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Founders Week 2017

Researcher of the Year

ROBERT K. "BOB" ERNST, PHD

SCHOOL OF DENTISTRY
Professor and vice chair, Department of Microbial Pathogenesis

"Structure Matters — Making Bacterial Molecules Work for Us"

University of Maryland Baltimore

OCT. 17, 2017 | 4:30 P.M.
DAVIDGE HALL

"Structure Matters — Making Bacterial Molecules Work for Us"

The Faculty Research Lecture for Founders Week 2017 is given by Robert K. "Bob" Ernst, PhD, who aims to understand the molecular basis of bacterial structural recognition by the host. This knowledge is used to re-engineer bacterial surface structures to augment or inhibit the body's immune response. The innate immune system is the first line of defense protecting the host from infection. Pathogens are detected by pattern recognition receptors on host cells that recognize structures that are broadly shared by pathogens. These bacterial patterns represent a signature or "bar code" that informs the host on the level of danger of the invading organism and how to respond. The goal of the Ernst laboratory is to produce modified "bar codes" or structural mimetics of the bacterial surface molecule, lipopolysaccharide (LPS). These structures can be used to improve the efficiency of future vaccines or inhibit the harmful response of the body's immune system to sepsis, a lethal blood-borne microbial infection. Ultimately, this work will shed new light on the crucial structural components of LPS that contribute to receptor recognition. This knowledge will allow us to produce effective therapeutic molecules, leading to improvements in patient outcome and reduced financial burden on the health care system.

ROBERT K. "BOB" ERNST, PhD

School of Dentistry

Robert K. "Bob" Ernst is professor and vice chair of the School of Dentistry's Department of Microbial Pathogenesis. But more important he sees himself as part of the research team at the University of Maryland, Baltimore (UMB).

"Absolutely, this is the most collegial university that I've been associated with," says Ernst, who came to UMB in 2008. "The Department of Microbiology and Immunology in the School of Medicine and our department work together hand in glove. We are now branching out to do work with cancer researchers at UMB, MedImmune, and the National Cancer Institute, as they are also looking for novel mechanisms to attack cancer cells in the body."

Ernst and his colleagues are engineering rationally designed mimetics based on bacterial surface molecules that will inhibit the body's immune response to sepsis, a condition that causes a death every two minutes in the U.S.

Called "one of the leading researchers studying how modified bacterial strains circumvent normal host innate immune system responses," by School of Dentistry Dean Mark A. Reynolds, DDS, PhD, MA, Ernst admits sepsis can't be cured with a single treatment regimen, saying "there will always be infections." But his team, which has been supported by $3 million in NIH funding, is making significant progress. "We're now able to modify the host response in model systems with the goal of giving physicians a better chance to treat the lethal symptoms associated with sepsis organ damage."

In addition to his interprofessional research, Ernst has actively mentored and trained graduate students and postdoctoral fellows to apply new technologies in related areas of research. What does he see as The Next Big Thing, technologically speaking — for research?

"Single cell analysis, taking all the disparaging data and using it in a systems biology approach, personalized medicine, direct imaging of pathogens in infected samples," he says. "There are so many potential ideas."

Ernst and David Goodlett, PhD, a professor in the School of Pharmacy, used such ideas to form a startup diagnostic company called Pataigin in 2016. Ernst, who is on the editorial boards for *Frontiers in Cellular and Infection Microbiology* and *Infection and Immunity*, has high hopes for the company.

"We would like to be able to rapidly identify bacteria and fungi directly from biological samples [blood, urine, wound effluent] so that clinicians can make more informed decisions to reduce the use of inappropriate antibiotics, thereby helping the patient. If we can reduce the size and cost of the instrumentation, it would be ideal to have it in any clinical setting or make it mobile so it could be easily deployable in an outbreak or Third World setting."