Necrotizing Fasciitis: A Profound Mystery in Medical Microbiology

By Alex Berezow, PhD — October 27, 2016

Necrotizing fasciitis, which literally translated means "inflammation of the fascia (connective tissue) causing cell death," is the proper medical term for what is colloquially known as "flesh-eating" disease. The most recent case that made national headlines involved a man who died four days after becoming infected with the ocean-dwelling microbe *Vibrio vulnificus*.

Naturally, public health officials, microbiologists, and journalists tend to focus on how a bacterium can become so deadly. Indeed, as bacteria evolve, they can acquire various weapons (e.g., genes that encode antibiotic resistance or toxins) that make them increasingly dangerous.

However, what perhaps deserves more focus is the genetic background of the patient. It is my hypothesis that herein lies the answer to the deepest and most profound mystery in medical microbiology: Why do microbes kill some people but not others?

Indeed, research is beginning to clarify why people can be susceptible (or unsusceptible) to particular infectious diseases. A person's immunogenetic profile partially determines the severity of infection with Group A *Streptococcus*. Mutations in genes that encode specific interleukins (signaling molecules of the immune system) can make a person more vulnerable to influenza. On the other hand, the fortunate few individuals who possess a mutation known as CCR5-delta 32 are resistant to HIV. Genetics, both of the host and the microbe, are vital to determining the outcome of an infection.

What about necrotizing fasciitis? There is little, if any, data on the role of human genetics. However, given the findings of research in other infectious diseases, it could be that human genetics plays a role. Consider that risk factors for necrotizing fasciitis include diabetes, obesity,
and being immunocompromised. Additionally, there is no one single microbial cause of necrotizing fasciitis. Instead, a large and evolutionarily diverse group of bacteria can cause the condition. A Dutch study [8] that examined 35 patients with type 1 necrotizing fasciitis isolated the following bacteria, usually in combination with other bacteria:

- Escherichia coli
- Klebsiella pneumoniae
- Proteus mirabilis
- Citrobacter freundii
- Enterobacter cloacae
- Serratia marcescens
- Pseudomonas aeruginosa
- Acinetobacter baumannii
- Stenotrophomonas maltophilia
- Aeromonas sobria
- Bacillus species
- Haemolytic streptococci, not group A
- Enterococcus species
- Streptococcus pneumoniae
- Viridans streptococci
- S. milleri group
- Clostridium perfringens
- Anaerobe gram negative rods, mainly B. fragilis

(Note: Type 1 necrotizing fasciitis is caused by a polymicrobial infection; Type 2 by Group A Streptococcus with or without Staphylococcus aureus; Type 3 by vibrios; and Type 4 by fungi.)

Because so many different microbes can cause necrotizing fasciitis, this possibly suggests that the real cause is an underlying health (or genetic) problem, and that some bacteria are capable of taking advantage of the host if given the chance. (Incidentally, microbiologists call these opportunistic infections.)

Media reports often emphasize the danger of bacteria lurking in the environment. While there is certainly much truth to that, it could be that another danger lies within your genetic blueprints.