The Evolution of Intergroup Bias: Human Adaptation to Threats of Violence and Disease

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Abstract

In-group favoritism and in-group derogation are phenomena widely observed in social life. However, questions concerning the psychological mechanisms underlying these two forms of intergroup bias and whether they possess an evolutionary basis have long remained unresolved. Through systematically reviewing research reports on how these two intergroup biases process threat cues under survival pressures constituted by violent and disease threats, following the smoke detection principle and functional flexibility principle, the study demonstrates that although they are diametrically opposed in direction, they constitute different responses generated by the same threat management mechanism toward specific in-group/out-group relationships, possessing evolutionary adaptability and thereby supporting the evolutionary hypothesis.

Full Text

Evolution of Intergroup Bias: Adaptation to the Threats of Violence and Disease

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Abstract

Ingroup favoritism and ingroup derogation are ubiquitous phenomena in social life, yet the psychological mechanisms underlying these two forms of intergroup bias and their evolutionary foundations remain unresolved. By systematically reviewing empirical evidence demonstrating that both biases process threat cues according to the smoke detector principle and functional flexibility principle under survival pressures posed by violence and disease threats, this review illustrates that although these biases are diametrically opposed in direction, they represent different responses of the same threat management mechanism to specific ingroup-outgroup relationships. These responses are evolutionarily adaptive and support the evolutionary hypothesis of intergroup bias.

Keywords: ingroup favoritism; ingroup derogation; threat; smoke detection; functional flexibility

Throughout evolutionary history, organisms have faced extremely complex natural environments with limited survival resources. To meet these challenges, organisms evolved the capacity to form social groups (Van Vugt & Park, 2009). Many animals tend to rely on groups to ensure survival—fish form schools for protection, while wolves hunt collectively to improve foraging efficiency. For humans, dependence on social groups for survival is a universal feature of social life. During the formation of different social groups, the distinction between “us” and “them” inevitably emerges in individuals' minds, leading to markedly different behavioral responses toward ingroup versus outgroup members—a phenomenon known as intergroup bias (Hewstone, Rubin, & Willis, 2002). Researchers have found that when encountering group members of different identities, people exhibit either ingroup favoritism (ingroup favoritism/ingroup bias) or ingroup derogation. Ingroup favoritism manifests as greater preference for and protection of ingroup members compared to outgroup members (Petersen, 2017), whereas ingroup derogation refers to the paradoxical pattern where individuals prefer outgroup members over their own ingroup (e.g., March & Graham, 2015; Wu, Liu, Li, Li, & Zhou, 2016; Wu, Tan, Wang, & Zhou, 2015; Zhao, Wu, Shen, Xuan, & Fu, 2012). Intergroup bias is remarkably prevalent, observed consistently both in real-world settings and across various laboratory tasks (e.g., He Xiao-li & Xie Rong-hui, 2018; Montalan, Lelard, Godefroy, & Mouras, 2012; Petersen, 2017; Reicher, Templeton, Neville, Ferrari, & Drury, 2016).

Psychologists have long sought to explain why two diametrically opposed forms of intergroup bias exist in human societies. Some researchers attribute ingroup favoritism to factors such as satisfaction derived from ingroup assimilation (Leonardelli & Brewer, 2001) and realistic conflict posed by outgroup members (Jackson, 1993), while ingroup derogation is linked to intergroup social status (Brewer, 2007) and social dominance orientation levels (Umphress, Simmons, Boswell, & Triana, 2008). These studies approach the issue from a proximate cause perspective, describing the psychological mechanisms of intergroup bias. However, they fail to address why such mechanisms could have evolved in the first place (Scott-Phillips, Dickins, & West, 2011). Recent research suggests that intergroup bias has an evolutionary basis and represents an adaptive psychological mechanism that humans developed to cope with interpersonal threats of violence and disease in social life.

This paper adopts an evolutionary perspective to systematically review published empirical studies on intergroup bias. We analyze the current state of evolutionary research on intergroup bias by examining how ingroup favoritism and ingroup derogation respond to violence and disease threats according to the smoke detector principle and functional flexibility principle. We argue that these two biases, though opposite in direction, are adaptive responses of the same threat management system (Neuberg, Kenrick, & Schaller, 2011; Schaller & Neuberg, 2012; Wu et al., 2015, 2016) to specific ecological conditions. We also identify existing research limitations and propose directions for future investigation.

2.1 Manifestations and Contexts of Ingroup Favoritism

Ingroup favoritism describes the phenomenon where humans, when categorizing social groups into "us" versus "them," show greater liking for "us" (Miller, Maner, & Becker, 2010). While people in everyday life may be reluctant to acknowledge such differential treatment, the phenomenon persists regardless of moral condemnation. For instance, groups based on kinship have existed since ancient times, and social development has continuously endowed them with new dimensions, such as marital and familial relationships, that serve as bonds distinguishing "us" from "them."

Research demonstrates that ingroup favoritism is deeply intertwined with daily life. This phenomenon is most pronounced between different religious groups (Terrizzi, Shook, & Ventis, 2012) and political affiliation groups (Terrizzi, Shook, & Mcdaniel, 2013). Ingroup favoritism can manifest in various forms, including stereotyping against different racial groups (Williams, Sng, & Neuberg, 2016), prejudice toward people with disabilities (Park, Faulkner, & Schaller, 2003), and discrimination against groups with specific characteristics, such as obese individuals (Park, Schaller, & Crandall, 2007) or older adults (Duncan & Schaller, 2009). Notably, ingroup favoritism also emerges in artificially created minimal groups with only nominal distinctions—for example, when participants are arbitrarily assigned to groups labeled with different letters, significant ingroup preference remains evident (e.g., Makhanova, Miller, & Maner, 2015). While ingroup favoritism appears across virtually all human cultures, it is more prevalent among participants from Western cultural backgrounds (Becker, Mortensen, Anderson, & Sasaki, 2014) and those from higher-status dominant social groups (Wilson, Hugenberg, & Rule, 2017). The bias is particularly pronounced when the targets being evaluated are ordinary, typical group members (Reese, Steffens, & Jonas, 2013). Although ingroup favoritism can negatively impact the physical and mental well-being of its targets (Lewis, Kravitz, Janssen, & Powell, 2011) and contribute to severe societal problems such as intergroup hostility, aggression, and even warfare (Hewstone et al., 2002; Schaller & Neuberg, 2012), it continues to persist and exert profound influence in human societies—a puzzling phenomenon that demands explanation.

2.2 Evolutionary Hypothesis of Ingroup Favoritism

Developmental psychology research indicates that infants preferentially learn language from ingroup members (Shutts, Kinzler, McKee, & Spelke, 2009) and can categorize people into "us" versus "them" by 11 months of age (Mahajan & Wynn, 2012), suggesting that ingroup favoritism emerges early in human development. Behavioral genetics evidence further demonstrates a heritable basis for ingroup favoritism (Orey & Park, 2012). Comparative psychology and zoological studies reveal that our closest primate relatives also exhibit ingroup favoritism—for most primates, intergroup interactions are more violent than intragroup interactions (Schaller & Neuberg, 2008). These findings collectively suggest that ingroup favoritism may have evolutionary origins.

Addressing why humans develop ingroup favoritism and what functions it serves, researchers have proposed from a threat management perspective that the psychological mechanisms underlying ingroup favoritism evolved as an adaptation (Schaller & Neuberg, 2012; Van Vugt & Park, 2009). Throughout human evolutionary history, outgroup members posed two primary threats. First, outgroup members presented violent threats: during resource competition, they could directly injure or kill individuals through violent acts. Second, outgroup members posed "disease" threats: they might carry bacteria, viruses, or parasites to which individuals lacked immunity, or they might be unfamiliar with local disease prevention strategies, thereby facilitating pathogen transmission. Consequently, psychological mechanisms that enabled individuals to distinguish between ingroup and outgroup members and take action to mitigate outgroup threats would have been evolutionarily adaptive.

Moreover, researchers propose that to address these dual threats, the psychological mechanisms of ingroup favoritism should operate according to the smoke detector principle and functional flexibility principle (Schaller & Neuberg, 2012). The smoke detector principle posits that human threat detection mechanisms, like smoke detectors, are characterized by hypersensitivity and overgeneralization: the cost of mistakenly identifying a genuine outgroup threat as safe far outweighs the cost of misidentifying a non-threatening cue as dangerous. Therefore, individuals tend to label outgroup members as threatening regardless of whether they pose actual danger. The functional flexibility principle states that to achieve threat management functions, the output of corresponding psychological mechanisms should be flexible and elastic. To minimize risks while reducing associated costs (such as missed opportunities for resource acquisition or reproduction), the cognitive, emotional, and behavioral changes produced by ingroup favoritism mechanisms should align with external threat levels, decreasing output when threats diminish and increasing output when threats escalate.

Current research primarily investigates the evolution of ingroup favoritism from the perspectives of outgroup violence and disease threats. Findings consistently demonstrate that ingroup favoritism exhibits adaptive characteristics for coping with outgroup violence and disease threats by adhering to both the smoke detector and functional flexibility principles.

2.3 Ingroup Favoritism and Adaptation to Outgroup Violence Threats

Throughout human evolutionary history, intergroup cooperation and conflict have been constant companions. Intergroup contact arising from conflict inevitably carries violent undertones, threatening individual safety and potentially resulting in death (Schaller & Neuberg, 2008). Therefore, in the face of ever-present violent threats, preferring ingroup members while disliking and derogating outgroup members would have been reasonable and adaptive during human evolution. This adaptive process is not blind but rather operates systematically according to smoke detector and functional flexibility principles, responding consistently yet adaptively to changing circumstances.

2.3.1 Smoke Detector Principle in Adaptation to Violence Threats

When adapting to violent threats, individuals follow the smoke detector principle by implicitly treating many non-threatening features as potential threat cues. This tendency is particularly pronounced when encountering outgroup members.

To minimize reproductive costs, individuals may be more inclined to associate outgroup members with violent threats, indiscriminately derogating outgroup members while favoring ingroup members to preemptively avoid harm. For instance, Miller et al. (2010) found that individuals are more likely to associate outgroup members with violent threats. Wilson et al. (2017) discovered that White men tend to stereotype Black men as threatening, and this effect persists even after controlling for the target’ s upper-body strength. Whitt and Wilson (2007) employed the dictator game to demonstrate that individuals from ethnic groups with histories of conflict prioritize ingroup resource allocation when interacting with other ethnic groups, indicating that defensive psychology toward outgroups remains even in peacetime when outgroups no longer pose actual threats.

However, adherence to the smoke detector principle is not perfectly accurate, and errors inevitably occur when relying solely on sensory cues, particularly when genuine violent threats are mistakenly identified as safe signals. Organisms require a compensatory mechanism to address suddenly intensified environmental threats. The functional flexibility principle serves this purpose, enabling individuals to continuously adjust their response states according to environmental changes (Schaller & Neuberg, 2012).

2.3.2 Functional Flexibility Principle in Adaptation to Violence Threats

The evolved mechanism of ingroup favoritism is activated elastically –it should be capable of weighing threat levels according to external circumstances, producing stronger responses when individuals are more likely to suffer violent attacks. Research reveals that, on one hand, direct violent threats enhance ingroup favoritism tendencies. For example, Bauer, Cassar, Chytilová, and Henrich (2013) found that individuals with greater war exposure place more emphasis on equality toward ingroup members than outgroup members.

Mange, Sharvit, Margas, and Cécile (2015) discovered that exposure to violent threat cues from outgroup members increases individuals' aggressive tendencies, whereas exposure to ingroup members or non-threatening outgroup members does not alter aggression levels. Mifune, Simunovic, and Yamagishi (2017) used the preemptive strike game (PSG) to demonstrate that malicious intentions or fearful emotions promote intergroup aggressive behavior.

On the other hand, even when facing only potential threats, individuals' responses intensify accordingly, manifesting in cognition, memory, and actual behavioral tendencies. In terms of cognition, Becker et al. (2011) found through signal detection tasks that when imagining themselves or friends being ambushed in peripheral cities, individuals tend to perceive angry, outgroup, and male faces as enemies. Regarding memory, Becker et al. (2014) showed that faces with threat cues enjoy encoding advantages in working memory—specifically, angry faces of Black men (outgroup) are encoded more efficiently in non-Black participants' memory, enabling faster and more accurate recognition. In behavioral tendencies, Miller et al. (2012) used a joystick approach-avoidance task to reveal that under violence threat priming, White participants' avoidance (push) responses toward Black individuals accelerate while approach (pull) responses slow down. Additionally, research indicates that individuals can flexibly regulate their responses based on relevant cues rather than merely increasing reactions in the presence of violent threats. For example, Cesario and Navarrete (2014) found that ingroup support and outgroup evaluations can modulate perceptual biases in threat distance, while Xin, Yang, and Liu (2016) discovered that certain survival pressures regulate trust levels with partners or opponents in investment games. These studies collectively demonstrate that the psychological mechanism producing ingroup favoritism is an elastic system that adjusts its output according to external environments to protect against outgroup violence threats.

Throughout human history, violent threats have been ever-present (Neuberg et al., 2011). However, outgroup members pose not only violent threats but also significant disease threats that cannot be ignored.

2.4 Ingroup Favoritism and Adaptation to Outgroup Disease Threats

During evolution, infectious pathogens have posed a massive threat to human survival and reproduction. To combat this, humans evolved physiological immune systems to effectively detect and eliminate invading pathogens (Schaller, 2011; Schaller & Park, 2011). Additionally, researchers propose that humans, like other animals, possess an evolved behavioral strategy that defends against pathogenic infection before it occurs—the behavioral immune system (Schaller, 2006). Since pathogens are too small to detect directly, the behavioral immune system must be triggered by indirect cues of disease risk (e.g., strangers, foul-smelling substances) and respond with emotional (disgust) and behavioral (avoidance) reactions (Wu Bao-pei & Zhang Lei, 2011; Van Leeuwen & Petersen, 2018; Murray & Schaller, 2016). This process involves specific emotional, cognitive, and behavioral components that also exhibit hypersensitivity (the smoke detector principle) (Haselton & Nettle, 2006) and environmental modulation (functional flexibility principle) (Schaller, Park, & Kenrick, 2007).

The evolutionary hypothesis of ingroup favoritism posits that social interactions with outgroup members may lead to disease infection, and individuals are less likely to receive help from outgroup members when ill. Consequently, the behavioral immune system may generate disgust responses toward outgroup members, who are perceived as potentially carrying novel, non-local pathogens to which ingroup members lack immunity (Fincher & Thornhill, 2012a) and may transmit pathogens due to violation of local hygiene norms (O' Handley, Blair, & Hoskin, 2017). Thus, preferring ingroup members while derogating outgroup members becomes an adaptive output of the behavioral immune system that helps reduce individual infection risk (Fincher & Thornhill, 2012a; Schaller & Neuberg, 2012).

2.4.1 Smoke Detector Principle in Adaptation to Disease Threats

When adapting to disease threats, individuals follow the smoke detector principle by tending to view outgroup members as pathogen carriers regardless of actual infection risk. Numerous studies show that people do associate outgroup members with disease (Fincher, Thornhill, Murray, & Schaller, 2008). When explicit disease cues are present, fear that outgroup members may carry pathogens against which one lacks immunity leads to prejudice. For example, Reicher et al. (2016) found that individuals exhibit greater disgust toward sweaty T-shirts worn by outgroup members compared to those worn by ingroup members. Even without obvious cues, individuals who perceive themselves as more vulnerable to disease threat are more likely to associate obese groups (which carry heuristic disease cues) with outgroup members and show stronger ingroup preference (Lund & Miller, 2014). Research reveals similar responses toward other groups carrying heuristic disease cues, including older adults (Duncan & Schaller, 2009), people with disabilities (Park et al., 2003), and homosexual individuals (Inbar, Pizarro & Bloom, 2012). Petersen (2017) further demonstrated that healthy outgroup members are psychologically represented similarly to diseased ingroup members.

In response to potential disease infection from outgroup members, the threat management mechanism of the behavioral immune system follows not only the smoke detector principle but also the functional flexibility principle to cope with fluctuating pathogen loads in the environment, thereby achieving adaptation to outgroup disease threats.

2.4.2 Functional Flexibility Principle in Adaptation to Disease Threats

Ingroup favoritism' s adaptation to disease threats follows the functional flexibility principle, producing stronger activation when individuals are more likely to contract illness. Supporting evidence includes Miller and Maner' s (2012) finding that compared to familiar ingroup members (White individuals), participants more readily associate unfamiliar outgroup members

(Asian individuals) with disease, and this effect is amplified among participants who perceive themselves as more susceptible to disease infection. To reduce reproductive risks from disease infection, Black and White women in their fertile phase show greater implicit bias against outgroup males and even against artificially created minimal outgroup males with no real significance (Mcdonald, Asher, Kerr, & Navarrete, 2011). When disease threats are real, activation of ingroup favoritism mechanisms intensifies further. For instance, Miller and Maner (2011) used a joystick task to demonstrate that recently ill individuals make faster consistent responses to avoid individuals with disfigured faces (heuristic disease cues) while approaching normal faces.

Additionally, research shows that when individuals' disease risk decreases, their ingroup favoritism activation subsides. For example, individuals show reduced prejudice toward outgroup members after receiving vaccinations and practicing handwashing (Huang, Sedlovskaya, Ackerman, & Bargh, 2011), and individuals concerned about pathogens in second-hand products show significantly increased willingness to purchase such products from strangers after handwashing (Huang, Ackerman, & Sedlovskaya, 2017).

The functional flexibility of ingroup favoritism in response to outgroup disease threats should also manifest as variations in ingroup preference according to regional pathogen load levels. Different regions harbor different pathogen loads, and individuals in high pathogen load areas should exhibit stronger ingroup favoritism. Current research supports this hypothesis. Schaller and Murray (2010) found that people in high pathogen load regions are less willing to accept different ethnic groups as neighbors, and these regions are more prone to violent ethnic conflicts (Letendre, Fincher, & Thornhill, 2010). Collectivist culture, which emphasizes "us" versus "them" distinctions and better inhibits pathogen transmission (Fincher et al., 2008), should be more prevalent in high pathogen load regions. Cashdan and Steele (2013) found that high pathogen load regions are more likely to socialize children toward collectivist values and emphasize traditionalism (Tybur et al., 2016). Higher regional pathogen load is associated with stronger emphasis on maintaining connections with ingroup members (Fincher & Thornhill, 2012a; Van Leeuwen, Park, Koenig, & Graham, 2012) and lower trust levels toward outgroup members (Le, 2013; Varnum, 2014). These findings collectively demonstrate links between pathogen load and ingroup favoritism, suggesting that ingroup favoritism is indeed an organized output of the behavioral immune system under disease threat, further supporting the evolutionary hypothesis that ingroup favoritism is an adaptation to outgroup disease threats.

Current evidence from violence and disease threat perspectives indicates that ingroup favoritism evolved as a threat management adaptation that operates according to smoke detector and functional flexibility principles. However, a critical limitation of ingroup favoritism evolutionary theory is its inability to explain the observed phenomenon where people sometimes prefer outgroup members while derogating ingroup members. This pattern, opposite in direction to ingroup favoritism, is also widespread in human societies (e.g., Barker & Barclay, 2016; Hu, Li, & Wu, 2018) and cannot be explained by the smoke detector or functional flexibility characteristics of ingroup favoritism mechanisms. Why, then, does ingroup derogation exist in human societies?

3.1 Manifestations and Contexts of Ingroup Derogation

Ingroup derogation is a peculiar phenomenon where individuals show lower preference or evaluation for ingroup members compared to outgroup members (Li Qiong & Liu Li, 2011; Hu et al., 2018; Wu et al., 2015, 2016). Research indicates that, like ingroup favoritism, ingroup derogation is not accidental but widely exists in social life. Individuals are more likely to derogate ingroup members and favor outgroup members when evaluating low-status disadvantaged groups (Xiang Ling & Zhao Yu-fang, 2013; Zuo Bin & Xu Tong-jie, 2015; Jost, 2001), ingroup deviants who differ from the norm (Reese et al., 2013), or when participants belong to ethnic minorities (March & Graham, 2015). This phenomenon is more prevalent in Eastern cultures. For instance, Chinese participants more readily associate Chinese people (rather than Westerners) with uncivilized behavior at an implicit level (Liu, Shan, & Jin, 2015), evaluate their family members more negatively than Westerners do, and implicitly associate family members with negative traits while linking Westerners with positive traits (Ma-Kellams, Spencer-Rodgers, & Peng, 2011). Chinese students are more willing to cooperate with outgroup members than ingroup members (Wu et al., 2015) and perceive outgroup members' faces as more attractive and names as more pleasant (Zhao et al., 2012). Similarly, Japanese people evaluate their relatives more negatively than Americans do (Endo, Heine, & Lehman, 2000) and believe their cities are more vulnerable than American cities in earthquakes (Kitayama, Palm, Masuda, Karasawa, & Carroll, 1996). East Asians also find it more difficult to make positive evaluations of ingroup members compared to Europeans (Cuddy et al., 2009). With ingroup derogation so pervasive, does it also have an evolutionary basis?

From an evolutionary perspective, ingroup derogation appears maladaptive: when outgroup members are more likely to pose violent or disease threats, preferring ingroup members and derogating outgroup members would have enhanced survival and reproduction, allowing such genes to be passed down. Conversely, doing the opposite would likely lead to elimination by natural selection. Therefore, according to evolutionary theory, ingroup derogation should not exist in human societies, or if it does, its probability should remain extremely low (i.e., mutation rate). This prediction clearly contradicts the reality of widespread ingroup derogation.

3.2 Evolutionary Hypothesis of Ingroup Derogation

The evolutionary hypothesis of ingroup favoritism rests on the premise that outgroup members pose greater threats than ingroup members. However, under certain conditions, ingroup members may pose greater violent or disease threats than outgroup members.

To better adapt to environments, groups establish relatively fixed territories as habitats (Fincher & Thornhill, 2012a). When intragroup population increases or survival resources become scarce, intragroup survival pressure mounts and tensions among group members escalate. Since natural selection operates at the genetic level, ingroup members also compete for resources among themselves (West, El Mouden, & Gardner, 2011), making the potential violent threat from ingroup members potentially greater than that from outgroups. Additionally, different environments harbor different pathogen load levels. When the pathogen load in an ingroup' s habitat becomes sufficiently high (e.g., during a pandemic), ingroup members become more likely than outgroup members to pose disease threats. If such phenomena occurred frequently during human evolution, individuals would need to evolve psychological mechanisms that favor outgroup members and derogate ingroup members to adapt to these circumstances.

Consequently, researchers have supplemented the evolutionary hypothesis of ingroup favoritism with a threat management-based evolutionary theory of ingroup derogation (Wu et al., 2015, 2016). This theory proposes that ingroup derogation is an adaptation to special ecological conditions where ingroup members pose greater violence and disease threats. Research on the evolution of ingroup derogation suggests that ingroup derogation and ingroup favoritism are different responses of the same evolved threat management mechanism to specific ingroup-outgroup relationships. That is, ingroup derogation, like ingroup favoritism, has an evolutionary basis and represents a "slightly different" form of intergroup bias that also follows the smoke detector and functional flexibility principles.

3.3 Ingroup Derogation and Adaptation to Intragroup Violence Threats

When the number of female mates within a group decreases or regional population carrying capacity reaches its limit, aggression and violence become advantageous for individuals to acquire mates and survival resources. Under such conditions, ingroup rules lose their 约束力, and attacking ingroup members becomes normalized. Individuals will then derogate and view ingroup members as primary threats (Wu et al., 2016).

To test this hypothesis, Wu et al. (2016) used computer simulations to examine the evolutionary process of ingroup derogation mechanisms when both ingroup and outgroup members could pose violent threats. Results showed that ingroup favoritism could evolve when intragroup relations were relatively harmonious, whereas ingroup derogation evolved when intragroup relations were relatively tense (when intragroup conflict caused individual death probability to exceed 10%). In subsequent research, Wu et al. (2016) further investigated the relationship between Chinese participants' violence threat perception, external violence threat cues, and ingroup derogation attitudes. Findings revealed that ingroup derogation attitudes intensified when individuals subjectively felt more vulnerable to violent attack or when direct environmental violence threat cues were present. When both ingroup and outgroup members displayed violence threat cues, individuals responded more strongly to ingroup members' threat cues and showed higher ingroup derogation attitudes. Additionally, even without explicit violence threat cues, individuals tended to perceive more aggressive intent from ingroup members than from outgroup members, and this bias positively correlated with ingroup derogation attitudes, further supporting the evolutionary hypothesis of ingroup derogation. Furthermore, Barker and Barclay (2016) and Zuo, Chen, and Zhao (2018) employed interpersonal game paradigms to demonstrate that when ingroup competition pressure exceeds outgroup competition pressure, individuals show stronger intentions to harm ingroup members than outgroup members, providing additional support for the ingroup derogation evolutionary hypothesis.

3.4 Ingroup Derogation and Adaptation to Intragroup Disease Threats

If the ingroup derogation hypothesis is valid, it should represent, like ingroup favoritism, a different form of behavioral immune system output under disease threat—specifically, to cope with recently emerged infectious diseases within the group or situations where the pathogen load in the ingroup habitat far exceeds that in the outgroup habitat.

Some evidence indirectly supports this hypothesis. Research indicates that disgust sensitivity negatively correlates with generalized social trust—individuals with higher disgust sensitivity trust both outgroup and ingroup members less (Aarøe, Osmundsen, & Petersen, 2016). Additionally, studies show that China' s pathogen load has been higher than Europe' s both historically and currently (Fincher et al., 2008), and ingroup derogation is indeed more prevalent in China (Ma-Kellams et al., 2011; Wu et al., 2015; Zhao et al., 2012). Research also reveals that the relationship between pathogen load and ingroup favoritism is not simply linear but may be better described by a quadratic function—ingroup favoritism decreases when pathogen load reaches a certain level (Cashdan & Steele, 2013; Fincher & Thornhill, 2012a, 2012b; Hruschka & Henrich, 2013; Talhelm et al., 2014). Zhang (2018) found that local disease load negatively correlates with ingroup trust, while the relationship between local disease load and outgroup trust is U-shaped—beyond a certain point, higher local disease load increases outgroup trust. These results suggest that when local disease load becomes sufficiently high, individuals exhibit ingroup derogation attitudes, indicating that ingroup derogation emergence is associated with excessively high local disease load.

Computer simulations have also revealed that social group attitudes vary across regions with different disease load rates—groups in low disease load regions tend to show ingroup favoritism, whereas groups in high disease load regions tend to show ingroup derogation (Hu et al., 2018). In high disease load regions, investing in ingroup strategies may not be optimal; instead, individuals may prefer to cooperate with outgroups when associated infection risks are not high (Brown, Fincher, & Walasek, 2016; Thornhill & Fincher, 2014). Additionally, Wu et al. (2015) used a minimal group paradigm to investigate the relationship between the behavioral immune system and ingroup derogation, finding that ingroup derogation intensifies when ingroup members display heuristic disease cues and remains elevated when both ingroup and outgroup members display such cues. These findings provide direct empirical support for the ingroup derogation evolutionary hypothesis, suggesting that ingroup derogation is indeed an evolved behavioral immune system response that also follows smoke detector and functional flexibility principles.

In summary, ingroup derogation may represent a "slightly different" form of intergroup bias that evolved under specific selective pressures. Its emergence is related to adaptation to violence or disease threats, representing a psychological mechanism that evolved within the threat management system to cope with situations where ingroup members pose greater violent or disease threats.

4 Issues and Future Directions

Previous research has provided relatively deep understanding of the emergence and development of intergroup bias. However, several issues remain to be addressed through more systematic and in-depth future research.

4.1 Effects of Individual Differences, Situational Activation, and Their Interactions on Intergroup Bias

Intergroup bias exhibits extensive individual differences, such as variations in perceiving violence and disease threat cues or in responding to these threats (Ackerman, Hill, & Murray, 2018). These differences may result from environmental influences—individuals living long-term in high disease load regions worry more about infection (Tybur et al., 2016), while those in regions with intense resource competition worry more about violent threats (Bauer et al., 2013). However, individuals' environments are not static. Direct environmental threat cues—such as people coughing or sneezing, disgusting odors, or resource deprivation, insults, and physical provocation from specific group members—serve as obvious triggers for activating intergroup bias (Ackerman et al., 2018). Therefore, changes in environmental cues also significantly impact individuals' intergroup bias.

Furthermore, some research on ingroup favoritism reveals interactive effects between individual differences and situational activation cues—individuals' responses to threat cues in the environment vary according to their risk perception differences, producing different effects on ingroup favoritism. For example, individuals with chronic illnesses (higher sensitivity) more readily detect and respond to relevant disease threat cues, whereas healthy individuals (lower sensitivity) may be less sensitive to disease cues (Murray & Schaller, 2016). Individuals who chronically feel vulnerable to interpersonal threats are more likely to categorize threatening targets (men) as outgroup members (Miller et al., 2010). Individual differences, situational activation, and their interactions all influence ingroup favoritism to varying degrees. Do they exert similar influences on ingroup derogation? Current research on ingroup derogation in this area is lacking, with studies only examining how external threat contexts and threat perception affect ingroup derogation attitudes (Wu et al., 2015, 2016). If ingroup derogation is indeed an adaptation to special group relationships, researchers should find that individual differences, situational activation, and their interactions exert similarly patterned influences on ingroup derogation attitudes. Future research should investigate this issue to further test the evolutionary theory of ingroup derogation. Additionally, future studies could explore other factors explaining individual differences in intergroup bias, such as ability to control violence and disease threats or strictness of social hygiene norms (Lab, 2019), and could employ other situational cues like olfactory and tactile cues (Liuzza, Olofsson, Cancino-Montecinos, & Lindholm, 2019) to further explore how individual differences, situational activation cues, and their interactions influence intergroup bias.

4.2 Neural and Physiological Mechanisms of Intergroup Bias Adaptation to Violence and Disease Threats

Beyond macro-level research, the neural and physiological responses underlying intergroup bias adaptation to violence and disease threats represent important future research directions. Previous neuroimaging studies have found that participants show significant amygdala activation when receiving visual stimuli related to outgroups (Phelps et al., 2000), and electrophysiological research indicates that contact with outgroup members may trigger fear-related cognitive and emotional responses (Blascovich, Mendes, Hunter, Lickel, & Knwai-Bell, 2001; Phelps et al., 2000). These studies provide preliminary adaptive evidence for ingroup favoritism at physiological and neural levels. However, no researchers have investigated whether similar physiological and neural mechanisms underlie ingroup derogation. If ingroup derogation has an evolutionary basis and indeed represents different responses of the same threat management mechanism as ingroup favoritism, researchers should observe specific physiological and neural mechanisms associated with ingroup derogation that are similar to those of ingroup favoritism. Investigating this issue would provide deeper evidence for the evolutionary hypothesis of intergroup bias.

Additionally, the internal mechanisms of individuals' neural and physiological systems are extremely complex, and existing research cannot explain how these intricate systems achieve rapid and accurate responses to external threats. Moreover, to effectively provide functional defense against threats, individuals' central nervous system responses, physiological immune system responses, and behavioral responses should work synergistically (Lab, 2019; Murray, Prokosch, & Airington, 2019). However, which specific neural, immune, and behavioral responses are involved in particular response tendencies, and how these three systems interact to effectively prevent violence and disease threats from specific social groups, are issues that have received little attention in previous research.

4.3 Interactive Effects of Violence and Disease Threats on Intergroup Bias

Previous research shows that threat management mechanisms interact with other motivations. For instance, Ainsworth and Maner (2014) found that subjectively hungry participants show greater prejudice toward outgroup members, and hungry participants who have fasted tend to categorize targets (obese and elderly individuals) as disease-related groups. Gilead and Liberman (2014) discovered that when outgroup members pose violent threats, mothers asked to recall caring for their newborns show greater prejudice toward outgroup members—activation of parental care motivation increases our avoidance of violent threats. Do violence and disease threats also interactively influence the threat management mechanisms of intergroup bias? When relative levels of violence and disease threats in the environment change, the threat management mechanism should produce correspondingly altered outputs to match environmental threat levels.

In an ideal environment, organisms could provide unlimited energy for individual survival and reproduction and offer solutions to countless other adaptive problems (avoiding violence threats, disease threats, etc.). However, humans do not live in such an ideal world; each individual' s resources for managing and preventing threats are limited. When facing multiple threats simultaneously, individuals weigh the costs and benefits of various management strategies and ultimately make decisions with relatively lower costs and higher benefits (Hengartner, 2017). In this process, both violence and disease threats are massive survival concerns, and different levels of these threats should differentially impact individuals' intergroup bias. Moreover, throughout human history, disease and violence threats have co-occurred rather than appearing in isolation, and intergroup bias should be jointly shaped by these two primary threats and their interactions. For example, when individuals are ill, they are more vulnerable to injury when facing violent threats; when individuals are injured by violence, they become more susceptible to disease infection. What specific effects do the interactions between violence and disease threats have on intergroup bias? How do individuals allocate their limited resources and make decisions in such complex risk environments? No researchers have yet explored these questions. Answering them will help us understand at a deeper level how natural selection has shaped intergroup bias.

4.4 Transitions Between Ingroup Favoritism and Ingroup Derogation and Their Adaptiveness

Previous research suggests that both ingroup favoritism and ingroup derogation are threat management mechanisms that evolved for survival and reproduction, adjusting their output according to environmental conditions. Although the two biases manifest differently, they may both reflect the same threat management mechanism at work. Is transition between these two biases possible? In which cultural backgrounds can such transitions be observed? If the evolutionary hypothesis of intergroup bias is valid, researchers should be able to observe the critical transition point between the two biases and the cross-cultural stability of this transition. That is, when individuals perceive that the expected threat from outgroups exceeds that from ingroups, they should exhibit ingroup favoritism; conversely, they should show ingroup derogation. Investigating this issue would enable deeper testing of intergroup bias evolutionary theory. However, no current research provides direct empirical evidence for this question.

Wu et al.’ s (2016) computer simulation results suggest that when the probability of individual death from intragroup conflict exceeds 10%, ingroup derogation evolves. This indicates that considering violence threat alone, transition between the two biases is indeed possible. Additionally, the evolutionary hypothesis of ingroup derogation suggests that when environmental cues indicate outgroup members are disease-prone, the psychological mechanism should adjust its output to produce stronger ingroup favoritism effects. After some time, if cues indicate that ingroup members are more likely to pose disease threats, this effect may weaken, disappear, or even reverse into ingroup derogation (Schaller & Neuberg, 2012; Wu et al., 2015). Future research could investigate the levels of violence and disease threats at which transitions between ingroup favoritism and ingroup derogation occur, as well as the functional adaptiveness of such transitions under complex interactions between violence and disease threats.

In conclusion, several issues remain in intergroup bias research that await future exploration. Addressing these questions will be crucial for further revealing the conditions and nature of intergroup bias, deepening our understanding of the formation conditions and interaction processes of group relations, enhancing our knowledge of prejudice, and improving ingroup and intergroup communication and cooperation while eliminating various forms of bias and discrimination against “outsiders” and “insiders” in society.

References

Li, Q., & Liu, L. (2011). Outgroup favoritism in low-status groups. *Advances in Psychological Science*, 19(7), 1061-1068.

He, X. L., & Xie, R. H. (2018). The influence of group empathy on intergroup relations: A perspective based on social conflict resolution. *Psychological Science*, 41(1).

Wu, B. P., & Zhang, L. (2011). Psychological defense against disease: How humans cope with pathogen threats. *Advances in Psychological Science*, 19(3), 410–419.

Xiang, L., & Zhao, Y. F. (2013). A study of ingroup/outgroup favoritism in low-status groups using the process dissociation procedure. *Psychological Science*, 36(3), 702–705.

Zuo, B., & Xu, T. J. (2015). Ingroup/outgroup favoritism in low-status groups: An examination based on SC-IAT. *Psychological Research*, 8(1), 26–30.

Aarøe, L., Osmundsen, M., & Petersen, M. B. (2016). Distrust as a disease avoidance strategy: Individual differences in disgust sensitivity regulate generalized social trust. *Frontiers in Psychology*, 7, 1038.

Ackerman, J. M., Hill, S. E., & Murray, D. R. (2018). The behavioral immune system: Current concerns and future directions. *Social & Personality Psychology Compass*, 12(2), e12371.

Ainsworth, S. E., & Maner, J. K. (2014). Hunger moderates the activation of psychological disease avoidance mechanisms. *Evolutionary Behavioral Sciences*, 8(4), 303–313.

Barker, J. L., & Barclay, P. (2016). Local competition increases people’ s willingness to harm others. *Evolution and Human Behavior*, 37(4), 315–322.

Bauer, M., Cassar, A., Chytilová, J., & Henrich, J. (2013). War’ s enduring effects on the development of egalitarian motivations and in-group biases. *Psychological Science*, 25(1), 47–57.

Becker, D. V., Mortensen, C. R., Ackerman, J. M., Shapiro, J. R., Anderson, U. S., Sasaki, T., ···Kenrick, D. T. (2011). Signal detection on the battlefield: Priming self-protection vs. revenge-mindedness differentially modulates the detection of enemies and allies. *PLoS ONE*, 6(9), e23929.

Becker, D. V., Mortensen, C. R., Anderson, U. S., & Sasaki, T. (2014). Out of sight but not out of mind: Memory scanning is attuned to threatening faces. *Evolutionary Psychology*, 12(5), 147470491401200.

Blascovich, J., Mendes, W. B., Hunter, S. B., Lickel, B., & Kowai-Bell, N. (2001). Perceiver threat in social interactions with stigmatized others. *Journal of Personality and Social Psychology*, 80(2), 253–267.

Brewer, M. B. (2007). The importance of being we: Human nature and intergroup relations. *American Psychologist*, 62(8), 728–738.

Brown, G. D. A., Fincher, C. L., & Walasek, L. (2016). Personality, parasites, political attitudes, and cooperation: A model of how infection prevalence influences openness and social group formation. *Topics in Cognitive Science*, 8(1), 98–117.

Cashdan, E., & Steele, M. (2013). Pathogen prevalence, group bias, and collectivism in the standard cross-cultural sample. *Human Nature*, 24(1), 59–75.

Cesario, J., & Navarrete, C. D. (2014). Perceptual bias in threat distance: The critical roles of in-group support and target evaluations in defensive threat regulation. *Social Psychological and Personality Science*, 5(1), 12–17.

Cuddy, A. J. C., Fiske, S. T., Kwan, V. S. Y., Glick, P., Demoulin, S., Leyens, J.-P., ···Ziegler, R. (2009). Stereotype content model across cultures: Towards universal similarities and some differences. *British Journal of Social Psychology*, 48(1), 1-33.

Endo, Y., Heine, S. J., & Lehman, D. R. (2000). Culture and positive illusions in close relationships: How my relationships are better than yours. *Personality and Social Psychology Bulletin*, 26(12), 1571–1586.

Duncan, L. A., & Schaller, M. (2009). Prejudicial attitudes toward older adults may be exaggerated when people feel vulnerable to infectious disease: Evidence and implications. *Analyses of Social Issues and Public Policy*, 9(1), 97–115.

Fincher, C. L., & Thornhill, R. (2012a). Parasite-stress promotes in-group assortative sociality: The cases of strong family ties and heightened religiosity. *Behavioral and Brain Sciences*, 35(2), 61–79.

Fincher, C. L., & Thornhill, R. (2012b). The parasite-stress theory may be a general theory of culture and sociality. *Behavioral and Brain Sciences*, 35(2), 99–119.

Fincher, C. L., Thornhill, R., Murray, D. R., & Schaller, M. (2008). Pathogen prevalence predicts human cross-cultural variability in individualism/collectivism. *Proceedings of the Royal Society B*, 275(1640).

Gilead, M., & Liberman, N. (2014). We take care of our own: Caregiving salience increases out-group bias in response to out-group threat. *Psychological Science*, 25(7), 1380–1387.

Haselton, M. G., & Nettle, D. (2006). The paranoid optimist: An integrative evolutionary model of cognitive biases. *Personality and Social Psychology Review*, 10(1), 47–66.

Hengartner, M. P. (2017). The evolutionary life history model of externalizing personality: Bridging human and animal personality science to connect ultimate and proximate mechanisms underlying aggressive dominance, hostility, and impulsive sensation seeking. *Review of General Psychology*, 21(4), 330–353.

Hewstone, M., Rubin, M., & Willis, H. (2002). Intergroup bias. *Annual Review of Psychology*, 53(1), 575–604.

Hruschka, D. J., & Henrich, J. (2013). Institutions, parasites and the persistence of in-group preferences. *PLoS One*, 8(5), e63642.

Huang, J. Y., Ackerman, J. M., & Sedlovskaya, A. (2017). (De)contaminating product preferences: A multi-method investigation into pathogen threat' s influence on used product preferences. *Journal of Experimental Social Psychology*, 70, 143-152.

Huang, J. Y., Sedlovskaya, A., Ackerman, J. M., & Bargh, J. A. (2011). Immunizing against prejudice: Effects of disease protection on attitudes toward out-groups. *Psychological Science*, 22(12), 1550-1556.

Hu, C., Li, X., & Wu, Q. (2018, September). Pathogen load and the nature of ingroup derogation: Evolution of ingroup derogation based on the sexual penna model. In *2018 4th International Conference on Social Science and Higher Education (ICSSHE 2018)*. Atlantis Press.

Inbar, Y., Pizarro, D. A., & Bloom, P. (2012). Disgusting smells cause decreased liking of gay men. *Emotion*, 12(1), 23-27.

Jackson, J. W. (1993). Realistic group conflict theory: A review and evaluation of the theoretical and empirical. *Psychological Record*, 43(3), 395-413.

Jost, J.T. (2001). Outgroup favoritism and the theory of system justification: An experimental paradigm for investigating the effects of socio-economic success on stereotype content. In G. Moskowitz (Ed.), *Cognitive social psychology: The Princetonsymposium on the legacy and future of social cognition* (pp. 89-102). Mahwah, NJ: Erlbaum. Hungarian Translation.

Kitayama, S., Palm, R. I., Masuda, T., Karasawa, M., & Carroll, J. (1996). Optimism in the US and pessimism in Japan: Perceptions of earthquake risk (Unpublished doctorial dissertation). Kyoto University.

Lab, T. H. (2019, January 31). Individual differences in pathogen avoidance motivation vary as a function of control over pathogen exposure and basal immunological activity. Retrieved April 12, 2019, from https://osf.io/rckh3/

Leonardelli, G. J., & Brewer, M. B. (2001). Minority and majority discrimination: When and why. *Journal of Experimental Social Psychology*, 37(6), 468-485.

Le, S. H. (2013). Societal trust and geography. *Cross-Cultural Research*, 47(4), 388-414.

Letendre, K., Fincher, C. L., & Thornhill, R. (2010). Does infectious disease cause global variation in the frequency of intrastate armed conflict and civil war? *Biological Reviews*, 85(3), 669-683.

Lewis, T. T., Kravitz, H. M., Janssen, I., & Powell, L. H. (2011). Self-reported experiences of discrimination and visceral fat in middle-aged african-american and caucasian women. *American Journal of Epidemiology*, 173(11), 1223-1231.

Liu, X., Shan, W., & Jin, S. (2015). Civilised behaviour: A Chinese indigenous intergroup perception dimension. *Journal of Pacific Rim Psychology*, 9(2), 108-119.

Liuzza, M. T., Olofsson, J. K., Cancino-Montecinos, S., & Lindholm, T. (2019). Body odor disgust sensitivity predicts moral harshness toward moral violations of purity. *Frontiers in Psychology*, 10, 458.

Lund, E. M., & Miller, S. L. (2014). Is obesity un-American? Disease concerns bias implicit perceptions of national identity. *Evolution and Human Behavior*, 35(4), 336-340.

Ma-Kellams, C., Spencer-Rodgers, J., & Peng, K. (2011). I am against us? Unpacking cultural cifferences in ingroup favoritism via dialecticism. *Personality and Social Psychology Bulletin*, 37(1), 15-27.

Mahajan, N., & Wynn, K. (2012). Origins of "Us" versus "Them": Prelinguistic infants prefer similar others. *Cognition*, 124(2), 227-233.

Makhanova, A., Miller, S. L., & Maner, J. K. (2015). Germs and the outgroup: Chronic and situational disease concerns affect intergroup categorization. *Evolutionary Behavioral Sciences*, 9(1), 8-19.

Mange, J., Sharvit, K., Margas, N., & Cécile Sénémeaud. (2015). Do I shoot faster because I am thinking about an outgroup or a threatening outgroup? *Social Psychology*, 47(1), 1-9.

March, D. S., & Graham, R. (2015). Exploring implicit ingroup and outgroup bias toward Hispanics. *Group Processes & Intergroup Relations*, 18(1), 89-103.

McDonald, M. M., Asher, B. D., Kerr, N. L., & Navarrete, C. D. (2011). Fertility and intergroup bias in racial and minimal-group contexts. *Psychological Science*, 22(7), 860-865.

Mifune, N., Simunovic, D., & Yamagishi, T. (2017). Intergroup biases in fear-induced aggression. *Frontiers in Psychology*, 8, 49.

Miller, S. L., & Maner, J. K. (2011). Sick body, vigilant mind: The biological immune system activates the behavioral immune system. *Psychological Science*, 22(12), 1467-1471.

Miller, S. L., & Maner, J. K. (2012). Overperceiving disease cues: The basic cognition of the behavioral immune system. *Journal of Personality and Social Psychology*, 102(6), 1198-1213.

Miller, S. L., Maner, J. K., & Becker, D. V. (2010). Self-protective biases in group categorization: Threat cues shape the psychological boundary between "us" and "them". *Journal of Personality and Social Psychology*, 99(1), 62-77.

Montalan, B., Lelard, T., Godefroy, O., & Mouras, H. (2012). Behavioral investigation of the influence of social categorization on empathy for pain: A minimal group paradigm study. *Frontiers in Psychology*, 3, 389.

Murray, D. R., Prokosch, M. L., & Airington, Z. (2019). PsychoBehavioroimmunology: Connecting the behavioral immune system to its physiological foundations. *Frontiers in Psychology*, 10, 200.

Murray, D. R., & Schaller, M. (2016). The behavioral immune system: Implications for social cognition, social interaction, and social influence. *Advances in Experimental Social Psychology*, 53, 75-129.

Neuberg, S. L., Kenrick, D. T., & Schaller, M. (2011). Human threat management systems: Self-protection and disease avoidance. *Neuroscience & Biobehavioral Reviews*, 35(4), 1042-1051.

O' Handley, B. M., Blair, K. L., & Hoskin, R. A. (2017). What do two men kissing and a bucket of maggots have in common? Heterosexual men' s indistinguishable salivary -amylase responses to photos of two men kissing and disgusting images. *Psychology & Sexuality*, 8(3), 173-188.

Orey, B. D., & Park, H. (2012). Nature, nurture, and ethnocentrism in the minnesota twin study. *Twin Research and Human Genetics*, 15(1), 71-73.

Park, J. H., Faulkner, J., & Schaller, M. (2003). Evolved disease-avoidance processes and contemporary anti-social behavior: Prejudicial attitudes and avoidance of people with physical disabilities. *Journal of Nonverbal Behavior*, 27(2), 65-87.

Park, J. H., Schaller, M., & Crandall, C. S. (2007). Pathogen-avoidance mechanisms and the stigmatization of obese people. *Evolution and Human Behavior*, 28(6), 410-414.

Petersen, M. B. (2017). Healthy out-group members are represented psychologically as infected in-group members. *Psychological Science*, 28(12), 1857-1863.

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(5), 729-738.

Reese, G., Steffens, M. C., & Jonas, K. J. (2013). Religious affiliation and attitudes towards gay men: On the mediating role of masculinity threat. *Journal of Community & Applied Social Psychology*, 24(4), 340-355.

Reicher, S. D., Templeton, A., Neville, F., Ferrari, L., & Drury, J. (2016). Core disgust is attenuated by ingroup relations. *Proceedings of the National Academy of Sciences*, 113(10), 2631-2635.

Schaller, M. (2006). Parasites, behavioral defenses, and the social psychological mechanisms through which cultures are evoked. *Psychological Inquiry*, 17(2), 96-101.

Schaller, M. (2011). The behavioural immune system and the psychology of human sociality. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 366(1583), 3418-3426.

Schaller, M., & Murray, D. M.(2010). Infectious diseases and the evolution of cross-cultural differences. In M. Schaller, S. J. Norenzayan, T. Heine, Yamagishi

& T. Kameda (Eds.), *Evolution, culture, and the human mind* (pp. 243–256). New York, NY: Psychology Press.

Schaller, M., & Neuberg, S. L. (2008). Intergroup prejudices and intergroup conflicts. In C. Crawford & D. L. Krebs (Eds.), *Foundations of evolutionary psychology* (pp. 399–412). Mahwah, NJ: Lawrence Erlbaum Associates.

Schaller, M., & Neuberg, S. L. (2012). Danger, disease, and the nature of prejudice(s). In J. M. Olson & M. P. Zanna (Eds.), *Advances in experimental social psychology, Vol. 46* (pp. 1-54). Burlington: Academic Press.

Schaller, M., & Park, J. H. (2011). The behavioral immune system (and why it matters). *Current Directions in Psychological Science*, 20(2), 99–103.

Schaller, M., Park, J. H., & Kenrick, D. T. (2007). Human evolution and social cognition. In R. I. M. Dunbar & L. Barrett (Eds.), *Oxford Handbook of Evolutionary Psychology* (pp. 491–504). Oxford: Oxford University Press.

Scott-Phillips, T. C., Dickins, T. E., & West, S. A. (2011). Evolutionary theory and the ultimate-proximate distinction in the human behavioral sciences. *Perspectives on Psychological Science*, 6(1), 38–47.

Shutts, K., Kinzler, K. D., McKee, C. B., & Spelke, E. S. (2009). Social information guides infants' selection of foods. *Journal of Cognition and Development*, 10(1-2), 1–17.

Talhelm, T., Zhang, X., Oishi, S., Shimin, C., Duan, D., Lan, X., & Kitayama, S. (2014). Large-scale psychological differences within China explained by rice versus wheat agriculture. *Science*, 344(6184).

Terrizzi, J. A., Shook, N. J., & McDaniel, M. A. (2013). The behavioral immune system and social conservatism: A meta-analysis. *Evolution and Human Behavior*, 34(2), 99–108.

Terrizzi, J. A., Shook, N. J., & Ventis, W. L. (2012). Religious conservatism: An evolutionarily evoked disease-avoidance strategy. *Religion, Brain & Behavior*, 2(2), 105–120.

Thornhill, R., & Fincher, C. L. (2014). *The parasite-stress theory of values and sociality: Infectious disease, history and human values worldwide.* Cham, Switzerland: Springer International Publishing.

Tybur, J. M., Inbar, Y., Aarøe, L., Barclay, P., Barlow, F. K., de Barra, M., ···Žeželj, I. (2016). Parasite stress and pathogen avoidance relate to distinct dimensions of political ideology across 30 nations. *Proceedings of the National Academy of Sciences*, 113(44), 12408–12413.

Umphress, E. E., Simmons, A. L., Boswell, W. R., & Triana, M. del C. (2008). Managing discrimination in selection: The influence of directives from an authority and social dominance orientation. *Journal of Applied Psychology*, 93(5), 982–993.

Van Leeuwen, F., Park, J. H., Koenig, B. L., & Graham, J. (2012). Regional variation in pathogen prevalence predicts endorsement of group-focused moral concerns. *Evolution and Human Behavior*, 33(5), 429-437.

Van Leeuwen, F., & Petersen, M. B. (2018). The behavioral immune system is designed to avoid infected individuals, not outgroups. *Evolution and Human Behavior*, 39(2), 226-234.

Van Vugt, M., & Park, J. H. (2009). Guns, germs, and sex: How evolution shaped our intergroup psychology. *Social and Personality Psychology Compass*, 3(6), 927-938.

Varnum, M. E. W. (2014). Sources of regional variation in social capital in the United States: Frontiers and pathogens. *Evolutionary Behavioral Sciences*, 8(2), 77-85.

West, S. A., El Mouden, C., & Gardner, A. (2011). Sixteen common misconceptions about the evolution of cooperation in humans. *Evolution and Human Behavior*, 32(4), 231-262.

Whitt, S., & Wilson, R. K. (2007). The dictator game, fairness and ethnicity in postwar Bosnia. *American Journal of Political Science*, 51(3), 655-668.

Williams, K. E. G., Sng, O., & Neuberg, S. L. (2015). Ecology-driven stereotypes override race stereotypes. *Proceedings of the National Academy of Sciences*, 113(2), 310-315.

Wilson, J. P., Hugenberg, K., & Rule, N. O. (2017). Racial bias in judgments of physical size and formidability: From size to threat. *Journal of Personality and Social Psychology*, 113(1), 59-80.

Wu, Q., Liu, W., Li, C., Li, X., & Zhou, P. (2016). A price paid for our internal strife: Escalated intragroup aggression and the evolution of ingroup derogation. *Frontiers in Psychology*, 7, 1453.

Wu, Q., Tan, C., Wang, B., & Zhou, P. (2015). Behavioral immune system and ingroup derogation: The effects of infectious diseases on ingroup derogation attitudes. *PLOS ONE*, 10(3), e0122794.

Xin, Z., Yang, Z., & Liu, Y. (2017). The impact of friend-or-foe cues and survival pressure on trust in the investment game. *Evolution and Human Behavior*, 38(2), 181-189.

Zhang, J. (2018). Contemporary parasite stress curvilinearly correlates with outgroup trust: Cross-country evidence from 2005 to 2014. *Evolution and Human Behavior*, 39(5), 556-565.

Zhao, K., Wu, Q., Shen, X., Xuan, Y., & Fu, X. (2012). I undervalue you but I need you: The dissociation of attitude and memory toward in-group members. *PLoS ONE*, 7(3), e32932.

Zuo, Y., Chen, B., & Zhao, Y. (2018). The destructive effect of ingroup competition on ingroup favoritism. *Frontiers in Psychology*, 9, 2207.

Evolution of intergroup bias: Adaptation to the threats of violence and disease

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Abstract: Ingroup favoritism and ingroup derogation are very common in our social lives, but researchers still don' t know why these two kinds of intergroup biases can exist and whether these two kinds of biases have evolutionary functions. By systematically reviewing the research reports about the evidence that these two kinds of intergroup biases follow the principles of smoke detection and functional flexibility to deal with the threats of violence and disease incurred by ingroups and outgroups, the literature review showed that although the directions of ingroup favoritism and ingroup derogation are completely opposite to each other, both of these two biases are adaptive responses of the same threat management mechanism which is designed to deal with specific ingroup and outgroup threats. In conclusion, the current evidence suggests that the intergroup bias has adaptive functions and thus it supports the evolutionary hypothesis of intergroup bias.

Key words: ingroup favoritism; ingroup derogation; threat; smoke detection; functional flexibility