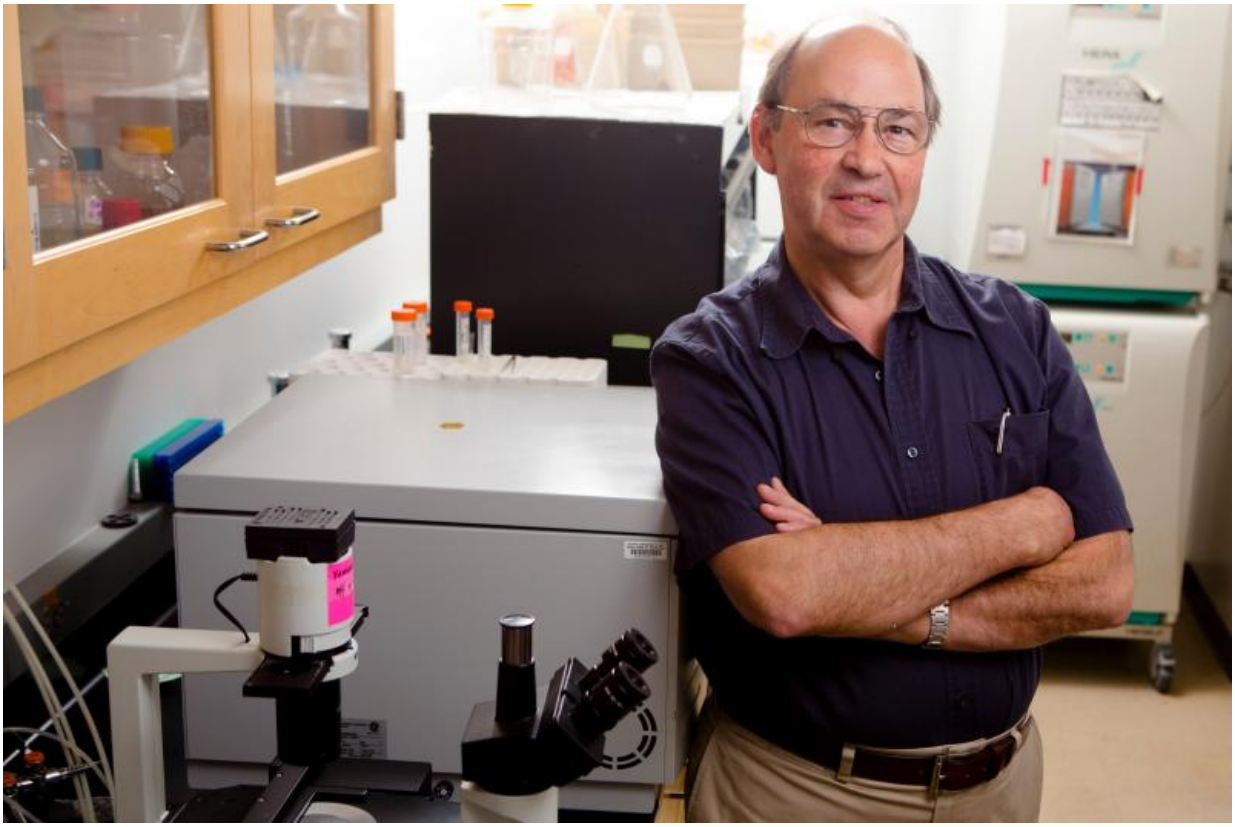
# To combat 'superbugs,' immunologist suggests scientists think like pathogens

April 28 2015, by Ellen Goldbaum



UB immunologist Michael Rusell, PhD, has developed an understanding of the intricate interactions between hosts and pathogens, based on his research on gonococcal infection.

With drug resistance on the rise and the emergence of increasingly

deadly viral pathogens, scientists must develop a better understanding of the human immune system and its adaptability in order to take full advantage of it, writes a University at Buffalo immunologist.

"It is…time to think of and exploit new ways of dealing with the age-old problem of infectious disease," writes Michael W. Russell, PhD, professor in the Department of Microbiology and Immunology in the University at Buffalo School of Medicine and Biomedical Sciences. His opinion piece was published today in the journal *mBio*.

Fewer drugs are effective against some viruses and eukaryotic pathogens due to resistance, he writes, "most notably in the case of malaria, where resistance to artemisinin appeared sooner than anticipated." That's why, he writes, science should no longer view microbial pathogenicity "as a simple linear process" between the pathogen, which attacks, and the host, which defends.

Instead, he says, complex and ingenious responses occur as the pathogen reacts to the host and the host to the pathogen. By better understanding the methods that pathogens use to constantly stay one step ahead of immune defenses, scientists can learn to "counter-manipulate" how pathogens subvert the immune response, thereby inducing effective immunity.

"Pathogens manipulate the host immune response to favor their own survival or exploit inherent weaknesses in the immune system," he explains. To get around the problem of resistance, he suggests directly targeting the immune system. "We can do this by tweaking it in some way to generate effective immune responses, avoiding the problem of antibiotic resistance, which threatens to render some infections untreatable, amid the emergence of so-called 'superbugs,'" he says.

Recent research has revealed that both pathogen and host have sensory

mechanisms that quickly detect the presence of the other so that, he writes, "…the outcome may be an emergent property of the interaction between host and pathogen, not easily predictable from separate consideration of their characteristics."

Russell's understanding of these intricate interactions comes from his research on the pathogen that causes gonorrhea, recently cited by the Centers for Disease Control as one of the top three pathogens requiring urgent action. The World Health Organization has warned of a pending gonorrhea crisis due to soaring drug resistance rates and estimates that over 100 million cases per year occur worldwide.

Russell and his colleagues developed the concept that gonococcal infection seems to inhibit specific adaptive immune responses, which is, in part, why people can become infected multiple times. "It turns out that gonococcal infection very cleverly controls the immune system, inducing responses the bacterium can fight and suppressing the responses that it cannot fight," he said.

In 2013, Russell published a paper describing a potential new treatment for gonorrhea that modifies the immune response to the infection. He based the idea on a cancer treatment a colleague had developed that helps stimulate an immune response against tumors that normally suppress immunity. The potential treatment not only reversed the suppression of the immune response that is caused by the infection, but also established "immune memory," providing protection against future reinfections in laboratory animals.

"This approach, of tweaking the immune system, should work well against infections of mucosal surfaces – the mouth, the gastrointestinal system, the respiratory system and the genital tract, which are where the great majority of infectious diseases first invade the body," he says.

He cautions that plenty of research needs to be done to demonstrate these advantages and that, of course, new and better antibiotics as well as conventional and novel types of vaccines must be vigorously pursued.

"But our immune system is extraordinarily capable and adaptable, and is amenable to exploitation to enhance protective immunity against a potentially unlimited variety of pathogens," he adds. "Because these novel types of interventions would rely on the ability of the adaptive immune system to mount a seemingly limitless array of defenses against pathogens, they should sidestep the problem of antibiotic resistance."

Provided by University at Buffalo

Citation: To combat 'superbugs,' immunologist suggests scientists think like pathogens (2015, April 28) retrieved 25 April 2024 from https://medicalxpress.com/news/2015-04-combat-superbugs-immunologist-scientists-pathogens.html