GALLOGLY COLLEGE OF ENGINEERING
STEPHENSON SCHOOL OF BIOMEDICAL ENGINEERING
The UNIVERSITY *of* OKLAHOMA

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ENGINEERING CONTROL OF THE LOCAL ENVIRONMENT IN SURGERY: TRANSLATIONAL PLATFORMS IN INFECTION, FIBROSIS, AND IMAGING

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Gallogly Hall, Room 126

ABSTRACT

Surgical outcomes are often determined not only by operative technique, but by the degree to which the local biological environment can be controlled. Many common surgical problems—including intra-abdominal infection, burn wound contamination, and postoperative adhesions—arise within spatially complex, dynamic systems that are difficult to regulate using conventional approaches.

This talk will present three translational research platforms that reframe these challenges as problems of transport, distribution, and dose. First, photodynamic therapy (PDT) is explored as a strategy for broad-spectrum antimicrobial control in perforated appendicitis, where heterogeneous light delivery limits efficacy. Second, PDT is applied to burn wounds, an accessible and controllable system, demonstrating how uniform energy delivery enables predictable antimicrobial effects and clinical translation. Third, postoperative adhesions are examined as a failure of regulated healing, motivating the development of localized, sustained drug delivery systems to modulate fibrosis.

Across these examples, a unifying principle emerges: clinical failure often reflects a lack of control over the local environment, and engineering that control enables effective, predictable therapy. These platforms highlight opportunities for interdisciplinary collaboration across optics, biomaterials, and computational modeling.

BIO

Nicole A. Wilson, PhD, MD, FACS is an Associate Professor of Surgery and Biomedical Engineering at the University of Oklahoma Health Sciences Center and a pediatric surgeon at Oklahoma Children's Hospital. Her research focuses on applying engineering principles to surgical problems, including photodynamic therapy for infection, biomaterial-based approaches to prevent adhesions, and computational modeling of intestinal mechanics.