

Investigating How Hospital-Acquired Bacteria Cause Severe Infections

Alan Hauser, MD, PhD, vice chair, Department of Microbiology-Immunology, and professor of Microbiology-Immunology and Medicine (Infectious Diseases)



The laboratory of [Alan Hauser, MD, PhD](#), investigates the pathogenesis of multidrug resistant bacteria. Hauser and his team's other interests include the use of genomic approaches for the identification of novel virulence determinants and the development of novel translational approaches to treat bacterial infections. Hauser's study exploring how pneumonia strains compete in the lung was published this past spring in *Infection and Immunity* (read more [here](#)).

Recently, Hauser also helped Chicagoland high school students test a novel concept they had invented: the PeelTowel, a citrus peel-based, anti-microbial paper towel. Their findings were published in the *Journal of Emerging Investigators*, a peer-reviewed journal that highlights science by middle and high school students (read more [here](#)).

Q&A

What are your research interests?

My main research interest is in the area of bacterial pathogenesis. My laboratory strives to better understand how hospital-acquired bacteria cause severe infections. Many of the most problematic bacterial infections, such as those caused by *Pseudomonas aeruginosa*, *Klebsiella pneumoniae* and *Acinetobacter baumannii*, occur after patients come into contact with healthcare institutions. Not only are these infections associated with high mortality rates, but the bacteria that cause them are becoming increasingly resistant to antibiotics, making optimal treatment difficult and sometimes impossible.

My group uses a variety of approaches, including molecular techniques, genomics, microscopy, cell culture and animal models to dissect the pathogenic mechanisms of these bacterial pathogens.

What is the ultimate goal of your research?

Our goal is to better understand the mechanisms used by hospital-acquired bacteria to cause disease so that new vulnerabilities in their pathogenesis can be uncovered and exploited. Bacteria, even within a species, are quite genetically heterogenous, and one of our aims is to perform comparative genomic studies on bacterial populations to determine why some bacteria within a species are so much more aggressive than others and how this impacts disease outcomes.

Our ultimate goal is to extend the personalized medicine approach to include not only the patient's genome but also that of the pathogen infecting him or her. A second aim is to understand at the molecular level the virulence toolkits used by these pathogens to overcome host defense barriers. A third aim is to use molecular techniques to better understand the transmission and epidemiology of these pathogens. For example, we have identified a multidrug-resistant strain of *P. aeruginosa* that has persisted in our hospital for at least 16 years. Even though most *P. aeruginosa* strains are relatively rare, this strain has been cultured from patients throughout the world. We suspect strains such as this one possess genes that confer the ability to be more easily transmitted from patient to patient or to better persist in the environment.

Using a variety of approaches, we are attempting to identify these genes and characterize their products. It is my hope that such knowledge will contribute to efforts to develop novel preventative and therapeutic strategies.

What types of collaborations are you engaged in across campus (and beyond)? Northwestern University is the home of many outstanding research groups with expertise relevant to bacterial pathogenesis, and collaborations have been a key to my success. My laboratory is part of the NIH-funded Successful Clinical Response in Pneumonia Therapy (SCRIPT) Systems Biology U19 grant to explore how the pathogen, the microbiome and the host together dictate outcomes in patients with ventilator-associated pneumonia. This multidisciplinary project includes [Richard Wunderink, MD](#) (the PI of the grant), [Benjamin Singer, MD, PhD](#), and Alexander Misharin, MD, PhD (all from the Division of [Pulmonary and Critical Care](#)); [Patrick Seed, MD, PhD \(Pediatrics\)](#); [Chao Qi, PhD \(Pathology\)](#); and many other talented investigators across both campuses.

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Research in the News

WTTW News, October 3

[Researchers Develop Blood Tests to Detect Diabetic Complications, Cancer](#) Wei Zhang, PhD, was quoted.

Crain's Chicago Business, October 17

[A Northwestern investigator aims to fight the opioid crisis with an implantable device](#) John Rogers, PhD, was quoted.

► This research was also featured in WTTW News.

Newsweek, October 22

[Possible Celiac Disease Nanotechnology Treatment Breakthrough Revealed](#) Stephen Miller, PhD, was quoted.

CNN, October 28

[What makes soda so addictive?](#) Marilyn Cornelis, PhD, was featured.

Associated Press, October 31

[Science Says: How daylight saving time affects health](#) Phyllis Zee, MD, PhD, was quoted.

► This research was also featured in The New York Times, U.S. News & World Report, Fox News, and others.

[More media coverage available online.](#)

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What aspects of your position do you particularly enjoy?

I feel fortunate to be able to teach and train the next generation of researchers and have dedicated a substantial portion of my time to this. In addition to mentoring graduate students and postdoctoral fellows in my laboratory, I supervise the research phase of the Infectious Disease Fellowship Program and am PI of their NIH T32 training grant. I also am PI of an NIH K24 award dedicated to training physician-scientists at the fellow and junior faculty level. My trainees return the favor by constantly reminding me that it is not only a privilege to be able to do biomedical research but that it can be fun, too.

How is your research funded?

The majority of my funding comes from the National Institutes of Health. The NIH-funded SCRIPT U19 award has allowed us to partner with a number of Northwestern investigators to apply systems biology approaches to ventilator-associated pneumonia. We have several ongoing projects relevant to *P. aeruginosa* infections in individuals with cystic fibrosis, supported by the Cystic Fibrosis Foundation. We have also received grants from the American Cancer Society, American Heart Association and Chicago Biomedical Consortium. Our foray into the field of *Klebsiella pneumoniae* infections was made possible by a generous seed grant from Feinberg.

Northwestern University NUCATS Clinical and Translational Sciences Institute



NUCATS Corner

NUCATS Increases NMH Clinical Research Unit Outpatient Capacity to Support Growing Research Portfolio

The NUCATS Center for Clinical Research (CRU) is pleased to announce the opening of its expanded adult Clinical Research Unit in the Northwestern Memorial Hospital (NMH) Galter Pavilion on the 15th floor. This additional outpatient capacity will continue the NMH CRU's long-held tradition of supporting excellence in clinical research by providing Northwestern investigators with experienced research nursing support and exemplary facilities and core lab capabilities.

The additional 6,300 square feet of outpatient research space will support NUCATS' commitment to accelerating leading-edge clinical and translational research discoveries and improving human health. The expansion includes an additional 15 exam rooms (including three rooms equipped with TVs for long infusions), three procedure rooms and touch-down workspace for coordinators. The space also includes an ADA bathroom, as well as hydraulic exam tables, to accommodate participants with mobility limitations. The NMH CRU Core Lab also received a significant expansion to provide new services, such as enzyme-linked immunosorbent assays (ELISAs), in addition to services already offered.

To learn more about NUCATS CRU, please visit our website: <https://www.nucats.northwestern.edu/resources/clinical-research-support/index.html>

To utilize the CRU's services, please submit your request here: <http://j.mp/1SZiiOe>

Who inspires you?

My inspiration comes from both ends of the professional spectrum. Among established scientists, my graduate school advisor, Pat Schlievert, taught me the value of hard work and passion. My postdoctoral mentor, Joanne Engel, showed me the value of asking important questions. I am also inspired on a daily basis by the enthusiasm of the junior investigators with whom I work. They remind me that, even when the glass is half empty, there is still plenty to drink.