression (Butler et al., 2007). The present research raises the question of whether this is particularly true of those with the G allele and whether a similar pattern of Gene–Culture interactions would occur for other forms of emotional regulation. Future research would profit by examining the costs and benefits of different emotion-regulation strategies for individuals as a function of both culture and genetic variability.

Gene-Culture Interactions

OXTR, like many polymorphisms that are associated with psychological differences, has ethnic differences in its allelic distribution. In the present sample, we observed a larger proportion of the A allele among Koreans and East Asian Americans than among European Americans. Researchers have developed different approaches to understand these genetic differences in the context of psychological and behavioral tendencies that possess at least a partial genetic basis. One model, termed culture–gene coevolution or duel inheritance theory, proposes that cultural tendencies are adaptive and influence the social and physical environments under which genetic selection operates (Boyd & Richerson 1985; Cavalli-Sforza & Feldman 1981; Chiao & Blizinsky, 2009). In particular, it has been suggested that cultural values serve as a buffer against genetic susceptibility to psychological vulnerability (Chiao & Blizinsky, 2009). Following the same reasoning, it is possible

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that the cultural value of collectivism among Asians, which is characterized by greater emphasis on social relations and interpersonal coordination, serves to buffer against the genetic susceptibility to lower socioemotional sensitivity.

The Gene–Environment interaction approach has received much attention in recent years (see Kim-Cohen & Gold, 2009, for a review). The present research expands the notion of environment to include culture and thus provides additional support for the approach. Other researchers have also examined culture from the Gene × Environment perspective. For example, cultural consonance, that is, the perception that one is congruent with cultural values, has been shown to predict psychological outcomes as a function of genes. In a within-culture study in Brazil, individuals' perception of the extent to which their family's values are congruent with their culture's values predicted lower levels of depression, and this relationship was strongest among people with the AA variant of the 2A receptor in the serotonin system (Dressler, Balieiro, Ribeiro, & Dos Santos, 2009), which is viewed as a more vulnerable allele. Thus, culture is a variable that should be considered as researchers pursue both within- and between-culture analyses of the interaction of Genes and Environment.

We have now obtained Gene × Culture interactions in three psychological domains, specifically emotion (the present study), cognition (Kim et al., 2010a), and social interaction (Kim et al., 2010b). In each study, we have found that cultural differences that have been observed in the literature are amplified among people with particular genotypes theorized to predict sensitivity to environmental input. The same genotype can lead to very different behavioral phenotypes, depending on an individual's cultural context. Taken together, these findings illustrate the importance of examining the interaction of these two distinct sources of variation to provide a more complete understanding of human behavior.

Declaration of Conflicting Interests

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Note

1. Given the small sample size of Korean GG genotypes, we conducted an additional analysis with AG and GG genotypes combined, as combining the rarer homozygous genotype with the heterozygous genotype is commonly used to deal with skewed genetic distribution (e.g., Bakermans-Kranenburg & van IJzendoorn, 2008; Rodrigues et al., 2009). This approach yielded 50 AA and 49 AG/GG genotypes among Koreans and 33 AA and 119 AG/GG genotypes among Americans. The 2 (Culture: Koreans vs. Americans) by 2 (*OXTR*: AA vs. AG/GG) analysis of variance (ANOVA) produced the same pattern of results, with a statistically significant interaction, $F(1, 247) = 6.83$, $p = .009$.

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