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Neurobiological Causes and Consequences of Cultural Differences in Social Cognition

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Individuals from different cultures vary in how they perceive, think about and respond to the social world. A prominent view is that environmental factors, such as the prevalence of infectious disease threats, may promote certain social cognitive processes that facilitate survival (Fincher & Thornhill, 2008; Schaller & Duncan, 2007). Thus, cultures across the globe vary in ideologies, such as collectivism versus individualism, in part because environmental factors vary across regions of the world. However, the underlying neurobiological mechanisms that link environmental factors, like threat of infection, to differences in cultural ideologies remains unknown. Another mystery is how our cultural background spontaneously shapes our responses to the social environment. Specifically, while it is well known that cultural background influences many of our social reactions, to date it remains unclear *how* cultural backgrounds (1) guide our responses from moment to moment and (2) mold our social learning and memory. The goal of the present chapter is to review neuroscience research that may offer new insight into these lingering questions.

How Do Environmental Factors Influence Cultural Ideologies? The Parasite Stress Theory of Sociality

Given that infectious disease threats vary regionally, cultures around the world may foster different cultural ideologies in part to cope with the disease threats posed by the region. In particular, the parasite stress theory of sociality suggests that the threat of infectious and parasitic diseases fosters social cognitive processes that prioritize assortative sociality, such as

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strong feelings of connection to in-group members and avoidance of out-group members (Fincher & Thornhill, 2012; Fincher, Thornhill, Murray, & Schaller, 2008; Schaller & Duncan, 2007). The logic of the parasite stress theory of sociality is that connection to in-group members and avoidance of out-group members should minimize the possibility of infection from novel pathogens (Faulkner, Schaller, Park, & Duncan, 2004; Fincher & Thornhill, 2008; Navarrete & Fessler, 2006; Navarrete, Fessler, & Eng, 2007; Park, Schaller, & Crandall, 2007; Schaller & Duncan, 2007; Schaller & Murray, 2008).

Support for the parasite stress theory of sociality comes from evidence that cultural differences in assortative sociality scale with infectious disease prevalence (Fincher & Thornhill, 2012; cf. Currie & Mace, 2012; van de Vliert & Postmes, 2012). For example, a common component of collectivism (versus individualism) is amplified in-group/out-group divisions, in which in-group cohesion and out-group avoidance are heightened (Iyengar, Lepper, & Ross, 1999; Markus & Kitayama, 2010; Meyer et al., 2015; Triandis, 1972, 1989). Interestingly, pathogen prevalence across regions of the world positively correlates with the degree to which collectivistic ideologies are endorsed by cultures in those regions. In fact, this relationship exists with historical as well as with contemporary levels of pathogen prevalence (Fincher et al., 2008). Pathogen prevalence has also been linked to a variety of other cultural ideologies relevant to assortative sociality, such as religiosity, conservatism, and the importance of family ties (Fincher & Thornhill, 2008).

Of course, there are benefits associated with interacting with out-group members, such as access to new trade goods and mate options. Computational modeling approaches have addressed this tradeoff by showing that disease threat tips the cost–benefit ratio of connecting with out-group members. Specifically, spontaneously formed groups will preferentially form connections with agents distant from their local social network when the threat of infection is low. However, when the threat of infection is high, groups prefer more local and less global social network connections (Brown, Fincher, & Walasek, 2016).

While provocative, the parasite stress theory of sociality relies on correlational data, and more recently computational modeling, for support. Thus it remains unclear how – in terms of underlying biological mechanisms – threat of infection influences cultural ideologies. Research from social neuroscience suggests that inflammation, the body's first line of defense against infection, may be a mechanism by which threat of infection promotes assortative sociality. This work finds that inflammation not only defends the body from physical threats, but also heightens neural sensitivity to social threats.

Research on how inflammation influences social cognition often uses neuropharmacological manipulations to systematically induce inflammation, and subsequently measures neural and behavioral responses to social threats and rewards. In these paradigms, participants are randomly assigned to receive either endotoxin (0.4–0.8 ng/kg), which induces inflammation in a safe and time-limited manner, or a placebo. Two hours later, when endotoxin-induced inflammation is at its peak (Krabbe et al., 2005; Reichenberg et al., 2001; Suffredini, Hochstein, & McMahon, 1999; Wright, Strike, Brydon, & Steptoe, 2005), participants complete psychological tasks of interest.

For example, in one study, participants were randomly assigned to receive endotoxin or a placebo and subsequently underwent functional magnetic resonance imaging (fMRI). During their fMRI scan, participants alternated between viewing photographs of (1) socially threatening strangers (e.g., an angry face), (2) socially non-threatening strangers (e.g., a smiling face), (3) non-social threatening images (e.g., a snake), and (4) non-social, non-threatening images (e.g., a cup). Results showed that activity in the amygdala, a region previously associated with threat responding (Green & Phillips, 2004; Phan, Fitzgerald, Nathan, & Tancer, 2006), preferentially increased in participants who had received endotoxin when they viewed threatening strangers (Inagaki, Muscatell, Irwin, Cole, & Eisenberger, 2012). Thus, inducing inflammation, the body's response to physical threats in the environment, enhances sensitivity to social threats in the environment. Therefore, inflammation may amplify the threat of out-group strangers, and so facilitate assortative sociality.

Other work that combines endotoxin administration with fMRI scanning finds that inflammation also increases neural sensitivity to social acceptance. Muscatell and colleagues (2016) found that when participants received negative (versus neutral) social feedback, endotoxin (versus placebo) increased activity in the neural regions associated with threat and distress (the amygdala, the dorsal anterior cingulate cortex) (Adolphs, 2001; Amaral et al., 2003). Alternatively, when participants received positive (versus neutral) social feedback, endotoxin (versus placebo) increased activity in brain regions associated with reward (the ventral striatum and the ventromedial prefrontal cortex; Cador, Robbins, & Everitt, 1989; Gläscher, Hampton, & O'Doherty, 2009; Kable & Glimcher, 2007; Knutson, Taylor, Kaufmann, Peterson, & Glover, 2005; O'Doherty, Deichman, Critchley, & Dolan, 2002; Padoa-Schioppa & Assad, 2006;

Sabatinelli, Bradley, Lang, Costa, & Versace, 2007). Moreover, another study found that the participants with the greatest inflammatory response to endotoxin exposure showed the greatest activity in distress-related neural regions during social exclusion (Eisenberger, Inagaki, Rameson, Mashal, & Irwin, 2009). Together, these findings suggest that inflammation heightens sensitivity to social acceptance, another process that may be relevant to assortative sociality.

Interestingly, animal and human research has shown that inflammation also increases affiliation with familiar others, a process that is probably key to the in-group-connection component of assortative sociality. For example, in both rats and non-human primates, inducing an inflammatory response increases the amount of close contact with familiar cagemates (Dantzer, 2001; Willette, Lubach, & Coe, 2007; Yee & Prendergast, 2010). Piggybacking on this work, a study in humans found that administration of endotoxin (versus placebo) increased participants' self-reported desire to spend time with close others (Inagaki et al., 2015). When these participants underwent fMRI scanning, individuals who received endotoxin (versus placebo) also showed greater activity in the ventral striatum, a region key to reward processing (Cador et al., 1989; Knutson et al., 2005; O'Doherty et al., 2002), when they viewed photographs of a close other compared to photographs of a gender-, age-, and race-matched non-close other. Furthermore, the participants with the greatest inflammatory response showed the greatest ventral striatum activity in response to observing photographs of their close other. Thus, inflammation may increase the reward value of close others, motivating the desire to affiliate with them.

Inflammation also influences "mentalizing," or the process of thinking about people's personality traits, intentions, and emotions (Frith & Frith, 2006; Kullmann et al., 2014; Moieni et al., 2015; Muscatell et al., 2016). When participants think about other people's mental states in the fMRI scanner, prior administration of endotoxin (versus placebo) increases neural activity in the two brain regions most consistently implicated in mentalizing – the temporoparietal junction and the medial prefrontal cortex (Frith & Frith, 2006; Saxe & Kanwisher, 2003; Spunt, Satpute, & Lieberman, 2011). In one study, after administration of endotoxin (versus placebo), participants completed the "Reading the Mind in the Eyes" task, which requires them to determine what a photographed person is thinking on the basis of limited information expressed in the photographed person's eyes (Kullmann et al., 2013). Participants who were administered endotoxin (versus placebo) showed increased activity in the temporoparietal junction during the Reading the Mind in the Eyes task. Meanwhile, another study using a different mentalizing task, in which participants consider what other people think of them, found that administration of endotoxin (versus placebo) increased activity in the medial prefrontal cortex (Muscatell et al., 2016). Together, these studies suggest that inflammation may enhance mentalizing neural mechanisms.

In connection with the parasite stress theory of sociality, collectivistic ideologies also influence mentalizing (de Greck et al., 2012; Harada, Li, & Chaoi, 2010; Meyer et al., 2015; Wang et al., 2012; Zhu, Zhang, Fan, & Han, 2007), particularly mentalizing about in-group and out-group members. For example, one study found that greater endorsement of collectivistic ideology simultaneously correlated with (1) greater activity in the medial prefrontal cortex when mentalizing about an in-group member and (2) less activity in the medial prefrontal cortex when mentalizing about an out-group member (Meyer et al., 2015). In other words, interdependent self-construal was associated with a mentalizing tradeoff in the medial prefrontal cortex for in-group versus out-group members. Given that inflammation influences mentalizing neural responses, and that mentalizing neural responses to in-group and out-group members vary as a function of collectivism, inflammation may also trigger mentalizing patterns important to the development and maintenance of collectivistic ideologies. That said, this suggestion is preliminary and requires empirical testing in future research.

To date, only a handful of studies have begun to explore the role of inflammation in social and affective processes, and even fewer have begun to link inflammation to differences in cultural ideologies. However, two pieces of evidence suggest this may be a fruitful area to probe the parasite stress theory of sociality. First, it has been shown that simply viewing diseased-looking people is sufficient to increase inflammation (Schaller, Miller, Gervais, Yager, & Chen, 2010), which suggests that the immune system may respond similarly to threats of infection and real infection. Second, a study has found that, after observing photographs of diseased-looking people, participants with collectivistic ancestral backgrounds (versus individualistic ancestral backgrounds) showed significant increases from baseline in immunoglobulin A (IgA) (Brown, Ikeuchi, & Lucas, 2014), which is used by the immune system to counteract pathogens (Carter & Curran, 2011). Thus, a promising direction for future cross-cultural neuroscience research may be to examine whether inflammation triggers threat-related neural circuitry in response to out-group members and reward responses to in-group members (see Figure 17.1A–B), which may in turn

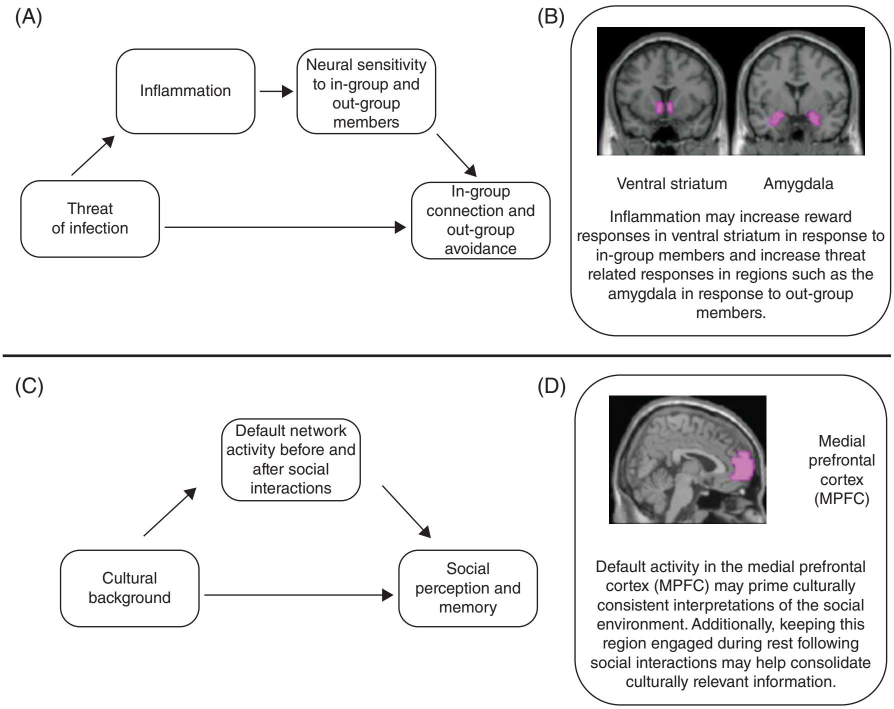

Figure 17.1 Potential mechanisms by which threat of infection leads to in-group preference and out-group avoidance (A–B) and cultural background shapes social perception and memory (C–D)

promote assortative sociality common to regions of the world with known threats of infection.

What Nudges Culturally Consistent Interpretations of the Social World?

Cross-cultural psychology research has shown that cultural ideologies influence how people think about the social environment (Markus & Kitayama, 1991, 2010). For example, among individuals from individualistic cultures, behavior is often interpreted as driven by personal dispositions (Ross & Nisbett, 2011). In contrast, individuals from collectivistic cultures interpret the same behavior as driven by social contextual factors (Choi, Nisbett, & Norenzayan, 1999). Collectivism and individualism also shape how we perceive ourselves. Collectivistic cultures tend to foster interdependent self-construals, which incorporate the values, goals and traits of other people in their social group. In contrast, individualistic cultures tend to foster independent self-construals, in which the self is defined by its uniqueness from others (see Markus & Kitayama, 1991, 2010 for reviews). Taken together, such findings suggest that collectivistic and individualistic cultural ideologies foster different patterns of self- and other-processing.

Cultural differences in self- and other-processing can be traced to different patterns of brain activity in the medial prefrontal cortex (e.g., Harada, Li, & Choi, 2010; Zhu et al., 2007). Portions of the medial prefrontal cortex are known to support various mentalizing processes about the self and others, including impression formation, trait judgments, and mental state inference (Denny, Kober, Wager, & Ochsner, 2012; Van Overwalle, 2009). Consistently with past cross-cultural psychology findings, a quantitative meta-analysis showed that East Asians from collectivistic cultures (versus Western samples from individualistic cultures) show greater activity in a dorsal portion of the medial prefrontal cortex (the dorsomedial prefrontal cortex) across a variety of social cognition tasks (see Han & Ma, 2014). The dorsomedial prefrontal cortex engages when participants are instructed to mentalize about people's intentions and states of mind (Denny et al., 2012; Mitchell, Banaji, & Macrae, 2005; Mitchell, Macrae, & Banaji, 2005; Spunt, Falk, & Lieberman, 2010; Spunt & Lieberman, 2012; Spunt et al., 2011; Van Overwalle, 2009), a process that may be more common among individuals from collectivistic cultures. Indeed, participants from collectivistic cultures (Chinese nationals) show equivalent medial prefrontal cortex activity when thinking about themselves and about close others, whereas participants from individualistic cultures (Caucasians from England, America, Australia, and Canada) more selectively recruit medial prefrontal cortex specifically for thinking about themselves (Zhu et al., 2007).

While this past work has localized "where" cultural differences in self- and other-processing exist in the brain, it remains unknown "how" different patterns of neural activity in these regions drive culturally influenced interpretations of the social world. The next section suggests that understanding an important physiological property of the medial prefrontal cortex – that it is part of the brain's neural baseline – may shed new insight into how cultural differences in self- and other-processing frame perceptions and responses to the social environment.

The medial prefrontal cortex is part of a larger neurocognitive network, which includes the precuneus, the temporoparietal junction and the temporal poles, known to engage whenever our mind is free (Raichle & Snyder, 2007). While other networks of the brain show reduced neural engagement when participants are not required to perform an experimental task, the default network engages whenever participants are not instructed to perform any task at all. This observation is so robust that it even led cognitive neuroscientists to term this network the "default network," because it appears to consistently engage by default (Binder et al., 1999; Greicius, Krasnow, Reiss, & Menon, 2003; Mayozer et al., 2001; Raichle, 2010; Raichle et al., 2001; Shulman et al., 1997). The default network engages during "resting-state scans," in which participants rest and relax in the scanner (typically for 5–8 minutes) as well as during brief mental breaks (typically 10–30 seconds) that occur in between experimental conditions. One study found that even during very brief rest periods (2 seconds), participants increase default network activity, including activity in the medial prefrontal cortex (Meyer, Spunt, & Lieberman, 2017). Thus, the tendency to engage the default network during mental breaks happens immediately, as soon as people are left to their own mental devices.

Priming Hypothesis

One way to think of the default network is that these regions comprise the baseline neural activity with which we enter new situations. Given that culturally specific responses during social processing are represented in the medial prefrontal cortex and that these regions engage reflexively by default, it is possible that moment-to-moment activity in the medial prefrontal cortex primes individuals to think and behave more or less consistently with their belief system (see Figure 17.1C–D).

Support for this possibility comes from studies that examine how neural activity during brief periods of rest (6–9 seconds) just before a self- and other-judgment task influences the speed (or ease) with which participants respond to these tasks (Meyer & Lieberman, 2017; Spunt, Meyer, & Lieberman, 2015). For example, in one study, participants shifted between 6–9-second rest periods and making trait judgments about themselves (e.g., "Are you funny?"), a well-known person (e.g., "Is Barack Obama charming?"), and a well-known non-social object (e.g., "Is the Grand Canyon dry?"; Meyer et al., 2017). Neural activity in the medial prefrontal cortex during each rest period corresponded with faster reaction time specifically on subsequent self-judgment trials. In contrast, neural activity in the dorsomedial prefrontal cortex during each rest period corresponded with faster reaction time on subsequent other-person (Barack Obama) trials. Meanwhile, no region of the brain during rest periods that preceded Grand Canyon trials corresponded with faster reaction time on these non-self and non-social judgments. Thus, medial and dorsomedial prefrontal cortex activity at rest may preferentially prime self- and other-processing, respectively. Consistently with this suggestion, dorsomedial prefrontal cortex activity seconds before reasoning about other people's mental states also led participants to identify more quickly the mental states driving a person's behavior (Spunt, Meyer, & Lieberman, 2015).

Medial and dorsomedial priming effects may relate to cultural differences in social cognition in at least two ways. First, if the medial prefrontal cortex primes self-referential processing, then individuals with interdependent self-construals may show this effect not only for themselves, but also for close others who are incorporated into their self-concepts. Cultural neuroscience paradigms often exogenously prime interdependent and independent self-construals and subsequently measure neural responses during self- and other-processing trials. While this approach has been useful for understanding how different self-construals influence social cognition, it does not explain how everyday social cognition is influenced – endogenously – by self-construal. Neural priming paradigms like the ones reviewed above suggest that medial prefrontal cortex activity at rest may be an endogenous prime that inclines individuals towards interdependent versus independent thinking.

Second, given past findings that individualism fosters dispositional attributions of behavior whereas collectivism fosters contextual attributions of behavior (Choi et al., 1999; Ross & Nisbett, 2011), and that the dorsomedial prefrontal cortex supports mental state reasoning (Denny et al., 2012; Mitchell, Banaji, & Macrae, 2005; Mitchell, Macrae, & Banaji, 2005; Spunt, Falk, & Lieberman, 2010; Spunt & Lieberman, 2012; Spunt, Satpute, & Liberman, 2011; Van Overwalle, 2009), different neural patterns within the dorsomedial prefrontal cortex at rest may prime people toward dispositional versus contextual attributions.

Thus, priming mechanisms in both the medial and the dorsomedial prefrontal cortices may nudge people to perceive the environment through, for example, a more collectivistic or individualistic lens, depending on their cultural background.

Consistently with these ideas, differences in interdependent self-construal and independent self-construal can be traced to differences in medial prefrontal cortex activity at rest. During a 7-minute resting-state scan, Chinese nationals with stronger interdependent self-construal showed greater connectivity (e.g., correlated changes in neural activity over time) between the medial prefrontal cortex and the dorsomedial prefrontal cortex, the region associated with thinking about other people's intentions and states of mind (Wang, Oyserman, Liu, Li, & Han, 2013). In contrast, individuals with stronger independent self-construal showed greater functional connectivity between the medial prefrontal cortex and the precuneus, a region associated with autobiographical and episodic memory (Addis, McIntosh, Moscovitch, Crawley, & McAndrews, 2004; Cavanna & Trimble, 2006; Svoboda, McKinnon, & Levine, 2006). Thus, interdependent self-construal mechanisms in the medial prefrontal cortex may link to mechanisms in the dorsomedial prefrontal cortex associated with thinking about other people, whereas independent self-construal mechanisms in the medial prefrontal cortex may link to other forms of self-processing, such as thinking about oneself in the past. Future work may reveal whether these different connectivity profiles at rest nudge different neural, cognitive, and behavioral responses known to vary between individuals from collectivistic and individualistic cultures.

How Does Cultural Background Influence How We Remember the Social World?

In addition to influencing how we respond to the present social context, cultural ideologies shape how we remember past social events. For example, one study found that individuals from China and the United States vary in the social content they remember from their own personal lives (Conway, Wang, Hanyu, & Haque, 2005). That is, participants from China mentioned other people (besides themselves) more often, and described more than twice as many social interactions than participants from the United States, when prompted to describe autobiographical memories. In contrast, participants from the United States (versus China), described more memories with personal themes (e.g., personal success).

These cultural differences in memory may be related to what social psychologists have termed "the self-reference effect" in memory: information that is encoded as relevant to the self is better recalled than information unrelated to the self (Rogers, Kuiper, & Kirker, 1977; Symons & Johnson, 1997). One possibility is that Chinese individuals (and perhaps individuals from other collectivistic cultures) are more likely than individuals in the United States (and perhaps individuals from other individualistic cultures) to consider information about people in the social environment as self-relevant. In line with this hypothesis, the self-reference effect extends to close others among individuals from Chinese culture, but not to individuals from Western cultures (e.g., Americans, Australians, and

Canadians; Klein, Loftus, & Burton, 1989; Lord, 1980; Zhu et al., 2007; Zhu & Zhang, 2002). While some work has shown that engaging the medial prefrontal cortex during the encoding of self-relevant information is associated with the self-reference effect in memory (Macrae, Moran, Heatherton, Banfield, & Kelley, 2004; Zhu et al., 2007), to date no work has explored how, in terms of neural mechanisms, self-relevant information is consolidated (i.e., committed to memory after encoding).

Consolidation Hypothesis

In connection with the possibility that collectivistic versus individualistic cultural background may influence what is remembered from the social environment, another function of default medial prefrontal cortex activity during rest may be to consolidate newly acquired social information (see Figure 17.1C–D). This hypothesis stems from animal research that found that, during sleep and waking rest, neural reactivation helps consolidate new information (Foster & Wilson, 2006; Hoffman & McNaughton, 2002; Ji & Wilson, 2007; Qin, McNaughton, Skaggs, & Barnes, 1997). Given that the medial prefrontal cortex is already engaged by default when participants rest in the scanner, a similar process could occur during human rest: the medial prefrontal cortex may work with other default network regions during mental breaks to consolidate social information.

To enable researchers to explore this possibility, participants underwent fMRI scanning and formed impressions of various people and locations (Meyer et al., 2017). During impression formation trials, participants observed either a person's face (social impression condition) or a location (non-social impression formation condition) and two traits that had been used to describe the person or location in the past. These two tasks were interleaved with resting-state scans that occurred before (baseline) and after each impression formation task. After their scan, participants completed a surprise memory task requiring them to identify which traits were presented with which faces and locations. The medial prefrontal cortex showed greater connectivity with other portions of the default network associated with social cognition (e.g., the temporoparietal junction) during the rest period that occurred after the participants had formed impressions of people than in the baseline rest period, as well as in the rest period that followed location impression formation. Moreover, greater connectivity between the medial prefrontal cortex and the temporoparietal junction during the rest that occurred after the participants had formed social impressions predicted better associative memory for the traits paired with faces (but not those paired with locations). Together, these findings are consistent with the idea that one function of medial prefrontal cortex and temporoparietal junction activity during rest may be that they work together to consolidate newly acquired social information. Given that default network connectivity during rest consolidates social information, it is possible that different forms of social consolidation occur during rest as a function of cultural ideologies.

Conclusions and Future Directions

Cultural ideologies influence our responses to the social environment. Cultural ideologies may evolve, in part, to help people cope with certain environmental factors, such as pathogen prevalence. This chapter presented research that suggests that inflammation – the body's first line of defense against infection – may be a mechanism through which the threat of infection influences cultural ideologies. Once cultural ideologies are formed, they may go on to influence how we perceive the social world and what we learn from it via default activity in portions of the medial prefrontal cortex. Future research should test these possibilities directly and ultimately aim to develop a model of the neurobiological causes and consequences of cultural ideologies.

Such a model would not only inform how culture "gets under the skin" and influences behavior, but may also help predict how cultural ideologies develop, spread, and change. For example, while it is well known that cultures vary in their ideologies, the neurocognitive mechanisms through which these ideologies and their related cultural norms develop and spread across individuals remains unknown. Interestingly, the medial prefrontal cortex has been associated (in Western samples) with social norms newly learned in adolescence (Welborn et al., 2016) and adulthood (Zaki, Schirmer, & Mitchell, 2011). Moreover, medial prefrontal cortex activity while encoding culturally relevant ideas (e.g., beliefs about the consequences of smoking) predicts the tendency to endorse and spread the ideas communicated in the message (Falk, Morelli, Welborn, Dambacher, & Lieberman, 2013). Future research that extends this literature to the cultural neuroscience arena may reveal interesting information about the development and spread of culture. As mentioned earlier in this chapter, the medial prefrontal cortex communicates with other portions of the default network during rest to consolidate newly acquired social information (Meyer et al., 2017). Thus, rest may be a time in which the medial prefrontal cortex solidifies, or consolidates, social norms.

Additionally, while most cultural neuroscience research to date maps existing cultural ideologies to areas of the brain, far less is known about how culturally influenced neural mechanisms can change with exposure to new environments. Acculturation is the process of learning cultural practices and beliefs when one joins a new culture, for example when relocating from one culture to another. While this is a very common phenomenon, relatively little is known about the brain basis of acculturation. It is known, however, that individuals with bicultural identities from Eastern and Western cultures can reflexively recruit the medial prefrontal cortex in response to thinking about the self independently or interdependently, depending on the cultural ideology with which they are primed (Chiao et al., 2010). Moreover, changes in cultural identity after migrating to another culture also reveal changes in medial prefrontal cortex responses to the self and close others (Chen, Wagner, Kelley, & Heatherton, 2015). Interestingly, both of these studies examined samples aged 19–27 years old, suggesting that self-construal in the medial prefrontal cortex appears to be flexible and susceptible to cultural changes even in young adulthood. Given that moving to new cultures is a common occurrence, research on these questions should yield theoretically and practically relevant information about the brain basis of acculturation.

In conclusion, cultural neuroscience has made great strides in understanding how cultural backgrounds influence social cognition. However, many questions remain unanswered. Future research that incorporates new methods, such as inducing inflammation and examining neural activity during rest, may shed new insight into the multifaceted relationships between neurobiology, cultural ideologies, and social cognition.

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