

DATE: Day 8 Month 5 Year 2026

SUMMARY of
FY2025 RESEARCH RESULTS REPORT
For International Collaborative Research with IPR, The University of Osaka

Research Title		In silico modelling of <i>S. aureus</i>' impact on human keratinocyte NF-κB homeostasis and the skin's innate immunity
Applicant	Name	Dr Ahmad A. Mannan
	Affiliation	Department of Bioengineering, Imperial College London, UK
	Present Title	Research Associate
Research Collaborator (Host PI)		Professor Mariko Okada
Summary Bacteria living on human skin play an important role – they prime our innate immunity to protect against the invasion of pathogens. However, in skin diseases such as eczema, the skin microbiome is unbalanced and our defense is weakened, allowing the invasion and skin damaging by pathogen <i>S. aureus</i> (SA). In eczema, SA can grow to large numbers and trigger skin inflammation by inducing a key signaling pathway in skin cells via receptors on the skin cell membrane. These signaling pathways of the inflammatory response are governed by a key global regulator known as NF-κB, making NF-κB a key therapy target of interest. However, therapies that inhibit NF-κB activity have shown recovery from skin inflammation, but sometimes have shown to exacerbate inflammation. Overall, we still have a poor systems-level understanding of how SA affects and is affected by NF-κB-mediated immune response. In this study, we aim to address this gap by developing a mathematical model of the dynamics of SA growth, its activation of NF-κB-regulated expression of antimicrobials, immune signaling molecules and skin barrier integrity (i.e., our innate immune response), based on literature knowledge. We have constructed a simplified schematic of the molecular-level interplay between SA and the innate immunity, based on a literature search. This schematic lays the foundation for developing a mathematical model that we envision will be used to predict the dynamic immune response for increasing loads of SA and its feedback to regulate SA growth, and ultimately to investigate therapy effects and its optimization for successful recovery.		

*Deadline: May 11, 2026

*Please submit it to E-mail: tanpakuken-kyoten@office.osaka-u.ac.jp.

*Please describe this summary within 1 sheet. Please DON'T add some sheets.

*This summary will be published on the web.