5 Neurobiological Foundations: Mechanisms of Reward and Punishment

This chapter presents an excursus on the neurobiology of sociality within the context of human differentiation. It introduces a further dimension that is frequently overlooked in social and cultural science discussions, despite its significant importance. In this transdisciplinary study, scientific and particularly neurobiological insights are of paramount importance, as they constitute an integral component of the processes of human differentiation. These insights are just as relevant as the cultural aspects of coded meanings or emotional components, albeit manifesting differently, operating on a distinct level, and possessing a different nature. The genesis of collective identity is profoundly rooted in our neuronal architecture, reflecting both evolutionary and anthropological dimensions, yet it also reflects the social and cultural dynamics from which it arises. The formation and perception of collective identities are not solely the result of biological predispositions; rather, they emerge from a circular interplay of biological, cognitive, social, and cultural factors. This holistic perspective acknowledges that individual and collective identities are shaped in a complex process of social and cultural evolution, whereby biological foundations interact with cultural and social practices. The subsequent discussion and analysis of the concepts of schemata and cultural codings demonstrate that these should not be perceived in a unidimensional manner. Instead, their interaction with the bodily dimensions of human existence, the environment, and the social systems individuals engage with is of paramount importance (see Chapter 6).

An examination of the role of *reward and punishment* in neurobiological research offers significant insights into the mechanisms underlying human differentiation. These mechanisms are inextricably linked to the dynamics that sustain and legitimize specific social systems. Neurobiological responses to social rewards and punishments not only reinforce the formation of ingroup and outgroup distinctions but also facilitate the maintenance of systems that are characterized by inequality and dominance. These processes facilitate the acceptance of hierarchies within social systems by neurobiologically "rewarding" positive evaluations of the ingroup and negative evaluations of the outgroup with pleasurable states. Such reinforcement cements the tendency towards system justification, whereby individuals perceive

existing social, economic, and political inequalities as legitimate and justified. Additionally, it facilitates the development of a dominance orientation, which is conducive to hierarchical relationships and the supremacy of the ingroup. In this regard, neurobiological mechanisms are integral to the maintenance and reinforcement of social and cultural systems. These processes underpin both individual and collective inclinations to legitimize and justify existing social orders, thereby playing a crucial role in the reproduction of structured inequalities and hierarchies.

The role of dopamine and the processing of emotions are of central importance with regard to the neurobiological dimension of human differentiation. The limbic system and other key brain regions play a pivotal role in emotional processing (Panksepp 1998, 42). In this system, the amygdala is of great relevance for emotional responses and threat detection, while the hippocampus plays a pivotal role in the formation of emotional memories (ibid., 217). Moreover, the prefrontal cortex oversees sophisticated cognitive processes, including decision-making and social interactions. It does so by integrating emotional and rational inputs to inform behavior. The ***mesolimbic pathway***, often referred to as the brain's reward system, is indispensable for processing signals related to rewards (Numan 2015, 19; Achterberg and Vanderschuren 2023). This is particularly the case with regard to those derived from positive social interactions, such as successful cooperation or peer recognition (Massaccesi et al. 2024). The mesolimbic dopamine pathway is a principal component of this system, as it plays a pivotal role in regulating experiences of pleasure and motivation through the modulation of dopamine levels. This pathway is of great importance with regard to the emotional and motivational aspects of human behavior, particularly in the context of neurobiological studies pertaining to human differentiation.

Dopamine is a neurotransmitter, which is to say a type of chemical messenger that transmits signals between nerve cells (neurons) in the brain. It plays a key role in a number of critical functions, including movement control, reward and pleasure processing, mood regulation, and attention and learning modulation. Dopamine is intrinsically linked to feelings of reward and pleasure, enhancing the desire for activities or objects that are perceived as pleasurable or rewarding. This quality makes dopamine a fundamental element in the development of motivation, influencing behavior towards rewarding experiences and away from those deemed unpleasant. The neurotransmitter exerts a pivotal influence on the formation of habits and decision-making processes, encompassing both the physiological and psychological aspects of human behavior (Mehta 2020; Bzdok and Dunbar 2020; Kanske and Murray 2019). Moreover, dopamine plays a role in the development of addictive behaviors, whereby actions that result in repeated drug use are reinforced. In the context of social interactions, dopamine is released during positive experiences, thereby enhancing one's sense of well-being and encouraging the maintenance of certain behaviors. In light

of these findings, it can be concluded that the effects of dopamine are comparable to those of substances such as alcohol or cocaine (Young, Gobrogge, and Wang 2011), which stimulate its release. The release of dopamine is also observed during sexual activities. In humans, merely contemplating sexual experiences can also elicit the release of dopamine. This illustrates the extensive influence of dopamine on both physical pleasure and psychological reinforcement, which is essential for comprehending the social and motivational dynamics of the human condition (Chow et al. 2024; Rincon-Cortes and Grace 2023; Cloutier et al. 2008). Dopamine is synthesized within the mesolimbic dopamine system, which is primarily located in the ventral tegmental area (VTA) of the brain. The VTA plays a pivotal role in the reward processing mechanism. Dopamine neurotransmitters are dispatched from the ventral tegmental area (VTA) to various brain regions, including the *nucleus accumbens* and the prefrontal cortex. The prefrontal cortex, which is responsible for a range of functions including decision-making, self-control, and social situation analysis, integrates input from the nucleus accumbens in order to assess potential courses of action based on anticipated rewards. These interconnected structures constitute a vital part of the mesolimbic pathway, elucidating the neurobiological underpinnings of social interactions, reward experiences, and motivational states. This network provides an illustrative example of the manner in which the brain interprets and responds to reward signals, exerting a considerable influence on behavioral responses within social environments.

Let us reexamine the ***nucleus accumbens***, which is frequently referred to as the "reward center" of the brain. This brain region plays a crucial role in regulating our experiences of pleasure and motivation. Engagement in activities that are essential to our survival or well-being—such as eating, drinking, or social interaction—activates the nucleus accumbens, thereby providing a rewarding experience. However, its function is not limited to the processing of rewards. Furthermore, the nucleus accumbens plays a substantial role in social reinforcement, prompting individuals to engage in behaviors that enhance social recognition and group affiliation. Positive feedback from the social environment, such as recognition or approval from peers, activates this area, thereby reinforcing social behaviors that are aligned with group norms and values. This mechanism is of great importance in encouraging conformity to the social norms and values that define group identity (Wei, Zhao, and Zheng 2013; Wu, Luo, and Feng 2016). The nucleus accumbens exerts a decisive influence on the drive for social affiliation and recognition, prompting behaviors that facilitate conformity within the group. This inclination has a profound impact on social structure and group dynamics, reinforcing cohesion and, at times, suppressing individuality. The neurochemical foundations of social conformity, particularly through the activities of the nucleus accumbens, offer new insights into the processes of subjectivation, conditioning, and adaptation to dominant power structures and social

norms, as explored in Chapter 8. Throughout these processes, individuals engage in active identity and behavioral modification in order to align themselves with the expectations and norms of their social system (Izuma, Saito, and Sadato 2008). This mechanism elicits an augmented sense of well-being and fosters the maintenance of behaviors that align with the desired outcome. The brain's reward system strengthens these behaviors, acting as a neurochemical catalyst for the internalization of social power dynamics and exerting a profound influence on the individual's self-concept. This internalization process is complex, forming individual identities and beliefs within the context of collective expectations and norms. Individuals may suppress their personal desires, needs, or beliefs in order to achieve social conformity and the subsequent dopamine-induced reward, which is driven by dopamine—or more accurately, by the pleasurable experiences it facilitates (Watt and Panksepp 2016, 4). Given that dopamine functions similarly to an intoxicating and addictive substance, non-conforming behavior can be seen as a withdrawal of reward, thereby rendering the process of conditioning to social norms a profoundly significant phenomenon. This dynamic aligns with the concept of bio-culturally co-evolved collective intentionality, which is discussed in depth in Chapter 3. Additionally, scientific studies have demonstrated that envy and schadenfreude are intricate emotional states that are processed by the brain's dopaminergic systems. It is noteworthy that the regions activated during episodes of envy are associated with pain sensations, particularly when individuals are exposed to the excessive happiness and popularity of others. The anterior cingulate cortex (ACC), which is activated during feelings of envy, plays a pivotal role in the regulation of these emotions (Takahashi et al. 2009; Xiang et al. 2016). In contrast, feelings of schadenfreude have been observed to activate the ventral striatum, a region of the brain that plays a pivotal role in reward processing and the experience of well-being (Wang et al. 2024; Sun et al. 2024). The activation of dopaminergic regions during reports of a fictional person's misfortune provides evidence that the dopamine system mediates emotional states associated with resentment, hostility, and envy. Consequently, neurochemical motivation introduces an additional layer of complexity to the intricate analysis of human differentiation in group-based comparisons, fostering motivations for achieving personal superiority and deriving pleasure from the failures of others. The processes of social categorization and value assignment are largely automatic, intertwined with prosocial behavior and group identification. This fosters prejudice by accentuating the positive attributes of the in-group while simultaneously devaluing those of the out-group. This process, which is further intensified by the minimal group paradigm, solidifies the distinctions between collectives that are perceived as in-groups and out-groups. Guided by a covert logic, it is designed to evoke a sense of collective identity. The mesolimbic dopamine pathway is of pivotal importance with regard to the consolidation of group affiliations. The release of dopamine in response to social stimuli, such as conformity or imitation, has been observed to

elicit positive emotions and reinforce group bonding. While these mechanisms enhance group cohesion and solidarity, they also perpetuate prejudice and discrimination by neurochemically endorsing in-group favoritism and out-group devaluation. It is important to gain a comprehensive understanding of the neurobiological foundations of social categorization, as it has a profound impact on the formation of social bonds and shapes social perceptions and judgments. The insights gained into the mesolimbic dopamine system provide insight into group-based behaviors, thereby illustrating the extent to which these processes are embedded in our neural architecture. These insights direct our attention to the amygdala, another crucial brain structure that significantly impacts our social interactions and associated emotional responses. The mesolimbic system elucidates the neurochemical basis of our feelings of belonging and group dynamics. In contrast, the amygdala offers further insights into the emotional factors that shape perceptions and responses to individuals who are perceived as different due to their sociocultural background.

The ***amygdala***, an almond-shaped structure situated within the temporal lobe, represents a principal element in the processing of emotional stimuli and exerts a profound influence on our responses to social categories and "others." The amygdala plays a vital role in the evaluation of threats and emotionally charged memories, which are essential for the formation of prejudices and the consolidation of group identities. The amygdala plays a pivotal role in differentiating between the self and other groups by regulating both innate and learned fears, thus supporting the processes of human differentiation. The amygdala's dual role in threat evaluation and emotional memory establishes its integral function in categorization processes and group-based identification (Panksepp 1998, 196). The amygdala, a critical component of the limbic system located beneath the neocortex and present bilaterally in both hemispheres of the brain, plays a pivotal role in linking thoughts and memories with emotions (Matthies et al. 2012). This function is of vital importance for the regulation of behaviors associated with aggression and the fear response, including the processing of perceived threats during hostile interactions (Swaab and Meynen 2023; Ibrahim et al. 2022). The amygdala is especially responsive to individuals who display threatening behaviors, such as aggressive gestures and facial expressions, which can evoke an instinctual fear response (Pinker 2012, 738). The amygdala serves as a primary site for both innate and learned fear responses, playing a pivotal role in emotional processing and the regulation of fear reactions. The amygdala is a key player in the formation of emotional memories, which in turn affects how individuals perceive and respond to their social environment (Asede, Joseph, and Bolton 2020). Innate fears are instinctive responses to specific stimuli or situations, often triggered automatically without prior exposure or learning. For example, an innate fear of potentially dangerous animals, such as snakes or large predators, can prompt an immediate reaction from the amygdala, thereby facilitat-

ing survival responses without the necessity for personal, painful learning experiences (Zaki et al. 2022). In contrast, learned fears originate from direct experiences and learning processes. The amygdala is a vital structure in the development of fear responses to specific objects, faces, or skin colors, which occur through conditioning or learned associations. When an individual is exposed to a threatening or traumatic event, the amygdala encodes this experience, thereby influencing future reactions to similar stimuli. This phenomenon, known as fear conditioning, is characterized by the amygdala's capacity to form and retain emotional memories, which are then reactivated in subsequent encounters with the related stimulus. This phenomenon exemplifies the function of the amygdala in facilitating both immediate and learned fear responses, which contributes to the dynamics of emotional regulation and responses to perceived threats (Lei et al. 2022; Zaki et al. 2022). Furthermore, the amygdala has been identified as a crucial structure for the recognition and processing of fear signals, as well as the orchestration of corresponding bodily responses. Individuals with damage to this region often exhibit an impairment in the recognition of facial expressions indicative of anger and aggression. A prominent feature of both ape and human behavior is the connection between aggression and the emotions of fear and anxiety, which is evidenced by the presence of an amygdala in both species (Kalin, Shelton, and Davidson 2004, 5506). This connection is especially pronounced in individuals with post-traumatic stress disorder (PTSD), where the amygdala may exhibit exaggerated responses to minor fear stimuli and delayed normalization (Prager, Wynn, and Ursano 2016; Nicholson et al. 2018; An et al. 2021; Haris et al. 2023). A shift in focus from the amygdala to the insular lobe allows for an examination of another critical area involved in the processing of complex emotions. The insular lobe has functions that extend beyond those of the amygdala, playing a vital role in the evaluation of disgust and moral judgments. The significance of this area is particularly evident in how emotional responses impact social interactions and judgments, providing a more comprehensive understanding of the neurobiological foundations of these processes.

The ***insular lobes***, or *insulae*, are located within the lateral sulcus of the brain, situated between the temporal, frontal, and parietal lobes. They are integral to a variety of functions that facilitate the integration of internal perceptions and external social interactions. They play a pivotal role in the processing of emotions and are essential for the perception of complex social emotions, including affection, ridicule, scorn, hatred, disgust, and empathy (Sapolsky 2017, 58). Furthermore, the insulae are essential for interoceptive awareness, which pertains to the recognition of internal states such as hunger, thirst, and pain. Furthermore, this region of the brain is involved in integrating sensory information, particularly taste and tactile sensations, and is essential for social interactions, particularly in empathizing with and understanding others' emotions. Furthermore, the insular lobes are implicated in a

range of cognitive functions, including attention and decision-making, particularly in contexts where risk and reward assessments are necessary. These diverse functions provide evidence of the insula's fundamental role in mediating between bodily self-awareness and dynamic social exchanges. The use of ridicule and scorn directed at individuals or groups perceived as foreign not only elicits intense emotional responses but also stabilizes in-group solidarity (Hodson, Rush, and MacInnis 2010, 660). The role of disgust in the formation of in-group and out-group boundaries is a crucial one. The insular lobe's response to signs of spoiled food—which activates the amygdala to trigger reactions such as nausea, retching, facial contortions, and turning away—demonstrates its fundamental role in immediate physical and emotional responses. This response to potentially harmful substances, initiated by olfactory or gustatory stimuli, is analogous to the social domain, where analogous mechanisms of disgust and aversion are observed in the context of out-groups (Sapolsky 2017, 59). From a political and strategic standpoint, these responses are structured in a way that provokes an immediate and involuntary aversion towards external entities. This is achieved by drawing upon the same rapid and involuntary neural pathways that govern our avoidance of spoiled food. This instinctual response remains unaltered until higher cognitive processes in the cerebral cortex engage in reflective thinking to assess and potentially reject these prejudiced associations. The following chapters will examine in greater detail the role of these affective-cognitive-bodily schemata in the differentiation and marginalization of groups within social structures. Moreover, the connection between the insular lobe and the amygdala, which is responsible for feelings of disgust, is also activated during moral judgments. It is notable that the mere act of contemplating morally reprehensible acts can evoke neurobiological responses that are analogous to those elicited by the visual presentation of disgusting animals or foods. These neurobiological mechanisms illustrate how disgust can be strategically utilized as a marker to differentiate from and demean undesirable foreign groups. The association of disgust, threat, aggression, and anger with minority groups represents a long-standing practice of denigration of members of such groups. This insight is fundamental to the analysis of emotion markers within the framework of cultural coding, as discussed in Chapter 8.

The integration of neurobiological perspectives into the study of human differentiation provides novel insights into the underlying mechanisms of human social behavior, elucidating the ways in which biological processes and social dynamics influence our interactions. While neurobiological variables in discriminatory practices may be susceptible to misuse, they are not inherently linked to social exclusion. Instead, these variables engage in a complex interplay between biological predispositions and social influences. The aforementioned neurobiological elements and dynamics play a pivotal role in emotional responses to perceived "otherness," yet they do not function in isolation. These systems are part of a broader neural network that is in-

fluenced by social learning, cultural contexts, and individual experiences. This suggests that reactions to social signals are shaped by a multitude of factors that extend beyond neurobiological variables. It is imperative to acknowledge the indispensable function of concentrated neurobiological systems in processing social stimuli, particularly those pertaining to exclusion and devaluation. The instrumentalization of emotions such as hatred and envy against particular groups provides an illustrative example of how such reactions, including threat, resentment, and disgust, can be neurobiologically triggered and manipulated across diverse cultural, identity, and gender lines to influence public opinion. The substantial, though not deterministic, influence of these factors challenges the prevailing notion in the predominantly social constructivist cultural and social sciences, revealing the need for a deeper appreciation of the interplay between biological and socio-cultural factors. The integration of diverse theoretical perspectives offers insights into the significance of cultural norms and values in shaping biological predispositions. This synthesis depicts how these interactions give rise to a multitude of behaviors pertaining to group membership and differentiation across a range of cultural contexts. This illustrates the human capacity to deliberately alter and regulate one's responses, despite the presence of biological processes that may facilitate the development of social fears and prejudices. Consequently, group-based social exclusion is not regarded as an inevitable or inherent aspect of human behavior. Instead, it represents a challenge to surmount biological biases through deliberate strategies, including education, social interaction, and critical reflection. The objective of these strategies is to mitigate the misuse of biologically based systems and to enhance a holistic understanding of social recognition and exclusion processes. The following chapter presents a synthesis of the theoretical frameworks discussed thus far, articulated through the concept of affective-cognitive-bodily schemata of differentiation. From the perspective of contemporary systemic-anthropological inquiry, these schemata play a crucial role in human differentiation.