Immune System Response

Diana Fleischman
University of Portsmouth, Portsmouth, UK

Synonyms

Disease cues and immune response; Disgust and immunity

Definition

The degree to which the immune system responds to disease cues.

Introduction

Pathogens including viruses, protozoa, bacteria, and parasites, including helminths (worms), ticks, and mites, have been an important selective force for all multicellular organisms. Pathogens and parasites take energy and resources from their hosts. They use their hosts to reproduce and make copies of themselves siphoning off calories and interfering with physiological processes. There is evidence that some pathogens and parasites alter hosts' behavior and physiology to their own adaptive ends (e.g., some parasites sterilize their hosts). Two systems have evolved to prevent, mitigate, and eliminate infection. The immune system, a set of specialized cells and mechanisms, is mostly engaged when parasites and pathogens have entered the organism. The immune system fights infection by, for example, producing enzymes to destroy the structure of the parasite or creating antibodies that can neutralize pathogens. The other adaptive system, sometimes called behavioral prophylaxis or the behavioral immune system (BIS), is a suite of evolved strategies to minimize the risk or prevent the introduction of pathogens and parasites into the organism. Examples in animals include selectively grazing away from feces or avoiding sick conspecifics. The human BIS is thought to center around the emotion of disgust. Recently, researchers have discovered that the BIS and the immune system are responsive to one another. For example, there is some evidence that immune vulnerability makes people more sensitive to disease cues (Miller) and that disease cues (e.g., seeing a sick looking person) can activate the immune system.

This entry will focus on human literature showing immune response to disease cues. The functional rationale behind this work is that perceiving disease cues is indicative of likely imminent infection and the most adaptive response is an anticipatory mobilization of the immune system.

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Measure of Immune Activation: Cytokines, Antibodies, Proteins, and Body Temperature

Immune response in psychological studies is measured both in blood and in saliva. Blood is often considered a better and more direct method. However, salivary markers are easier to collect. Because the mouth is one of the main entryways for pathogens, we might expect immune defenses to be mobilized preferentially in the mouth (Stevenson et al. 2011). A few kinds of immune marker are measured in these studies. Cytokines are proteins that act as messengers for the rest of the immune system and can activate other cells (Delves et al. 2011, p. 6). In particular, these kinds of studies are interested in inflammatory cytokines, messengers that recruit cells to sites of infection. However, it's important to remember that cytokines do not have a unitary function and many cytokines have both anti-inflammatory and pro-inflammatory properties. Immunoglobulins are antibody molecules that usually bind to pathogens neutralizing them or tagging them as "foreign" for other cells to clean up (Delves et al. 2011, p. 36). Immunoglobulins have classes based on their variable molecular structure. Most of these studies focus on what are commonly termed "innate immune" markers; these aspects of immunity are the first line of defense against pathogens because they distinguish the body's own cells from foreign and infected cells without previous exposure to the pathogen.

One study (Stevenson et al. 2012) also looked at body temperature. Body temperature may be increased to (1) make the body less hospitable to pathogens that are adapted to live in a certain temperature range and (2) increase metabolism and thus hasten the production of antibodies and other immune components (Kluger et al. 1996).

Thermal and Immune Response to Disease Cues

Five studies have investigated how exposure to disease cues or disgust activates aspects of the immune system. Schaller et al. (2010) conducted the first study, randomly assigning 28 participants (both men and women) to either watch a neutral slideshow and then a gun slideshow (fear condition) or a neutral slideshow and then a disease slideshow (disgust/disease condition). Participants came in on separate days and had blood drawn before and after the neutral slideshow and the experimental slideshow. The blood samples were incubated with a compound that the immune system perceives as a bacterial infection and then were measured for inflammatory cytokine interleukin-6 (IL-6). Participants in the disease condition showed greater increase in blood IL-6 response (23.6%) than participants in the fear condition (6.6%).

Stevenson et al. (2011) examined salivary immune response disgust. Stevenson et al. (2011) randomly assigned 92 male participants under 30 years of age to a disgust condition, a negative affect control condition or a neutral control condition. They measured antibody salivary immunoglobulin A (IgA) and inflammatory cytokine TNF-alpha (TNF-α).

They found a decrease in IgA and an increase in TNF-α in the disgust relative to control conditions. Disgust stimulates increased salivation, possibly to protect the tooth enamel from intestinal acids. The authors surmise that this is why there was a decrease in the concentration of IgA.

Stevenson et al. (2012) conducted another study on 74 male participants randomly assigned to look at disgusting food, pleasant food, nonfood-related disgusting images, and a negative affect control. Again they measured IgA and TNF-α, but they also measured core body temperature (BT). IgA showed a different pattern for disgusting food than for nonfood-related disgusting images. The disgusting food condition showed a sharp increase in IgA posttest and a subsequent decrease. The nonfood-related disgust condition showed a decrease in IgA like the previous study. TNF-α increased across both disgust groups (food and nonfood) relative to both control groups (food and negative). This was the first study to demonstrate a significant increase in body temperature from disgust induction; participants in the disgust conditions were 0.3 °C

warmer than the participants in the control conditions.

Ersche et al. (2014) looked at salivary immunological reactions in men, 31 cocaine addicts and 30 controls. Like the previous Stevenson et al. study, they compared food and nonfood images in both the disgust and neutral categories.

They measured salivary cytokines IL-6, IL-1beta (IL-1β), TNF-α, interferon-gamma (IFN-γ), and IL-12, IL-10, and IL-8. All group comparisons controlled for an inflammatory marker known as C-reactive protein (CRP) which was significantly greater in cocaine addicts. They found IFN-γ, IL-1β, IL-6, and TNF-α were significantly increased after viewing disgust stimuli in all men.

Stevenson et al. (2015) noted that previous studies haven't found a relationship between self-reported disgust and immune activation. They designed a study that uncoupled disgust and disease stimuli creating three sets of images: (1) disgusting but minimally disease related (e.g., a dead cat), (2) disease related but minimally disgusting (e.g., a woman sneezing), and (3) a negative control. Thirty-nine male participants viewed all sets of images 1 week apart. In this study, none of the conditions caused an increase in salivary TNF-α or IgA. The researchers found that TNF-α increased in the subset of participants with high trait disgust for both the disgust (1) and disease (2) image sets.

Conclusion

The examination of how disease- and disgust-related emotions and cognitions influence immunity is still in early stages; these studies have been conducted on mostly male participants with mostly salivary markers. Thus far it seems that many inflammatory cytokines, some antibodies, and body temperature are influenced by exposure to disgusting and disease-related cues. AU3

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