

## INTRODUCTION

# Culture and Biology Interplay: An Introduction

José M. Causadias  
Arizona State University

Eva H. Telzer  
University of North Carolina at Chapel Hill

Richard M. Lee  
University of Minnesota

**Objective:** Culture and biology have evolved together, influence each other, and concurrently shape behavior, affect, cognition, and development. This special section highlights 2 major domains of the interplay between culture and biology. **Method:** The first domain is neurobiology of cultural experiences—how cultural, ethnic, and racial experiences influence limbic systems and neuroendocrine functioning—and the second domain is cultural neuroscience—the connections between cultural processes and brain functioning. **Results:** We include 3 studies on neurobiology of cultural experiences that examine the associations between racial discrimination and heart rate variability (Hill et al., 2016), economic and sociocultural stressors and cortisol levels (Mendoza, Dmitrieva, Perreira, & Watamura, 2016), and unfair treatment and allostatic load (Ong, Williams, Nwizu, & Gruenewald, 2016). We also include 2 studies on cultural neuroscience that investigate cultural group differences and similarities in beliefs, practices, and neural basis of emotion regulation (Qu & Telzer, 2016), and reflected and direct self-appraisals (Pfeifer et al., 2016). **Conclusions:** We discuss pending challenges and future directions for this emerging field.

**Keywords:** culture, biology, culture and biology interplay, neurobiology of cultural experiences, cultural neuroscience

Recent advances in biological sciences, like neurosciences, genetics, and neurobiology, have transformed psychology, affording opportunities to examine novel questions and advancing our understanding of behavior, affect, cognition, and development. In the last decade, these new methods have been employed in the psychological science of culture, race, and ethnicity. For instance, genetic studies have reported the moderating role of some gene variants in the link between racial discrimination and the development of conduct problems (Brody et al., 2011) and criminal arrests (Schwartz & Beaver, 2011); neuroscience studies have shown cultural differences in neural reward activity among White and Latino youth during experiences of family assistance (Telzer, Masten, Berkman, Lieberman, & Fuligni, 2010); and neurobiology

of stress studies have found that discrimination can affect diurnal cortisol rhythm among African Americans (Fuller-Rowell, Doan, & Eccles, 2012) and Mexican Americans (Zeiders, Doane, & Roosa, 2012).

Despite these initial advances, psychological science on culture, race, and ethnicity has yet to fully profit from these innovations. Scholars in the field are justified in their skepticism toward methods that can potentially reduce the meaning of complex cultural experiences to a gene or brain area (Syed & Kathawalla, in press). Biological arguments also have been employed in the past to justify racial hierarchies (Hartigan, 2015) and to reify ethnic differences regarding intelligence (Sternberg, Grigorenko, & Kidd, 2005). Quite simply, the nature versus nurture debate continues to exert a polarizing influence in the way psychologists approach human behavior. It has placed culture and biology at opposite ends of a supposed spectrum, reinforcing the idea that if a process or trait is cultural, then it is not biological, and vice versa (Rogoff, 2003). This special section on the culture and biology interplay seeks to strike a constructive balance between the potential benefits of drawing upon biological science methodology, and safeguards against essentialist beliefs that perpetuate prejudice and stereotypes and increase racial inequalities.

---

*Editor's Note.* This is an introduction to the special issue/section "Culture and Biology Interplay."—R. M. L.

---

This article was published Online First August 15, 2016.

José M. Causadias, T. Denny Sanford School of Social and Family Dynamics, Arizona State University; Eva H. Telzer, Department of Psychology and Neuroscience, University of North Carolina at Chapel Hill; Richard M. Lee, Department of Psychology, University of Minnesota.

Correspondence concerning this article should be addressed to José M. Causadias, T. Denny Sanford School of Social and Family Dynamics, Arizona State University, Cowden Family Resources Building, 850 South Cady Mall, Tempe, AZ 85281. E-mail: [jose.causadias@asu.edu](mailto:jose.causadias@asu.edu)

### What Is Culture and Biology Interplay?

Because psychological science on culture, race, and ethnicity has yet to fully profit from innovations in neuroscience, genetics,

and neurobiology, pressing questions are still unanswered. For instance, how do cultural experiences, such as discrimination and immigration, affect neuroendocrine functioning (e.g., cortisol), cellular activity (e.g., c-reactive proteins), and gene expression? Are any of these associations responsive to interventions? Do individuals socialized into different cultural orientations of emotion regulation exhibit unique patterns of brain activation? What is the role of genetic variation in the link between acculturative stress and health outcomes?

The goals of this special section are to (a) advance understanding of culture, ethnicity, and race by tackling some of these questions; (b) offer an opportunity to overcome some of the aforementioned challenges; and (c) stimulate research on the emerging field of culture and biology interplay that centers on how these two processes have evolved together, influence each other, and concurrently shape behavior, affect, cognition, and development across multiple levels, types, and domains of analysis (Causadias, Telzer, & Gonzales, *in press*). The term *interplay* represents the association between culture and biology, as it encompasses several different relationships (Causadias, 2013), including cultural effects on biological systems (e.g., Zeiders et al., 2012), biological influences on behaviors that would serve to shape or select cultural environments (e.g., Chen, Burton, Greenberger, & Dmitrieva, 1999), culture–biology interactions (e.g., Brody et al., 2011), and culture–biology correlations (e.g., Richerson, Boyd, & Henrich, 2010).

Research on culture and biology interplay can improve understanding of the complexity of the human experience by elucidating how, when, and what cultural and biological processes work together to shape development and evolution. For example, it may elucidate the moderating role of genetic variants on cultural difference in independent versus interdependent social orientation (Kitayama et al., 2014). It also can document the dramatic repercussions of social injustice and exclusion on physical and mental health, such as exposing that high levels of racial discrimination among African American men is associated with shorter telomere length, leading to accelerated biological aging and premature death (Chae et al., 2014). Finally, this new line of research presents new opportunities for social change through the design and implementation of intervention programs aimed at reversing the biological sequelae of injustice.

Culture and biology interplay is rooted in evolution, as natural selection has favored the transmission of a predisposition to cooperate and participate in cultural communities (Tomasello, 1999). It also is informed by an interdisciplinary, multiple levels of analyses perspective (Cicchetti & Dawson, 2002) that incorporates theory and research from the fields of psychology, neuroscience, genomics, and neurobiology of stress. Ultimately, behavior, affect, and cognition are approached as the result of the interdependence, codetermination, and simultaneous influence of multiple processes (Sroufe, 2007). Moreover, cultural and biological processes are recognized as equally important and mutually influential. Thus, no component, subsystem, or level of analysis has causal privileges over the other (Cicchetti & Cannon, 1999).

### The Special Section on Culture and Biology Interplay

The study of culture and biology interplay can be organized into different domains that focus on the relationship between cultural

processes and one particular biological level of analysis. For this special section, we present new empirical research on two domains: neurobiology of cultural experiences and cultural neuroscience. Neurobiology of cultural experiences centers on the exploration of how cultural, ethnic, and racial experiences have repercussions in limbic and neuroendocrine functioning (Doane, Sladek, & Adam, *in press*). Cultural neuroscience is the inquiry of cultural variation at the psychological and neural levels aimed to articulate their mutual relationships and emergent properties (Chiao & Ambady, 2007; Lin & Telzer, *in press*).

### Neurobiology of Cultural Experiences

Three studies examine how adverse experiences—racial discrimination, poverty and cultural stressors, and unfair treatment—affect neurobiological systems. Hill and colleagues (2017, pp. 5–14) investigated the relationship between discrimination and resting heart rate variability, an important biomarker of parasympathetic cardiac modulation and overall health in a sample of 103 African American youth. They found that lifetime discrimination, as well as discrimination due to threats or actual aggression, were inverse predictors of heart rate variability. Next, Mendoza, Dmitrieva, Perreira, Hurwich-Reiss, and Watanura (2017, pp. 15–26) explored whether acculturation, economic hardship, and immigration-related stress predicted physical (body mass index and salivary cortisol levels) and psychological (internalizing and externalizing behavior problems) symptoms in a sample of 71 children of Latino immigrants. They found that economic hardship and acculturation interacted to predict cortisol levels, and economic hardship and immigration stress forecasted internalizing and externalizing behavior problems. Ong, Williams, Nwizu, and Gruenewald (2017, pp. 27–35) examined chronic experiences of unfair treatment (or day-to-day discrimination) in relation to allostatic load, a multisystem index of biological dysregulation. Using a sample of 233 African American adults, they found that unfair treatment was associated with higher allostatic load, even after controlling for sociodemographics, medication use, smoking status, alcohol consumption, depressive symptoms, lifetime discrimination, and global perceived stress. These three studies provide new evidence that adverse cultural experiences can have deleterious effects on neurobiological systems.

### Cultural Neuroscience

Two studies examined neural processes that are involved in cultural values and behaviors. Qu and Telzer (2017, pp. 36–44) employed an experimental approach using fMRI scans to investigate differences and similarities between 14 American and 15 Chinese participants regarding beliefs, practices, and neural basis of emotion regulation. They found that Chinese participants, in contrast with American participants, reported more frequent use of reappraisal and correspondingly less ventrolateral prefrontal cortex activation when regulating negative emotions. Using fMRI scans in a sample of 16 Chinese adults, Pfeifer et al. (2017, pp. 45–58) examined how interdependent self construals are processed at the neural level and vary within individuals across social and academic domains. In addition to finding an extended network of brain regions in the cortical midline structure when self-reflecting, the authors found that the temporal-parietal junction may be more

variably engaged when reflecting in academic relative to social domains. These two studies highlight the importance of cultural orientations and social experiences in influencing the neural foundation of emotional and self-relevant information.

### Conclusions and Future Directions

This special section provides a broader perspective on the biological processes associated with cultural experiences. The five studies illustrate how diverse cultural processes—such as discrimination, acculturation, and immigration—are linked to multiple stress-related mechanisms that have important implications for health and well-being, as well as how culture may modulate neural processes involved in emotion regulation and self-related identity processes. Methodologically, the articles in this special section include results from correlational and experimental studies, targeting children, adolescents, and adults of African, European, Latino, and Asian backgrounds, sampled both in the United States as well as in China.

These articles represent two domains of culture biology interplay: neurobiology of cultural experiences and cultural neuroscience. It is important to note two other domains not represented in this issue, including research on animal culture and cultural genomics. Research on nonhuman primates, for instance, allows us to better understand the role of culture in animal communities and underscores the complexity and meaning of nonhuman behavior and social systems (Causadias et al., in press). In addition, examining genetic variation across cultural groups increases our understanding of individual differences in cultural processes (Kitayama et al., 2014). Therefore, although the studies in this issue examine the intersection of cultural experiences, neuroscience, and neurobiology of stress, additional investigations are necessary on the relationship between cultural and genetic processes. In addition, more research is needed to further understand how the findings reported in these studies replicate with other ethnic and national groups. Longitudinal studies that address how change and continuity in cultural experiences shape the brain and the genome are also warranted. Because most of the emerging research in culture and biology focuses on how adverse cultural experiences (e.g., racial discrimination) disrupt neurobiological functioning, future studies should also address how empowering cultural experiences may have positive effects in the body. Finally, graduate and postgraduate psychological training in issues related to culture, ethnicity, and race—traditionally focused on the development of competences closely related to the humanities and social sciences—should also focus on acquiring skills associated with biological sciences, like neurosciences and genetics (Causadias et al., in press).

In conclusion, this special section brings together two fields that often operate in isolation: culture and biology. Although this field is still emerging and much future work is necessary with different populations, methods, and themes, this special section is a meaningful first step in the endeavor of broadening our understanding of the complex, multifaceted, and mutually influential link between cultural and biological processes. We hope this special section will be useful in helping researchers who study culture, ethnicity, and race to overcome some of the aforementioned reasons why we have yet to fully embrace new methods from the biological sciences. This special section can help underscore that, instead of

reducing the meaning of cultural processes, biological methods offer a new platform to appreciate an even more nuanced and rich landscape; instead of justifying racial hierarchies, they can be useful in documenting the effect of racial inequalities and discrimination; and instead of replacing cultural research, they can offer new avenues of inquiry. Ultimately, culture and biology interplay research can help us better understand how nature and nurture work together, and not against each other, to shape risk, resilience, and well-being.

### References

- Brody, G. H., Beach, S. R., Chen, Y. F., Obasi, E., Philibert, R. A., Kogan, S. M., & Simons, R. L. (2011). Perceived discrimination, serotonin transporter linked polymorphic region status, and the development of conduct problems. *Development and Psychopathology*, *23*, 617–627. <http://dx.doi.org/10.1017/S0954579411000046>
- Causadias, J. M. (2013). A roadmap for the integration of culture into developmental psychopathology. *Development and Psychopathology*, *25*(4pt2), 1375–1398. <http://dx.doi.org/10.1017/s0954579413000679>
- Causadias, J. M., Telzer, E. H., & Gonzales, N. A. (in press). Introduction to culture and biology interplay. In J. M. Causadias, E. H. Telzer, & N. A. Gonzales (Eds.), *Handbook of culture and biology interplay: Bridging evolutionary adaptation and development*. New York, NY: Wiley.
- Chae, D. H., Nuru-Jeter, A. M., Adler, N. E., Brody, G. H., Lin, J., Blackburn, E. H., & Epel, E. S. (2014). Discrimination, racial bias, and telomere length in African-American men. *American Journal of Preventive Medicine*, *46*, 103–111. <http://dx.doi.org/10.1016/j.amepre.2013.10.020>
- Chen, C., Burton, M., Greenberger, E., & Dmitrieva, J. (1999). Population migration and the variation of dopamine D4 receptor (DRD4) allele frequencies around the globe. *Evolution and Human Behavior*, *20*, 309–324. [http://dx.doi.org/10.1016/S1090-5138\(99\)00015-X](http://dx.doi.org/10.1016/S1090-5138(99)00015-X)
- Chiao, J. Y., & Ambady, N. (2007). Cultural neuroscience: Parsing universality and diversity across levels of analysis. In S. Kitayama & D. Cohen (Eds.), *Handbook of cultural psychology* (pp. 237–254). New York, NY: Guilford Press.
- Cicchetti, D., & Cannon, T. D. (1999). Neurodevelopmental processes in the ontogenesis and epigenesis of psychopathology. *Development and Psychopathology*, *11*, 375–393. <http://dx.doi.org/10.1017/S0954579499002114>
- Cicchetti, D., & Dawson, G. (2002). Multiple levels of analysis. *Development and Psychopathology*, *14*, 417–420. <http://dx.doi.org/10.1017/S0954579402003012>
- Doane, L. D., Sladek, M. R., & Adam, E. K. (in press). Introduction to neurobiology of cultural experiences. In J. M. Causadias, E. H. Telzer, & N. A. Gonzales (Eds.), *Handbook of culture and biology interplay: Bridging evolutionary adaptation and development*. New York, NY: Wiley.
- Fuller-Rowell, T. E., Doan, S. N., & Eccles, J. S. (2012). Differential effects of perceived discrimination on the diurnal cortisol rhythm of African Americans and Whites. *Psychoneuroendocrinology*, *37*, 107–118. <http://dx.doi.org/10.1016/j.psyneuen.2011.05.011>
- Hartigan, J. (2015). *Race in the 21st century. Ethnographic approaches*. New York, NY: Oxford University Press.
- Hill, L. K., Hoggard, L. S., Richmond, A., Gray, D. L., Williams, D. P., & Thayer, J. F. (2017). Examining the association between perceived discrimination and heart rate variability in African Americans. *Cultural Diversity & Ethnic Minority Psychology*, *23*, 5–14.
- Kitayama, S., King, A., Yoon, C., Tompson, S., Huff, S., & Liberzon, I. (2014). The dopamine D4 receptor gene (DRD4) moderates cultural difference in independent versus interdependent social orientation. *Psychological Science*, *25*, 1169–1177. <http://dx.doi.org/10.1177/0956797614528338>

- Lin, L. C., & Telzer, E. H. (in press). An introduction to cultural neuroscience. In J. M. Causadias, E. H. Telzer, & N. A. Gonzales (Eds.), *Handbook of culture and biology interplay: Bridging evolutionary adaptation and development*. New York, NY: Wiley.
- Mendoza, M. M., Dmitrieva, J., Perreira, K. M., Hurwich-Reiss, E., & Watamura, S. E. (2017). The effects of economic and sociocultural stressors on the well-being of children of Latino immigrants living in poverty. *Cultural Diversity & Ethnic Minority Psychology, 23*, 15–26.
- Ong, A. D., Williams, D. R., Nwizu, U., & Gruenewald, T. L. (2017). Everyday unfair treatment and multisystem biological dysregulation in African-American Adults. *Cultural Diversity & Ethnic Minority Psychology, 23*, 27–35.
- Pfeifer, J. H., Mahy, C. E. V., Merchant, J. S., Chen, C., Masten, C. L., Fuligni, A. J., . . . Chen, C. (2017). Neural systems for reflected and direct self-appraisals in Chinese young adults: Exploring the role of temporal-parietal junction. *Cultural Diversity & Ethnic Minority Psychology, 23*, 45–58.
- Qu, Y., & Telzer, E. H. (2017). Cultural differences in beliefs, practices, and neural mechanisms of emotion regulation. *Cultural Diversity & Ethnic Minority Psychology, 23*, 36–44.
- Richerson, P. J., Boyd, R., & Henrich, J. (2010). Gene-culture coevolution in the age of genomics. *Proceedings of the National Academy of Sciences of the United States of America, 107*(2, Suppl. 2), 8985–8992. <http://dx.doi.org/10.1073/pnas.0914631107>
- Rogoff, B. (2003). *The cultural nature of human development*. New York, NY: Oxford University Press.
- Schwartz, J. A., & Beaver, K. M. (2011). Evidence of a gene×environment interaction between perceived prejudice and MAOA genotype in the prediction of criminal arrests. *Journal of Criminal Justice, 39*, 378–384. <http://dx.doi.org/10.1016/j.jcrimjus.2011.05.003>
- Sroufe, L. A. (2007). The place of development in developmental psychopathology. In A. Masten (Ed.), *Multilevel dynamics in developmental psychopathology: Pathways to the future* (Vol. 34, pp. 285–299). Mahwah, NJ: Erlbaum.
- Sternberg, R. J., Grigorenko, E. L., & Kidd, K. K. (2005). Intelligence, race, and genetics. *American Psychologist, 60*, 46–59. <http://dx.doi.org/10.1037/0003-066X.60.1.46>
- Syed, M., & Kathawalla, U. K. (in press). Integrating culture and biology in psychological research: Conceptual clarifications and recommendations. In J. M. Causadias, E. H. Telzer, & N. A. Gonzales (Eds.), *Handbook of culture and biology interplay: Bridging evolutionary adaptation and development*. New York, NY: Wiley.
- Telzer, E. H., Masten, C. L., Berkman, E. T., Lieberman, M. D., & Fuligni, A. J. (2010). Gaining while giving: An fMRI study of the rewards of family assistance among white and Latino youth. *Social Neuroscience, 5*, 508–518. <http://dx.doi.org/10.1080/17470911003687913>
- Tomasello, M. (1999). *The cultural origins of human cognition*. Cambridge, MA: Harvard University Press.
- Zeiders, K. H., Doane, L. D., & Roosa, M. W. (2012). Perceived discrimination and diurnal cortisol: Examining relations among Mexican American adolescents. *Hormones and Behavior, 61*, 541–548. <http://dx.doi.org/10.1016/j.yhbeh.2012.01.018>