



# Exploring human freeze responses to a threat stressor

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## Abstract

Despite the fundamental nature of tonic immobility in anxiety responses, surprisingly little empirical research has focused on the “freeze” response in humans. The present report evaluated the frequency and predictors of a freeze response in the context of a biological challenge. A nonclinical sample ( $N = 404$ ) underwent a 20-s inhalation of 20% CO<sub>2</sub>/balance O<sub>2</sub>. Perceptions of immobility in the context of the challenge were reported in 13% of the sample, compared with 20% reporting a significant desire to flee. Subjective anxiety and panic during the challenge were associated with the freeze response, as were a number of anxiety symptom dimensions.

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## 1. Background

The phrase “fight or flight” was coined by Cannon (1927, 1929) in the 1920s to describe key behaviors that occur in the context of perceived threat. This term has not only been influential in later conceptual and empirical work on anxiety and its disorders but also has become relatively well known in popular culture. In the context of anxiety research, the alarm or fear response described by Barlow (2002) reflects an interaction between learning and innate, biological systems designed to help animals adapt to threat. The more contemporary notion of a true or false alarm still contains the two primary features of

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Cannon's original expression, though the ordering of effects is probably best reversed; flight is the overwhelming action tendency subsequent to an alarm, whereas relatively fewer instances of fight responses result from threat (Lang, 1994). Part of Barlow's (2002) description of an adaptive alarm model suggests that a freeze response may occur in some threatening situations. Specifically, freezing—or tonic immobility—may overwhelm other competing action tendencies. For example, when fleeing or aggressive responses are likely to be ineffective, a freeze response may take place.

Similar to the flight/fight response, a freeze response is believed to have adaptive value. In the context of predatory attack, some animals will freeze or “play dead.” This response, often referred to as tonic immobility (Gallup, 1977), includes motor and vocal inhibition with an abrupt initiation and cessation. Ethologists have documented non-volitional freeze responses in several animal species (Arduino & Gould, 1984; Kalin, Shelton, Rickman, & Davidson, 1998). Freezing in the context of an attack seems counterintuitive. However, tonic immobility may be the best option when the animal perceives little immediate chance of escaping or winning a fight (Arduino & Gould, 1984; Korte, Koolhaas, Wingfield, & McEwen, 2005). For example, tonic immobility may be useful when additional attacks are provoked by movement or when immobility may increase the chance of escaping, such as when a predator believes its prey to be dead and releases it.

Despite evidence suggesting that tonic immobility may be a key facet of alarm reactions, freezing has received relatively little scientific attention in humans. One exception is the PTSD/rape literature, wherein several studies have described a rape-induced paralysis that appears to share many of the features of tonic immobility (Galliano, Noble, Travis & Puechl, 1993; Mezey & Taylor, 1998; Scaer, 2001; Suarez & Gallup, 1979). This literature suggests that a relatively high percentage of rape victims feel paralyzed and unable to act despite no loss of consciousness during the assault (Burgess & Holmstrom, 1976; Heidt, Marx, & Forsyth, 2005). Since fear, predation, contact, and restraint are common to both rape and the induction of tonic immobility in animals, it has been concluded that these phenomena are essentially isomorphic (Suarez & Gallup, 1979).

Given the general paucity of research on human tendencies to freeze in the context of threat, as well as the general reliance on retrospective reports in the existed literature, we sought to expand knowledge in this area by providing a laboratory-based exploration of the tendency to freeze in the context of threat. Laboratory-based biological challenges offer controlled methods for understanding biological and psychological factors that influence the generation of fear (McNally, 1994; Schmidt et al., 2000; Zvolensky & Eifert, 2001). The primary aim of the present study was to determine whether laboratory-based threat stressors can provoke freeze responses and, if so, to evaluate the frequency and predictors of these responses. Because a CO<sub>2</sub> challenge has been found to be a potent stressor (Zvolensky & Eifert, 2001), and a freeze tendency is believed to be a central response to threat, we hypothesized that some participants would report these reactions, although we believed these might be less frequent than flight responses. Although the challenge did not involve physical attack, participants are somewhat physically confined by a breathing apparatus attached around the head, which may simulate some of the parameters relevant to freeze in the context of predatory grasp. The second aim of the research was to determine whether anxiety-related traits or predisposing factors might predict a freeze response. There is little prior work to guide hypotheses, but it was generally expected that higher levels of anxiety-relevant traits would be associated with a freeze response. Since these responses have also been documented among some PTSD

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