

Running head: ASTHMA AND FIGHT OR FLIGHT

A Theoretical Asthma Model: *the fight or flight response*

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Abstract

Asthma is generally described as an immunological reaction to a broad range of apparently irreconcilable, environmental triggers. Among these are airborne particulate matter, greenhouse gases, biological pathogens, as well as social and psychological stressors. Epidemiological research of asthma among such a broad range of etiological agents and possible triggers, has produced an assortment of conflicting correlations; to be sure, the quest to find the single-cause of asthma has drowned in a sea of confounding variables. The present study attempts to rationalize the otherwise chaotic elements at work within the asthmatic space, via a theoretical model that proposes a plausible mediating mechanism between the environment and the individual asthma sufferer. It is specifically argued, that *the fight or flight* response is the mediating instrument that unifies the presentation of asthma.

KEYWORDS: Asthma, Fight or Flight, Theoretical Model, Immune System, Nervous System, Firewall, Threat Detection, Response Mechanism, Trigger, Reverse Engineering, Inflammation, Reactivity.

A Theoretical Asthma Model: *the fight or flight response*

The instinctual and automatic response to real or perceived environmental threats is the common denominator of all living organisms; survival often depends on autonomic reactivity to environmental dangers. The precise mechanism by which a threat is assessed varies somewhat among animals, and it is not very well understood at present; yet, it is safe to posit that the survival mechanism in humans can be broadly conceptualized as *the fight or flight* response as described by Cannon (1939). Because the fight or flight response is a strategy for survival in a hostile ecosystem, its internal design is likely to follow a logical methodology of threat detection. Thus, the proposed theoretical model is structured in analogy to the way modern computer systems protect hardware and software components from external harm.

For the purpose of this model (see Fig. 1), it is theorized that asthma is an immunological response to environmental agents, which are incorrectly perceived as survival threats by the organism's intrusion detection system. Environmental agents, such as airborne particulate matter, which are capable of breaching the innate immune protective barriers by way of the lungs, become associated as survival threats via an automatic immune challenge mechanism.

As can be inferred from the model, because the fight or flight response mobilizes the entire defense system, it becomes the likely mediator between the otherwise semi-independent, nervous and immune functions; which are structurally separated by the nearly absolute blood-brain barrier. It is therefore posited, that the fight or flight response is essentially a layered defense mechanism which integrates contrasting provinces of the nervous and immune systems.

The model

The model depicted in this study, attempts to integrate the semi-autonomous mechanisms of survival response by establishing a layered defense prototype which is analogous to common, computer network intrusion and detection methodology. The fight or flight response system is therefore rationalized to have at least three biological firewalls:

1. The Innate Immune Firewall (IIF) is the environmental interface and defends the system from threats via genetic instructions.
2. The Adaptive Immune Firewall (AIF) is the second layer of defense against environmental agents which are able to breach the IIF. These agents include, among others, airborne particulate matter (APM), Biological Pathogens (BP), and Greenhouse Gases (GG).
3. The Brain-Blood Firewall (BBF) separates the delicate neural structures from nearly all physical agents, including those of the immune system. A breach of the BBF, is usually fatal.

It is logical to assume that an adaptive survival system include command and control methodology as well as an internal, real-time, feedback mechanism capable of maintaining the homeostatic balance of the organism. In the present model, it is therefore theorized that the fight or flight response is executed within the framework of two paradoxical domains:

1. The mechanisms of the parasympathetic/sympathetic structures (P/SS).
2. The adrenal/neural feedback loop (A/NFL).

Essentially, it is posited that the executive functions of the *central nervous system* (CNS) control the fight or flight response via the opposing instructions of the autonomic nervous system (ANS); while constantly regulating, via hormonal communication signals, the paradoxical response of the nervous and adrenal pathways.

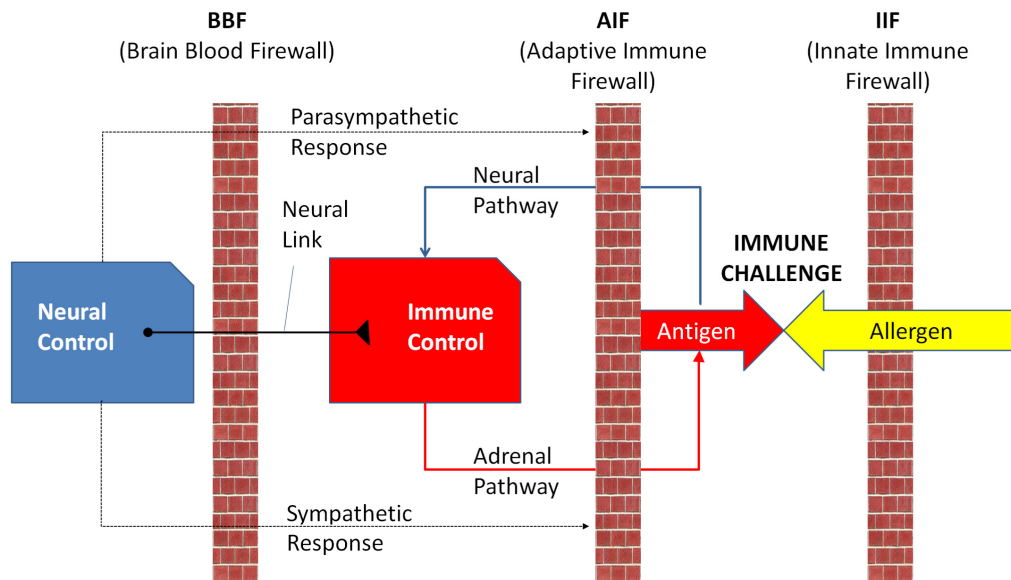


Fig. 1 - Theoretical Asthma Model: *The Fight or Flight Response*

The presentation of asthma is paradoxical, because the normal sympathetic response to survival threats is to expand lung capacity and inhibit mucus production in preparation for fight or flight; yet, because the perceived threat affects the respiratory airways, the internal mechanisms of homeostatic regulation produce a localized parasympathetic response that attempts to protect the vital respiratory system from environmental harm. This paradoxical response, results in the closing the bronchial airways and the overproduction of particulate-capturing phlegm.

Conclusion

From the aforementioned model, it may be inferred, that asthma is likely the result of a processing error within the human threat detection system; common and otherwise harmless environmental agents are interpreted as survival threats. The misrepresentation of threat valence by the immune system, incorrectly triggers the fight or flight response, and in turn a system-wide, psychosomatic reaction which results in the symptomatic presentation of asthma: distress, inflammation of the bronchial airways and the overproduction of mucus.

Relevance

A theoretical model, such as the one presented here, is relevant to the ongoing conversation regarding epidemiological spaces in at least three ways.

1. Theoretical models show how the utilization of reverse engineering logic can be useful in providing a likely conceptual framework for otherwise chaotic and paradoxical systems.
2. Theoretical models are not intended to answer, but to elicit hard questions regarding the logical links between and among its components; indeed, this model is anticipated to lead to the formulation of discrete hypothesis regarding the correlation strength of the proposed mechanisms.
3. Theoretical models can serve to provide a blueprint for the segmentation of interdisciplinary research among, often conflicting, scientific disciplines, thus allowing for the integration of specific specialties within discrete areas of research responsibility.

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