The Relationship Between Disgust and Suicidal Behavior

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Date: 2022-06-09T00:00:00+00:00

Abstract

Suicide is causing an increasing number of human deaths, yet the psychological mechanisms underlying suicide remain unclear. Recent research has found that disgust is a primary emotional factor leading to suicide, with individuals taking their own lives due to self-disgust. Disgust is a basic emotion involving aversion to one' s own and others' excreta, which promotes individuals to avoid toxicity and disease, thereby generating "immune behavior." Many psychological problems stem from disgust toward surrounding people or things; individuals with suicidal behavior exhibit extreme self-disgust, indicating a malfunction in their disgust emotion. Like somatic immunity attacking the self, self-disgust is a key factor in suicidal ideation, with early trauma as its root cause, and life stress and mental illness also participating. The neural basis of disgust-induced suicidal ideation is related to the HPA axis and the serotonin system. Future research can utilize neuroscientific techniques such as neuroimaging and electrophysiology to examine the neural mechanisms of suicidal behavior and explore the psychological and neural mechanisms through which disgust emotion influences suicidal behavior.

Full Text

The Relationship Between Disgust and Suicidal Behavior

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Abstract: Suicide claims an increasing number of human lives, yet its psychological mechanisms remain unclear. Recent research has identified disgust as a primary emotional factor underlying suicide, with individuals ending their lives due to self-directed disgust. Disgust is a basic emotion that evokes revulsion toward excreta from oneself and others, promoting avoidance of toxins and disease —what might be termed "immune behavior."

Many psychological problems stem from disgust reactions toward people or circumstances in one' s environment. Individuals who engage in suicidal behavior exhibit profound self-disgust, indicating a dysfunction in their disgust response. Just as somatic autoimmunity involves the immune system attacking the body itself, self-disgust represents a key factor in suicidal ideation, with early trauma as its root cause and life stress and mental illness as contributing factors. The neural basis linking disgust to suicidal behavior involves the HPA axis and serotonin system. Future research should employ neuroscientific techniques such as neuroimaging and electrophysiology to examine the neural mechanisms of suicidal behavior and explore the psychological and neural pathways through which disgust influences suicide.

Keywords: disgust emotion, death instinct, basic emotions, depression, suicidal behavior

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Suicide represents one of the leading causes of death and disability worldwide, with approximately 703,000 people dying by suicide annually. While accidental deaths constitute the primary cause of mortality, suicide accounts for one-third of all accidental fatalities (WHO, 2021). Suicide is a major cause of death among young people, posing a serious threat to human life and psychological wellbeing.

Suicidal behavior encompasses suicidal ideation, suicide attempts, and completed suicide. Suicidal ideation refers to serious thoughts of suicide and preparation for a potentially lethal, self-directed, injurious action intended to result in death, but without a specific plan. A suicide attempt involves thinking about, considering, or planning suicide with the intention of gaining attention through self-harm, though not necessarily causing actual injury (Klonsky et al., 2016). Completed suicide refers to the implementation of self-directed injurious behavior that results in death. Generally, suicide is associated with hopelessness, impulsivity, and depression (Lutz et al., 2017; Ypsilanti et al., 2019), with many studies identifying depression as the primary cause. However, depressive mood involves persistent low and sad affect, characterized by lethargy that makes suicidal attempts difficult to initiate. According to Freud' s theory of aggressive instinct and death instinct (Freud, 1920; Pedder, 1992), suicide represents an instinct—a self-directed aggressive act driven by a powerful impulse or internal force. What, then, is the primary psychological mechanism influencing suicidal behavior?

Disgust, among Ekman's six basic emotions, has received the least research attention, yet accumulating evidence reveals its crucial role in daily life and numerous

psychological disorders. Recent findings demonstrate that many psychological problems arise from patients' disgust toward their surroundings, and disgust is also implicated in suicide (Hu et al., 2021; Schienle et al., 2020). Disgust is an emotional response to repulsive stimuli (Ekman, 1992) and a behavioral defense mechanism that protects against potential disease, viruses, and contamination by promoting avoidance of spoiled food or other pollutants (Oaten et al., 2018). Disgust comprises core disgust and moral disgust—the former being a reaction to bodily excreta (feces, urine, vomit, putrefaction) through taste, smell, or vision, while the latter involves revulsion toward behaviors that violate social ethics, particularly sexual behaviors. Moral disgust represents an advanced form of disgust, manifesting as social disgust in interpersonal interactions. This indicates that disgust functions not only to critique ingestion behaviors but also to evaluate social interactions (Vicario et al., 2017; Stevenson et al., 2019). Previous research has identified social rejection and disgust as core components of suicidal behavior (Courtet & Olié, 2019), with disgust-induced negative interpersonal relationships and relational conflicts further increasing self-disgust (Till et al., 2017; Cáceda et al., 2020). How, then, does disgust—so decisive in social functioning—contribute to suicidal behavior?

This paper systematically reviews recent research on disgust' s influence on suicidal behavior and its neural underpinnings, connecting these findings to Freud' s "death instinct" theory. We aim to substantiate this theoretical perspective through empirical evidence, explore the psychological mechanisms by which disgust triggers suicidal behavior, and provide support for Freud' s death instinct theory. We propose a valence model of disgust (death instinct) and joy (life instinct), offering a novel perspective for research on basic emotions and suicide.

2 Theories of Suicidal Behavior

Numerous studies on suicidal behavior have proposed various hypotheses (see Du & Jiang, 2015 for a review), including the Interpersonal Theory of Suicide, the Integrated Motivational-Volitional Model, and the Three-Step Theory. Most of these hypotheses are built upon the ideation-to-action framework, which separates suicidal ideation and suicide attempts into two developmental stages with distinct emotional causes and predictive factors. However, both suicidal ideation and attempts are associated with disgust.

2.1 Interpersonal Theory of Suicide

Joiner (2005) proposed the Interpersonal Theory of Suicide (ITS) (Joiner et al., 2016), which posits that perceived burdensomeness and thwarted belongingness are primary causes of suicidal ideation. Perceived burdensomeness involves viewing oneself as a burden on others, encompassing dimensions such as perceived responsibility and self-disgust (Van Orden et al., 2010). Thwarted belongingness refers to feelings of alienation from social groups and deteriorated connections, including dimensions such as loneliness and lack of care, manifested through self-reported loneliness, few friends, living alone, incomplete families,

social withdrawal, and family conflict (Van Orden et al., 2010). The theory hypothesizes that when perceived burdensomeness and thwarted belongingness are present, self-disgust intensifies, leading to suicidal ideation. Under conditions of acquired capability for suicide and with fear of death eliminated, lethal suicidal behavior occurs (see Figure 1a [Figure 1: see original paper]).

Subsequently, Becker and colleagues (2020) tested the three-way interaction among burdensomeness, belongingness, and fearlessness about death in ITS, finding results consistent with theoretical predictions: low belongingness was positively associated with high burdensomeness and fearlessness about death. Moreover, extreme disgust elicited by thwarted belongingness and perceived burdensomeness increases suicidal ideation. Chu et al. (2013) integrated ITS to propose that disgust with life may lead to perceived burdensomeness and thwarted belongingness, both of which are associated with desire for suicide (Joiner et al., 2005; Van Orden et al., 2010). Wong et al. (2020) categorized suicide risk into three groups based on self-injurious thoughts and behaviors: low suicide ideation without attempts, moderate suicidal ideation, and severe suicidal ideation with high levels of self-injurious behavior. In summary, self-disgust elicited by thwarted belongingness and perceived burdensomeness can trigger suicidal desire and represents an important cause of suicidal ideation.

2.2 Integrated Motivational-Volitional Model

O' Connor and Kirtley (2018) proposed the Integrated Motivational-Volitional Model of Suicidal Behavior (IMV), which divides suicidal behavior into three stages: pre-motivational, motivational, and volitional. (1) The pre-motivational stage involves disgust eliciting suicidal ideation, beginning with defeat or disgust developing into entrapment, which then gives rise to suicidal ideation. (2) The motivational stage represents the maturation of suicidal ideation and intent, characterized by interactions between motivational moderators and disgust-related interpersonal factors. (3) The volitional stage involves the transition from suicidal ideation to suicide attempts or death, representing the implementation phase where volitional moderators play crucial roles, including fearlessness about death and increased physical pain tolerance (O' Connor & Kirtley, 2018; Li et al., 2021) (see Figure 1b).

This theory has received empirical support. For instance, Li et al. (2021) tested the IMV model in Chinese adolescents, finding that defeat was significantly correlated with entrapment, and that defeat, thwarted belongingness, and perceived burdensomeness were all significantly associated with suicidal ideation, which in turn was significantly correlated with suicide attempts. However, they found no correlation between pain tolerance and fearlessness about death with suicide attempts, consistent with previous research (Ren et al., 2019). International studies have also validated the motivational phase of the IMV model (Lucht et al., 2020; Rasmussen et al., 2019). Thus, biological or genetic vulnerabilities and cognitive fragility increase individuals' disgust sensitivity, making them more susceptible to defeat and disgust from negative life events and en-

vironmental stress, leading to loss of confidence in interpersonal relationships, development of entrapment, and increased suicide risk.

2.3 Three-Step Theory of Suicide

Klonsky and colleagues (2016) proposed the Three-Step Theory of Suicide (3ST), a recent addition to suicide theories. Similar to the IMV model, 3ST divides suicidal behavior into three steps: First, when self-disgust reaches a certain level, it leads to pain (especially psychological pain) and hopelessness, whose interaction produces suicidal ideation. Second, when self-disgust extends to social connections (i.e., connections to people, work, roles, and interests that give life meaning and purpose), disgust toward these connections intensifies suicidal ideation. Third, under conditions of acquired capability, intense suicidal ideation results in suicide (Yang et al., 2018) (see Figure 1c).

Subsequently, Klonsky and May (2015) validated 3ST using a cross-sectional study of American adults, demonstrating that suicidal ideation arises from the interaction between disgust-induced pain and hopelessness, while capability for suicide mediates the relationship between suicidal ideation and attempts. Yang et al. (2019) tested 3ST in a Chinese college student sample, also finding an interactive effect of psychological pain and hopelessness in predicting suicidal ideation, providing preliminary evidence for suicide prevention in Chinese contexts. Additionally, Oaten et al. (2015) found that disgust increases pain sensitivity, with similar results reported in a UK college student sample (Dhingra et al., 2019). Moreover, experimental results from psychiatric patients have confirmed 3ST (Tsai et al., 2021). In summary, 3ST has strong empirical support, with disgust primarily functioning in the first step: extreme disgust produces pain and hopelessness.

2.4 Summary

In conclusion, self-disgust is a critical factor in the formation of suicidal ideation. Specifically, when individuals experience burden and stress, they feel defeated and self-disgusted, eventually reaching hopelessness (extreme self-disgust) and generating suicidal ideation. Under conditions of acquired capability for suicide (such as fearlessness about death and pain tolerance), this transitions to suicide attempts, culminating in suicidal behavior.

Figure 1. Illustration of self-disgust in theories of suicidal behavior: a. Interpersonal Theory of Suicide; b. Integrated Motivational-Volitional Model; c. Three-Step Theory of Suicide

3 Disgust Eliciting Suicidal Ideation

Disgust can elicit suicidal ideation. Hom and colleagues (2019) surveyed American college students and found that disgust toward others and the environment constitutes a primary cause of suicidal ideation. Schienle et al. (2020) found

that disgust was negatively correlated with social support and positively correlated with avoidant coping, which in turn was positively associated with suicide. Conversely, individuals with suicidal ideation exhibit higher levels of disgust and self-hatred, with active suicidal ideation showing greater disgust and self-hatred than passive ideation (Szanto et al., 1996). If disgust is a primary cause of suicidal ideation, how does it elicit these thoughts?

From an evolutionary perspective, disgust is a basic emotion that defends against disease, viruses, and contamination by promoting avoidance of toxins and illness. The original stimuli for disgust are one' s own excreta (feces, urine, vomit). Disgust regulates numerous behaviors to eliminate waste and maintain hygiene. We propose that if disgust generalizes and individuals cannot separate themselves from disgusting objects, it may lead to psychological problems similar to autoimmunity (Curtis, 2011; Cox et al., 2020), such as eating disorders (Anderson et al., 2021; Özkan et al., 2021). Some researchers have proposed the concept of a "behavioral immune system" to describe this phenomenon —a physiological response that detects pathogens and mobilizes immunity to eliminate these disease-causing invaders (Schaller, 2011; Schaller et al., 2015). How, then, does disgust as "behavioral immunity" elicit suicidal ideation?

3.1 Early Trauma as the Root of Disgust-Induced Suicidal Ideation

Recent research suggests that disgust-induced suicidal ideation can be traced back to childhood psychological trauma. Childhood trauma represents an early experiential factor affecting suicide and self-injury (Hu & Qiao, 2021), and such trauma is often accompanied by disgust (Dyer et al., 2015). Self-disgust stemming from early traumatic events can mediate the development of mental illness (Simpson et al., 2020), such as anorexia nervosa (AN). Researchers have explained AN patients' persistent and excessive food restriction through disgust-induced avoidance (Glashouwer & de Jong, 2021), suggesting that self-disgust may originate early in life, for instance from severe psychological trauma such as caregiver abandonment. These emotions can affect adult suicidal ideation, which then progresses to suicide attempts and completed suicide through the three pathways outlined in suicide theories.

3.2 Life Stress Involvement in Disgust-Induced Suicidal Ideation

Research indicates that disgust elicited by life stress also contributes to suicidal ideation. Factors such as hopelessness (Du & Jiang, 2015; Klonsky et al., 2016; Wolfe et al., 2019), psychological pain (Courtet & Olié, 2019), anxiety (Klonsky et al., 2016), depression (Qian et al., 2020; Lutz et al., 2017), insomnia (Akram et al., 2019; Hom et al., 2019), and impulsivity (Feng & Tang, 2013; Lazuras et al., 2018) can induce disgust and consequently suicidal ideation. Studies have shown that self-disgust and self-contempt are most closely associated with core depressive symptoms—namely hopelessness and feelings of inadequacy (Zahn et al., 2015), and both can predict suicidal behavior. Ypsilanti et al. (2018) found that individuals with insomnia scored higher on self-disgust, anxiety, and de-

pression compared to normal sleepers. Ypsilanti et al. (2019) also demonstrated that self-disgust plays an important role in the relationship between loneliness and depressive symptoms, representing an affective mechanism that transforms loneliness into depressive symptomatology. Regarding impulsivity, this personality trait factor influences suicide implementation; highly impulsive individuals exhibit greater aggression, more easily acquire capability for suicide, and show higher lethality (Feng & Tang, 2013). Moreover, impulsivity directly affects self-disgust, as highly impulsive individuals are prone to regret, which generates self-disgust (Lazuras et al., 2018).

Furthermore, current literature suggests that behavioral abnormalities induced by life stress—including eating disorders, interpersonal sensitivity, social anxiety, psychoticism, and obsessive-compulsive symptoms—correlate with disgust (Chesney et al., 2014; Ille et al., 2014; Chu et al., 2015; Aristotelidou et al., 2021). These psychological problems may themselves stem from disgust toward oneself and others (Aristotelidou et al., 2021; Christensen & Lewis, 2021). According to ITS and related research, disgust toward others and oneself creates psychological burden and emotional/functional dysregulation (Powell et al., 2013), thereby generating suicidal ideation and behavior.

3.3 Mental Illness Involvement in the Disgust-Suicidal Ideation Relationship

Disgust can also strengthen the relationship between mental disorders and suicidal ideation. For example, Chu et al. (2015) found that at high levels of self- and environmental disgust, disgust intensified the association between eating disorders and suicidal ideation. Additionally, explicit recognition of disgust can enhance suicide attempts. Richard-Devantoy et al. (2013) showed that explicit disgust cognition may be associated with suicide vulnerability, while the number of suicide attempts negatively impacts disgust cognition. Among all mental illnesses related to suicide, bipolar disorder shows the highest suicide rate—approximately 20-30 times higher than the general population (Miller & Black, 2020). Iakimova et al. (2016) found that bipolar patients with a history of suicide attempts showed reduced disgust recognition ability and prolonged reaction times, consistent with previous findings (Demirel et al., 2014). This may occur because individuals with suicidal ideation show decreased disgust toward surrounding objects while increasing self-directed disgust. Indeed, intense self-disgust has proven to be the most relevant suicide risk predictor in mental illness (Schienle et al., 2020). For instance, Lin et al. (2019) found, based on ITS, that high-intensity disgust positively predicted suicide risk. Brake et al. (2017) examined self-disgust as a hypothesized mechanism linking PTSD symptoms to suicide risk, finding that PTSD-related self-disgust correlated positively with suicide risk, including disgust toward one' s own behavior and toward others. Hu et al. (2021) analyzed micro-expressions in videos of 130 college students offering suicide prevention advice to suicide attempters, finding that the intensity of disgust emotions and expressions when advising attempters could predict

suicide risk.

In summary, self-disgust enhances suicidal ideation and increases suicide risk in mental illness and other psychiatric disorders. For example, major symptoms of acute suicidal affective disturbance (ASAD) include feelings of burdensomeness and disgust toward others and oneself (Rogers et al., 2019), further demonstrating the relationship between suicidal behavior and disgust and supporting ITS.

In 1920, Freud proposed a startling hypothesis in his later masterpiece *Beyond the Pleasure Principle*—the theory of the "death instinct." Prior to this, despite the already shocking nature of Freud' s life instinct (sexual instinct) theory and pleasure principle hypothesis, the death instinct theory addressed an apparently unacceptable problem.

Freud (1920) argued that humans possess two primal instincts: the life instinct (Eros) and the death instinct (Thanatos), also called the self-instinct. The death instinct is a death drive with primary aggression.

Although Freud never developed the death instinct theory as fully as his survival instinct theory, it remains an important component of his work. Freud believed the life instinct must accompany and serve the death instinct, quoting Schopenhauer: "The goal of all life is death." We propose that life instinct and death instinct function like the horizontal axis (valence) of an emotional coordinate system, with physiological needs and life instinct on the right side and disgust on the left (Figure 2 [Figure 2: see original paper]). Disgust can be divided according to its direction into self-disgust and other-disgust, consistent with previous theories and research (Akram et al., 2019; Clarke et al., 2019; Chu et al., 2013). Self-disgust can be further subdivided into disgust toward oneself and disgust toward one' s own behavior (Brake et al., 2017), while other-disgust can extend to disgust toward the world (Hom et al., 2019). Disgust is also an evolutionarily adaptive physiological process and thus, to some extent, an instinct.

Similarly, Freud viewed the death instinct as an aggressive drive, similar to disgust, aimed at expelling unpleasant objects (Akram et al., 2019; Clarke et al., 2019; Lazuras et al., 2018; Brake et al., 2017; Ille et al., 2014). Disgust follows a distance principle: the closer something is to oneself, the greater the disgust; the more similar something is, the greater the disgust. For example, humans are more disgusted by human excreta than by fish excreta. Therefore, disgust functions like the death instinct. When directed externally, the death instinct manifests as aggression, hatred, and murder toward others; when directed internally, it produces self-destructive phenomena such as self-mutilation, self-harm, and suicide. Freud thus considered the death instinct destructive, with cruelty, suicide, murder, and aggression all driven by it. The ultimate goal of the death instinct is death, where true peace resides. Only in death—the final rest—can individuals hope to completely relieve tension and struggle. The so-called aggressive drive can be considered a derivative of the death instinct.

Disgust elicits aggressive behavior aimed at killing unpleasant objects (Chu et

al., 2013). When this aggressive object is oneself, it becomes the death instinct. The most primitive stimuli for disgust are one' s own excreta (feces, urine, vomit), followed by those of similar species, then generalization to objects associated with these excreta (toilets, vomit-like substances), and finally extension to all uncomfortable things (ugliness, noise). We propose that disgust originates from aversion to one' s own excreta, and excessive generalization leads to self-disgust and consequently suicide. Thus, as a basic emotion, disgust is evolutionarily adaptive, but when directed at oneself—especially under conditions of poor interpersonal relationships, low belongingness, high burdensomeness, and fearlessness about death—this adaptive mechanism reverses into a "survival of the unfit" principle, aligning with the death instinct' s ultimate goal. Freud' s death instinct, also called aggressive or destructive instinct, is an innate impulse to destroy order and return to a pre-life state. Subsequent thinkers including Bataille, Lacan, Deleuze, Baudrillard, and Žižek have variously developed and expanded upon the "death instinct" theory, demonstrating its profound influence, though none have clearly explained its origins. We propose that disgust-induced suicide may resemble cellular immune responses: just as autoimmunity attacks the self, self-directed disgust attacks the individual, becoming a form of self-harm.

Figure 2. The horizontal axis extremes in the emotion valence-arousal model: Death instinct–Life instinct

4 Neural Evidence for Disgust Eliciting Suicidal Ideation

Self-disgust may be influenced by early life stress, current psychological problems, and psychiatric issues. These adverse stressors can lead to underdevelopment of brain regions such as the anterior cingulate cortex and amygdala, as well as the serotonin system (Gu et al., 2016; Gu et al., 2018; Gu et al., 2019), making individuals vulnerable to self-disgust and suicidal ideation.

4.1 HPA Axis System

Hypothalamic-pituitary-adrenal (HPA) axis activation promotes release of stress hormones cortisol and adrenaline. Cortisol, a steroid hormone secreted in response to stress, promotes arousal and attention (Turecki, 2014). HPA axis-induced cortisol and sympathetic nervous system-released adrenaline constitute a stress response. Animal models of early life adversity indicate that early life stress events and stress-induced emotional arousal may lead to hypercortisolism and anxiety development (Wanner et al., 2012; Turecki, 2014; Liang et al., 2021). Numerous studies demonstrate that excessive cortisol enhances suicidal behavior. For example, Jokinen and Nordström (2009) used the dexamethasone suppression test to find that suicide attempters had significantly higher serum cortisol levels than non-attempters, indicating that HPA axis hyperactivity increases suicidal behavior. Combined with disgust' s effects on stress and pain, HPA axis-secreted cortisol likely plays a crucial role as a neurotransmitter in disgust-induced suicidal ideation.

4.2 Serotonin System

Abnormalities in the serotonin (5-hydroxytryptamine, 5-HT) system represent the primary etiology of depression. Childhood adversity may be the main cause of these abnormalities, determining adult stress response patterns, including suicide. Depression, impulsive aggression, and suicide may all result from serotonin system abnormalities, involving brain regions such as the orbital prefrontal cortex and anterior cingulate (Mann, 2013). The underlying mechanism may be serotonin system dysfunction that elicits suicide or provides a basis for disgust (Arango et al., 2002). In adults, reduced serotonergic neuron activity in the prefrontal cortex (PFC) is considered a key neurobiological feature of suicide vulnerability (Picouto et al., 2015; Van Heeringen & Mann, 2014). Countless experiments demonstrate that enhancing serotonin can treat depression and counteract suicide (Paul & Lowry, 2013; Schmaal et al., 2020; Belujon & Grace, 2014; Hahn et al., 2014). However, based on Ren et al.' s (2018) study of serotonin release in rats, serotonin may have sedative and sleep-promoting effects.

4.3 Serotonin (Peripheral)

Serotonin and 5-hydroxytryptamine are the same substance—the former peripheral, the latter central. Serotonin was first discovered in serum and is widely distributed in mammalian tissues. According to the suicide-stress diathesis model, serotonin dysfunction can be hypothesized as a stable trait marker of suicidal behavior (Pfeffer, 2001). Low serotonin levels are associated with adult suicidal behavior (Chatzittofis et al., 2013). Peripheral blood cells and platelets have been used as neural probes of central serotonergic activity and as methods for determining depressive mood and suicidal intent. Low platelet serotonin has been associated with suicidal behavior in adult patients with depression, psychosis, and PTSD (Kovacic et al., 2008), consistent with previous findings of higher 5-HT2A receptor numbers in platelets of suicidal patients compared to non-suicidal patients and controls (Pandey et al., 1995). Ninety-five percent of the body' s serotonin is secreted by the digestive tract, whose primary function is causing gastrointestinal spasms that produce nausea and vomiting—disgust behaviors. Thus, serotonin is intimately connected with disgust.

4.4 Oxytocin

Oxytocin is a neuropeptide involved in childbirth, lactation, and attachment (Parris et al., 2018), produced by neurons in the supraoptic nucleus, paraventricular nucleus, and medial preoptic nucleus, which project to various brain regions (Jahangard et al., 2020; Mitre et al., 2016). Oxytocin can reduce disgust responses and social avoidance toward threatening social stimuli (Zhang et al., 2021), with more pronounced effects in women than men (Ille et al., 2016; Lazuras et al., 2018; Kavaliers et al., 2019). The insular cortex mediates approach and avoidance responses to social affective stimuli through oxytocin receptor activity (Rogers-Carter et al., 2018), suggesting that high oxytocin levels may be associated with positive interpersonal relationships (Parris et al., 2018).

Massey et al. (2016) found that higher oxytocin concentrations correlated with lower depressive symptoms in pregnant women but higher symptoms in men. However, Chu et al. (2020) found that oxytocin reduction following social exclusion was associated with past suicide attempts but not current depressive symptoms, consistent with previous research (Parris et al., 2018). Additionally, studies have linked oxytocin concentration to suicidal ideation: Jahangard et al. (2020) found that suicide attempters had significantly lower serum oxytocin concentrations than healthy controls, and that higher suicidal ideation scores correlated with lower serum oxytocin across the entire sample. Lebowitz et al. (2018) examined salivary oxytocin levels in adolescents with primary anxiety disorders, finding that the association between negative peer social interactions and suicidal ideation was stronger in youth with high oxytocin levels.

In summary, serotonin and oxytocin influence not only suicidal ideation but also disgust processing and expression (Vicario et al., 2017; Kavaliers et al., 2019). Neural mechanisms of suicidal ideation include the HPA axis and serotonergic neurotransmitter systems, with relevant brain regions including the prefrontal cortex (PFC), anterior cingulate cortex (ACC), amygdala, hippocampus, nucleus raphe, locus coeruleus (LC), and orbital frontal cortex. Meanwhile, primary brain regions for disgust processing include the insula and basal ganglia, with additional involvement of the anterior cingulate and amygdala (Huang et al., 2010). Therefore, overlapping brain regions—particularly the anterior cingulate and amygdala—may constitute the neural substrate through which disgust influences suicidal behavior, while the HPA axis and serotonergic systems likely mediate stress responses to disgust in the process of influencing suicide.

5.1 Exploring the Relationship Between Disgust and Sadness from the Perspective of Basic Emotions

As one of the six basic emotions, disgust has long received little attention. Recent research suggests that many psychological problems may stem from disgust toward people or things in one' s environment (Aristotelidou et al., 2021; Christensen & Lewis, 2021). The mechanism underlying this disgust may be Freud' s death instinct, triggering dark, destructive behaviors that induce homicide or suicide. Among the basic emotions related to depression and suicide, both disgust and sadness are implicated. Sadness is a common emotion affecting mind and body, sometimes described as psychological pain accompanied by loneliness, suffering, depression, anxiety, and sorrow. Disgust also has adaptive functions, yet self-disgust is pathological and likewise accompanied by psychological pain. Thus, among Ekman' s six basic emotions, sadness and disgust may represent evolutionary variations of the same basic emotion.

Furthermore, psychologists typically associate depression with sadness. Power and Dalgleish (2008) hypothesized that the combination of self-disgust and sadness may produce typical depressive phenomena, subsequently validated by research (Overton et al., 2008). Disgust-induced avoidance may lead to persistent negative body evaluation (Spreckelsen et al., 2018), and negative evaluation can

engender feelings of failure, defeat, and sadness—negative emotions positively correlated with suicidal ideation and attempts (Zhang et al., 2017). When social maladjustment occurs, individuals may develop disgust toward themselves or others/the world, accompanied by sadness. This combination produces depression, which progresses from self-disgust to suicidal ideation, then to suicide attempts, and finally to completed suicide.

5.2 Exploring the Mechanism of Disgust Eliciting Suicide from the Perspective of Death Instinct

The death instinct and death drive, proposed by Freud as part of his dual drive theory, include the life drive (Eros) and death drive (Thanatos). These resemble the two extremes of an emotional valence coordinate: life instinct and disgust instinct. Disgust-induced aggressive behavior may represent a manifestation of the death instinct (O' Connor, 2016). Freud' s first principle, the pleasure principle, explains the dynamics of our psychosomatic life, representing the right side of the emotional valence coordinate. Freud' s death instinct may represent the left side—the extreme of disgust—reflecting human aversion and avoidance of oneself and the world. Freud believed the purpose of death is the return from organic life to an inorganic state, viewing death as liberation. Thus, the death drive represents the origin of the reality principle—the individual' s desire for coherence and truth.

Freud' s death instinct frequently succeeds in pushing the self toward death, much like a perfectionist who cleanses their own filth to achieve perfection. This suggests that more perfectionistic individuals may be more likely to develop self-disgust due to imperfection and be destroyed by the death instinct' s self-destructive power. Therefore, self-disgust may activate the superego' s death instinct (the desire for self-destruction), leading to suicide. Whether a neural mechanism generates the motive force of the death instinct in this process remains a worthwhile research question.

5.3 Research Prospects

Various classifications of disgust exist, and different types can increase suicidal behavior and risk, accompanied by insomnia, anxiety, depression, and other mental disorder symptoms. The psychological mechanisms may align with suicide theories: due to innate vulnerability, individuals experience burden and stress, feel defeated and pained, develop self-disgust, and finally reach hopelessness. Under conditions of acquired capability for suicide, they are likely to attempt suicide. Based on the neural mechanisms of suicidal behavior and relevant brain regions for disgust, we speculate that brain regions such as the anterior cingulate and amygdala, along with the HPA axis and serotonergic neurotransmitter systems, likely constitute part of the neural mechanism through which disgust influences suicidal behavior.

Current suicide research has several limitations. First, most studies remain

limited to cross-sectional designs that cannot address temporal factors. Future research should employ longitudinal and prospective designs to validate previous path analysis models, such as tracking changes in disgust levels, suicidal ideation, and attempt severity among suicide attempters, which may help understand the process from ideation to attempt. Second, since most studies are limited to questionnaire-based correlational research, future designs should integrate multiple fields including psychology and neuroscience, using neuroimaging and electrophysiological techniques to examine the neural mechanisms of suicidal behavior and explore how disgust influences these mechanisms.

References

Du, R., & Jiang, G. (2015). Suicidal behavior: Influencing factors, theoretical models, and research prospects. *Advances in Psychological Science*, 23(8), 1437–1452.

Feng, Y., & Tang, Q. (2013). Research progress on the relationship between impulsivity and suicidal behavior. *International Journal of Psychiatry*, 40(01), 35–38.

Hu, S., & Qiao, D. (2021). Research status on the correlation between childhood trauma and non-suicidal self-injury. *Journal of Psychiatry*, 33(5), 397–400.

Huang, H., Luo, Y., Feng, T., & Li, H. (2010). Neural basis of disgust processing. *Advances in Psychological Science*, 18(09), 1449–1457.

Li, S., & Catherine, O. (2020). Neurobiology of suicidal behavior. *World Science*, 2020(06), 20–23.

Lin, L., He, H., Liu, Y., Yang, Y., Mo, J., Wang, C., & Liu, T. (2019). The effect of negative emotions on suicide risk: The mediating role of self-injurious behavior. *Heilongjiang Researches on Higher Education*, 37(05), 83–87.

Qian, S., Zhang, K., & Duan, Y. (2020). The relationship between non-suicidal self-injury, impulsivity, and depressive symptoms in college students. *Chinese Mental Health Journal*, 34(11), 945–949.

Yang, L., Chen, X., & An, L. (2018). The three-step theory of suicide under the ideation-to-action framework. *Chinese Journal of Clinical Psychology*, 026(001), 94–99.

Zhang, X., Lei, Y., & Wang, F. (2021). Effects of oxytocin, progesterone, and estrogen on disgust processing and their neurophysiological mechanisms. *Advances in Psychological Science*, 30(1), 85–97.

Akram, U., Ypsilanti, A., Drabble, J., & Lazuras, L. (2019). The role of physical and behavioral self-disgust in relation to insomnia and suicidal ideation. *Journal of Clinical Sleep Medicine: JCSM: Official Publication of the American Academy of Sleep Medicine*, 15(3), 525–527.

Anderson, L. M., Berg, H., Brown, T. A., Menzel, J., & Reilly, E. E. (2021). The role of disgust in eating disorders. *Current Psychiatry Reports*, 23(2), 4.

Arango, V., Underwood, M. D., & Mann, J. J. (2002). Serotonin brain circuits involved in major depression and suicide. *Progress in Brain Research*, 136, 443–453.

Arias, J. A., Williams, C., Raghvani, R., Aghajani, M., Baez, S., Belzung, C., ··· Kemp, A. H. (2020). The neuroscience of sadness: A multidisciplinary synthesis and collaborative review. *Neuroscience and Biobehavioral Reviews*, 111, 1–15.

Aristotelidou, V., Tsatali, M., Overton, P. G., & Vivas, A. B. (2021). Autonomic factors do not underlie the elevated self-disgust levels in Parkinson' s disease. *PloS one*, 16(9), e0256144. https://doi.org/10.1371/journal.pone.0256144

Becker, S. P., Foster, J. A., & Luebbe, A. M. (2020). A test of the interpersonal theory of suicide in college students. *Journal of Affective Disorders*, 260, 73–76.

Belujon, P., & Grace, A. A. (2014). Restoring mood balance in depression: Ketamine reverses deficit dopamine-dependent synaptic plasticity. *Biological Psychiatry*, 76(12), 927–36.

Brake, C. A., Rojas, S. M., Badour, C. L., Dutton, C. E., & Feldner, M. T. (2017). Self-disgust as a potential mechanism underlying the association between PTSD and suicide risk. *Journal of Anxiety Disorders*, 47, 1–9.

Cáceda, R., James, G. A., Stowe, Z. N., Delgado, P. L., Kordsmeier, N., & Kilts, C. D. (2020). The neural correlates of low social integration as a risk factor for suicide. *European Archives of Psychiatry and Clinical Neuroscience*, 270(5), 619–631.

Chatzittofis, A., Nordström, P., Hellström, C., Arver, S., Åsberg, M., & Jokinen, J. (2013). CSF 5-HIAA, cortisol and DHEAS levels in suicide attempters. *European Neuropsychopharmacology: The Journal of the European College of Neuropsychopharmacology*, 23(10), 1280–1287.

Chesney, E., Goodwin, G. M., & Fazel, S. (2014). Risks of all-cause and suicide mortality in mental disorders: a meta-review. *World Psychiatry: Official Journal of the World Psychiatric Association (WPA)*, 13(2), 153–160.

Christensen, R. E., & Lewis, M. (2021). The development of disgust and its relationship to adolescent psychosocial functioning. *Child Psychiatry & Human Development*. Advance online publication. https://doi.org/10.1007/s10578-021-01208-4

Chu, C., Bodell, L. P., Ribeiro, J. D., & Joiner, T. E. (2015). Eating disorder symptoms and suicidal ideation: The moderating role of disgust. *European Eating Disorders Review: The Journal of the Eating Disorders Association*, 23(6), 545–552.

Chu, C., Buchman-Schmitt, J. M., Michaels, M. S., Ribeiro, J. D., & Joiner, T. (2013). Discussing disgust: The role of disgust with life in suicide. *International*

Journal of Cognitive Therapy, 6(3), 235–247.

Chu, C., Hammock, E., & Joiner, T. E. (2020). Unextracted plasma oxytocin levels decrease following in-laboratory social exclusion in young adults with a suicide attempt history. *Journal of Psychiatric Research*, 121, 173–181.

Clarke, A., Simpson, J., & Varese, F. (2019). A systematic review of the clinical utility of the concept of self-disgust. *Clinical Psychology & Psychotherapy*, 26(1), 110–134.

Courtet, P., & Olié, E. (2019). La douleur sociale au centre des conduites suicidaires [Social pain at the core of suicidal behavior]. *L' Encephale*, 45(Suppl. 1), S7–S12.

Cox, R. C., Jessup, S. C., Luber, M. J., & Olatunji, B. O. (2020). Pre-pandemic disgust proneness predicts increased coronavirus anxiety and safety behaviors: Evidence for a diathesis-stress model. *Journal of Anxiety Disorders*, 76, 102290.

Curtis, V. (2011). Why disgust matters. *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences*, 366(1583), 3478–3490.

Demirel, H., Yesilbas, D., Ozver, I., Yuksek, E., Sahin, F., Aliustaoglu, S., & Emul, M. (2014). Psychopathy and facial emotion recognition ability in patients with bipolar affective disorder with or without delinquent behaviors. *Comprehensive Psychiatry*, 55(3), 542–546.

Dhingra, K., Klonsky, E. D., & Tapola, V. (2019). An empirical test of the three-step theory of suicide in U.K. university students. *Suicide & Life-Threatening Behavior*, 49(2), 478–487.

Dyer, A. S., Feldmann, R. E., Jr, & Borgmann, E. (2015). Body-related emotions in posttraumatic stress disorder following childhood sexual abuse. *Journal of Child Sexual Abuse*, 24(6), 627–640.

Ekman, P. (1992). An argument for basic emotions. *Cognition and Emotion*, 6(3-4), 169–200.

Freud, S. (1920). *Beyond the pleasure principle* (Standard Edition 19). Vienna, London: Hogarth Press.

Gillespie, W. H. (1971). Aggression and instinct theory. *The International Journal of Psycho-Analysis*, 52(2), 155–160.

Glashouwer, K. A., & de Jong, P. J. (2021). The revolting body: Self-disgust as a key factor in anorexia nervosa. *Current Opinion in Psychology*, 41, 78–83.

Gu, S., Jing, L., Li, Y., Huang, J. H., & Wang, F. (2018). Stress induced hormone and neuromodulator changes in menopausal depressive rats. *Frontiers in Psychiatry*, 9, 253.

Gu, S., Wang, F., Cao, C., Wu, E., Tang, Y. Y., & Huang, J. H. (2019). An integrative way for studying neural basis of basic emotions with fMRI. *Frontiers in Neuroscience*, 13, 628.

Gu, S., Wang, W., Wang, F., & Huang, J. H. (2016). Neuromodulator and emotion biomarker for stress induced mental disorders. *Neural Plasticity*, 2016, 2609128.

Gunnell, D., Appleby, L., Arensman, E., Hawton, K., John, A., Kapur, N., ··· COVID-19 Suicide Prevention Research Collaboration (2020). Suicide risk and prevention during the COVID-19 pandemic. *The Lancet Psychiatry*, 7(6), 468-471.

Hahn, A., Haeusler, D., Kraus, C., Höflich, A. S., Kranz, G. S., Baldinger, P., ··· Lanzenberger, R. (2014). Attenuated serotonin transporter association between dorsal raphe and ventral striatum in major depression. *Human Brain Mapping*, 35(8), 3857-3866.

Hom, M. A., Stanley, I. H., Chu, C., Sanabria, M. M., Christensen, K., Albury, E. A., ···Joiner, T. E. (2019). A longitudinal study of psychological factors as mediators of the relationship between insomnia symptoms and suicidal ideation among young adults. *Journal of Clinical Sleep Medicine: JCSM: Official Publication of the American Academy of Sleep Medicine*, 15(1), 55-63.

Hu, C. S., Ji, J., Huang, J., Feng, Z., Xie, D., Li, M., ···Wei, Z. (2021). Wiser reasoning and less disgust have the potential to better achieve suicide prevention. *Crisis*, 42(3), 202-209.

Iakimova, G., Moriano, C., Farruggio, L., & Jover, F. (2016). Socio-demographic and clinical correlates of facial expression recognition disorder in the euthymic phase of bipolar patients. *Canadian Journal of Psychiatry. Revue Canadienne de Psychiatrie*, 61(10), 633-642.

Ille, R., Schöggl, H., Kapfhammer, H. P., Arendasy, M., Sommer, M., & Schienle, A. (2014). Self-disgust in mental disorders—symptom-related or disorder-specific. *Comprehensive Psychiatry*, 55(4), 938-943.

Ille, R., Wolf, A., Tomazic, P. V., & Schienle, A. (2017). Hyposmia and disgust: Gender-specific effects. *Chemical Senses*, 42(6), 493-497.

Jahangard, L., Shayganfard, M., Ghiasi, F., Salehi, I., Haghighi, M., Ahmadpanah, M., ···Brand, S. (2020). Serum oxytocin concentrations in current and recent suicide survivors are lower than in healthy controls. *Journal of Psychiatric Research*, 128, 75-82.

Joiner, T. E., Hom, M. A., Hagan, C. R., & Silva, C. (2016). Suicide as a derangement of the self-sacrificial aspect of eusociality. *Psychological Review*, 123(3), 235-254.

Joiner, T. E., Jr, Brown, J. S., & Wingate, L. R. (2005). The psychology and neurobiology of suicidal behavior. *Annual Review of Psychology*, 56, 287-314.

Jokinen, J., & Nordström, P. (2009). HPA axis hyperactivity and attempted suicide in young adult mood disorder inpatients. *Journal of Affective Disorders*, 116(1-2), 117-120.

Jokinen, J., Ouda, J., & Nordström, P. (2010). Noradrenergic function and HPA axis dysregulation in suicidal behaviour. *Psychoneuroendocrinology*, 35(10), 1536–1542.

Kato, T. A., & Kanba, S. (2013). Are microglia minding us? Digging up the unconscious mind-brain relationship from a neuropsychoanalytic approach. *Frontiers in Human Neuroscience*, 7, 13.

Kavaliers, M., Ossenkopp, K. P., & Choleris, E. (2019). Social neuroscience of disgust. *Genes, Brain, and Behavior*, 18(1), e12508. https://doi.org/10.1111/gbb.12508

Klonsky, E. D., & May, A. M. (2015). The three-step theory (3ST): A new theory of suicide rooted in the "ideation-to-action" framework. *International Journal of Cognitive Therapy*, 8(2), 114–129.

Klonsky, E. D., May, A. M., & Saffer, B. Y. (2016). Suicide, suicide attempts, and suicidal ideation. *Annual Review of Clinical Psychology*, 12, 307–330.

Kovacic, Z., Henigsberg, N., Pivac, N., Nedic, G., & Borovecki, A. (2008). Platelet serotonin concentration and suicidal behavior in combat related post-traumatic stress disorder. *Progress in Neuro-Psychopharmacology & Biological Psychiatry*, 32(2), 544–551.

Koyama, T. (1998). A possible neurophysiological basis for psychological pain. *Medical Hypotheses*, 51(5), 439–440.

Lazuras, L., Ypsilianti, A., Powell, P., & Overton, P. G. (2018). The roles of impulsivity, self-regulation and emotion regulation in the experience of self-disgust. *Motivation and Emotion*, 43(2), 145–158.

Lebowitz, E. R., Blumberg, H. P., & Silverman, W. K. (2018). Negative peer social interactions and oxytocin levels linked to suicidal ideation in anxious youth. *Journal of Affective Disorders*, 245, 806–811.

Lerner, J. S., Dahl, R. E., Hariri, A. R., & Taylor, S. E. (2007). Facial expressions of emotion reveal neuroendocrine and cardiovascular stress responses. *Biological Psychiatry*, 61(2), 253–260.

Li, X., Ren, Y., Zhang, X., Zhou, J., Su, B., Liu, S., ···You, J. (2021). Testing the integrated motivational-volitional model of suicidal behavior in Chinese adolescents. *Archives of Suicide Research: Official Journal of International Academy for Suicide Research*, 25(3), 373–389.

Liang, F., Xu, Q., Jiang, M., Feng, R., Jiang, S., Yuan, B., ···Huang, J. H. (2021). Emotion induced monoamine neuromodulator release affects functional neurological disorders. *Frontiers in Cell and Developmental Biology*, 9, 1234.

Lucht, L., Höller, I., Forkmann, T., Teismann, T., Schönfelder, A., Rath, D., ···Glaesmer, H. (2020). Validation of the motivational phase of the integrated motivational-volitional model of suicidal behavior in a German high-risk sample. *Journal of Affective Disorders*, 274, 871–879.

Lutz, P. E., Mechawar, N., & Turecki, G. (2017). Neuropathology of suicide: Recent findings and future directions. *Molecular Psychiatry*, 22(10), 1395–1412.

Mann, J. J. (2013). The serotonergic system in mood disorders and suicidal behaviour. *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences*, 368(1615), 20120537.

Massey, S. H., Backes, K. A., & Schuette, S. A. (2016). Plasma oxytocin concentration and depressive symptoms: A review of current evidence and directions for future research. *Depression and Anxiety*, 33(4), 316–322.

McQuaid, R. J., McInnis, O. A., Matheson, K., & Anisman, H. (2016). Oxytocin and social sensitivity: Gene polymorphisms in relation to depressive symptoms and suicidal ideation. *Frontiers in Human Neuroscience*, 10, 358.

Miller, J. N., & Black, D. W. (2020). Bipolar disorder and suicide: A review. *Current Psychiatry Reports*, 22(2), 6.

Mitre, M., Marlin, B. J., Schiavo, J. K., Morina, E., Norden, S. E., Hackett, T. A., ···Froemke, R. C. (2016). A distributed network for social cognition enriched for oxytocin receptors. *The Journal of Neuroscience: The Official Journal of the Society for Neuroscience*, 36(8), 2517–2535.

Oaten, M. J., Stevenson, R. J., & Case, T. I. (2015). The effect of disgust on pain sensitivity. *Physiology & Behavior*, 138, 107–112.

Oaten, M., Stevenson, R. J., Williams, M. A., Rich, A. N., Butko, M., & Case, T. I. (2018). Moral violations and the experience of disgust and anger. *Frontiers in Behavioral Neuroscience*, 12, 179.

O' Connor, B. (2016). Freud on the death drive as existence without tension. *Psychoanalytic Review*, 103(3), 423–443.

O'Connor, R. C., & Kirtley, O. J. (2018). The integrated motivational-volitional model of suicidal behaviour. *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences*, 373(1754), 20170268.

Overton, P. G., Markland, F. E., Taggart, H. S., Bagshaw, G. L., & Simpson, J. (2008). Self-disgust mediates the relationship between dysfunctional cognitions and depressive symptomatology. *Emotion (Washington, D.C.)*, 8(3), 363–366.

Özkan, İ., Taylan, S., Adıbelli, D., & Yılmaz, F. T. (2021). Investigation of the relationship between nursing students' disgust sensitivity and caring behaviours. *Nurse Education in Practice*, 54, 103090.

Pandey, G. N., Pandey, S. C., Dwivedi, Y., Sharma, R. P., Janicak, P. G., & Davis, J. M. (1995). Platelet serotonin-2A receptors: A potential biological marker for suicidal behavior. *The American Journal of Psychiatry*, 152(6), 850–855.

Parris, M. S., Grunebaum, M. F., Galfalvy, H. C., Andronikashvili, A., Burke, A. K., Yin, H., ···Mann, J. J. (2018). Attempted suicide and oxytocin-related

gene polymorphisms. *Journal of Affective Disorders*, 238, 62–68.

Paul, E. D., & Lowry, C. A. (2013). Functional topography of serotonergic systems supports the Deakin/Graeff hypothesis of anxiety and affective disorders. *Journal of Psychopharmacology (Oxford, England)*, 27(12), 1095–1109.

Pedder, J. (1992). Psychoanalytic views of aggression: Some theoretical problems. *The British Journal of Medical Psychology*, 65(Pt 2), 95–106.

Pfeffer, C. R. (2001). Diagnosis of childhood and adolescent suicidal behavior: Unmet needs for suicide prevention. *Biological Psychiatry*, 49(12), 1055–1061.

Picouto, M. D., Villar, F., & Braquehais, M. D. (2015). The role of serotonin in adolescent suicide: Theoretical, methodological, and clinical concerns. *International Journal of Adolescent Medicine and Health*, 27(2), 129–133.

Powell, P. A., Simpson, J., & Overton, P. G. (2013). When disgust leads to dysphoria: A three-wave longitudinal study assessing the temporal relationship between self-disgust and depressive symptoms. *Cognition & Emotion*, 27(5), 900–913.

Powell, P. A., Overton, P. G., & Simpson, J. (2014). The revolting self: An interpretative phenomenological analysis of the experience of self-disgust in females with depressive symptoms. *Journal of Clinical Psychology*, 70(6), 562–578.

Power, M., & Dalgleish, T. (2008). *Cognition and emotion: From order to disorder* (2nd ed.). Hove, UK: Psychology Press.

Rasmussen, S., Cramer, R. J., McFadden, C., Haile, C. R., Sime, V. L., & Wilsey, C. N. (2019). Sexual orientation and the integrated motivational-volitional model of suicidal behavior: Results from a cross-sectional study of young adults in the United Kingdom. *Archives of Suicide Research: Official Journal of the International Academy for Suicide Research*, 25(3), 439–457.

Ren, J., Friedmann, D., Xiong, J., Liu, C. D., Ferguson, B. R., Weerakkody, T., ···Luo, L. (2018). Anatomically defined and functionally distinct dorsal raphe serotonin sub-systems. *Cell*, 175(2), 472–487.

Ren, Y., You, J., Zhang, X., Huang, J., Conner, B. T., Sun, R., Xu, S., & Lin, M. P. (2019). Differentiating suicide attempters from suicide ideators: The role of capability for suicide. *Archives of Suicide Research: Official Journal of the International Academy for Suicide Research*, 23(1), 64–81.

Richard-Devantoy, S., Guillaume, S., Olié, E., Courtet, P., & Jollant, F. (2013). Altered explicit recognition of facial disgust associated with predisposition to suicidal behavior but not depression. *Journal of Affective Disorders*, 150(2), 590–593.

Rogers, M. L., Hom, M. A., & Joiner, T. E. (2019). Differentiating acute suicidal affective disturbance (ASAD) from anxiety and depression symptoms: A network analysis. *Journal of Affective Disorders*, 250, 333–340.

Rogers-Carter, M. M., et al. (2018). Insular cortex mediates approach and avoidance responses to social affective stimuli. *Nature Neuroscience*, 21(3), 404–414.

Rüsch, N., Oexle, N., Thornicroft, G., Keller, J., Waller, C., Germann, I., ··· Zahn, R. (2019). Self-contempt as a predictor of suicidality: A longitudinal study. *The Journal of Nervous and Mental Disease*, 207(12), 1056–1057.

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

Schaller, M., Murray, D. R., & Bangerter, A. (2015). Implications of the behavioural immune system for social behaviour and human health in the modern world. *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences*, 370(1669), 20140105.

Schienle, A., Schwab, D., Höfler, C., & Freudenthaler, H. H. (2020). Self-disgust and its relationship with lifetime suicidal ideation and behavior. *Crisis*, 41(5), 344–350.

Schmaal, L., van Harmelen, A. L., Chatzi, V., Lippard, E., Toenders, Y. J., Averill, L. A., ···Blumberg, H. P. (2020). Imaging suicidal thoughts and behaviors: A comprehensive review of 2 decades of neuroimaging studies. *Molecular Psychiatry*, 25(2), 408–427.

Simpson, J., Helliwell, B., Varese, F., & Powell, P. (2020). Self-disgust mediates the relationship between childhood adversities and psychosis. *The British Journal of Clinical Psychology*, 59(2), 260–275.

Spreckelsen, P. V., Glashouwer, K. A., Bennik, E. C., Wessel, I., & de Jong, P. J. (2018). Negative body image: Relationships with heightened disgust propensity, disgust sensitivity, and self-directed disgust. *PloS One*, 13(6), e0198532. https://doi.org/10.1371/journal.pone.0198532

Stevenson, R. J., Case, T. I., Oaten, M. J., Stafford, L., & Saluja, S. (2019). A proximal perspective on disgust. *Emotion Review*, 11(3), 209–225.

Suzuki, H., Ohgidani, M., Kuwano, N., Chrétien, F., Lorin de la Grandmaison, G., Onaya, M., ···Kato, T. A. (2019). Suicide and microglia: Recent findings and future perspectives based on human studies. *Frontiers in Cellular Neuroscience*, 13, 31.

Szanto, K., Reynolds, C. F., Frank, E., Stack, J., Fasiczka, A. L., Miller, M., ···Kupfer, D. J. (1996). Suicide in elderly depressed patients: Is active vs. passive suicidal ideation a clinically valid distinction? *The American Journal of Geriatric Psychiatry: Official Journal of the American Association for Geriatric Psychiatry*, 4(3), 197–207.

Till, B., Tran, U. S., & Niederkrotenthaler, T. (2017). Relationship satisfaction and risk factors for suicide. *Crisis*, 38(1), 1–5.

Tsai, M., Lari, H., Saffy, S., & Klonsky, E. D. (2021). Examining the three-step theory (3ST) of suicide in a prospective study of adult psychiatric inpatients. *Behavior Therapy*, 52(3), 673–685.

Turecki, G. (2014). The molecular bases of the suicidal brain. *Nature Reviews. Neuroscience*, 15(12), 802–816.

Van Heeringen, K., & Mann, J. J. (2014). The neurobiology of suicide. *The Lancet Psychiatry*, 1(1), 63–72.

Van Orden, K. A., Witte, T. K., Cukrowicz, K. C., Braithwaite, S. R., Selby, E. A., & Joiner, T. E. (2010). The interpersonal theory of suicide. *Psychological Review*, 117(2), 575–600.

Velkoff, E. A., Forrest, L. N., Dodd, D. R., & Smith, A. R. (2016). I can stomach that! Fearlessness about death predicts attenuated facial electromyography activity in response to death-related images. *Suicide & Life-Threatening Behavior*, 46(3), 313–322.

Vicario, C. M., Rafal, R. D., Martino, D., & Avenanti, A. (2017). Core, social and moral disgust are bounded: A review on behavioral and neural bases of repugnance in clinical disorders. *Neuroscience and Biobehavioral Reviews*, 80, 185–201.

Wanner, B., Vitaro, F., Tremblay, R. E., & Turecki, G. (2012). Childhood trajectories of anxiousness and disruptiveness explain the association between early-life adversity and attempted suicide. *Psychological Medicine*, 42(11), 2373–2382.

WHO. (2021). *Suicide worldwide in 2019: Global health estimates*. Geneva: World Health Organization.

Wolfe, K. L., Nakonezny, P. A., Owen, V. J., Rial, K. V., Moorehead, A., Kennard, B. D., & Emslie, G. J. (2019). Hopelessness as a predictor of suicide ideation in depressed male and female adolescent youth. *Suicide and Life-Threatening Behavior*, 49(1), 253–263.

Yang, L., Liu, X., Chen, W., & Li, L. (2019). A test of the three-step theory of suicide among Chinese people: A study based on the ideation-to-action framework. *Archives of Suicide Research: Official Journal of the International Academy for Suicide Research*, 23(4), 648–661.

Ypsilanti, A., Lazuras, L., Powell, P., & Overton, P. (2019). Self-disgust as a potential mechanism explaining the association between loneliness and depression. *Journal of Affective Disorders*, 243, 108–115.

Ypsilanti, A., Lazuras, L., Robson, A., & Akram, U. (2018). Anxiety and depression mediate the relationship between self-disgust and insomnia disorder. *Sleep Health*, 4(4), 349–351.

Zahn, R., Lythe, K. E., Gethin, J. A., Green, S., Deakin, J. F., Young, A. H., & Moll, J. (2015). The role of self-blame and worthlessness in the psychopathology

of major depressive disorder. *Journal of Affective Disorders*, 186, 337–341.

Zhang, X., Ren, Y., You, J., Huang, C., Jiang, Y., & Lin, M. P., et al. (2017). Distinguishing pathways from negative emotions to suicide ideation and to suicide attempt: The differential mediating effects of nonsuicidal self-injury. *Journal of Abnormal Child Psychology*, 45(8), 1609–1619.

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