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PS accumulation was assessed, and the potential for resistance development was evaluated.
Results: The findings confirm that AMPs can enhance PS uptake into bacterial cells. Moreover, the Protoporphyrin IX–Pexiganan conjugate was the most effective in aPDI. Further evaluation demonstrated that this compound does not induce resistance development.
Conclusions: This study highlights the effectiveness of this approach. The synergy between Pexiganan and Protoporphyrin IX against P. aeruginosa was confirmed. Further research is needed to assess the efficacy of the tested compound against other bacterial strains.

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672 Poster

Illuminating Bacterial Defenses: Differential Proteomic Responses of Staphylococcus aureus to Sublethal aPDI with Rose Bengal and New Methylene Blue

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Significance: This study elucidates the sublethal effects of antimicrobial photodynamic inactivation (aPDI) on Staphylococcus aureus proteomes, uncovering adaptive stress responses. These findings enhance our understanding of bacterial resistance mechanisms and support the development of innovative non-antibiotic therapies.
Approach: S. aureus strains were subjected to sublethal aPDI using Rose Bengal (RB) or New Methylene Blue (NMB) with custom LED illumination. Protein lysates were prepared using FASP and STAGE-tip desalting, then analysed by SWATH-MS at 0, 1, and 2 hours post-treatment. Data were processed and annotated.
Results: Photodynamic treatment with RB and NMB modulated protein expression in three S. aureus strains. RB affected 99 proteins (28 common across strains), while NMB altered 57 (4 common). Thirty-four proteins were shared overall, with most changes involving ribosomal, translational, and biosynthetic functions.
Conclusions: The results reveal photosensitizer-specific responses. RB induced a more consistent proteomic profile compared to NMB, providing insights for optimizing photodynamic inactivation strategies.

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673 Poster

Investigating application of PDT for Mucormycosis: A Novel Adjunctive Treatment for Deep-Seated Fungal Infections

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Significance: Mucormycosis is a life-threatening, angio-invasive fungal infection with high morbidity and mortality. Standard treatments, including antifungal therapy and surgical debridement, often fail to achieve complete fungal eradication. This study explores photodynamic therapy (PDT) as a potential adjunctive treatment to enhance therapeutic outcomes.
Approach: We are evaluating the antifungal effects of three photosensitizers—methylene blue, curcumin, and indocyanine green—activated by a light source on ex vivo human skin samples inoculated with mucormycosis. These photosensitizers were selected for their distinct light absorption spectra and tissue penetration capabilities.
Results: Preliminary findings suggest PDT's effectiveness in reducing fungal burden. Ongoing data collection will validate these outcomes and provide a comparison of the efficacy of each photosensitizer.
Conclusion: This study underscores the potential of PDT as an adjunctive treatment for mucormycosis, laying the foundation as a complementary strategy in clinical practice.

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674 oral

Photodynamic Therapy as a Supportive Approach for Treating Bacterial Pneumonia – An In Vivo Study

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Respiratory infections, particularly pneumonia, cause around 3.5 million deaths annually. Bacterial pneumonia inflames the alveoli, leading to fluid accumulation and breathing difficulties. With rising antimicrobial resistance, Antimicrobial Photodynamic Therapy (aPDT) offers a promising alternative, though its effectiveness is hindered by lung surfactant (LS) trapping photosensitizers (PSs). This study explored nebulization for PS delivery, testing Methylene Blue (MB) and Indocyanine Green (ICG) with the polymer Gantrez AN-139. The most effective formulation was ICG (200 μM) with Gantrez AN-139 (4% w/v), showing spectral broadening and red-shift post-nebulization. Fluorescence emission decreased significantly, while size and scattering analyses indicated a high dispersion index. In vivo, a 120 J/cm^2 light dose reduced bacterial counts by 2.5 logs. While results are promising, challenges in administration and variability remain. Refining dosage precision and delivery methods is crucial to optimizing therapeutic efficacy.

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675 oral

A Novel Method to Characterize in vitro Interactions between Photosensitizers and Antimicrobials using a Modified Checkerboard Assay

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Antimicrobial photodynamic therapy (aPDT) combines a photosensitizer with light and molecular oxygen to generate reactive oxygen species that damage microbial cells. Using complimentary mechanisms of action, the sublethal cellular damages caused by aPDT have shown priming effects that enhance microbial sensitivity to standard antimicrobial chemotherapy, offering a potent and resistance-free approach. To determine the types of interaction between aPDT and antimicrobial compounds—whether synergistic, additive, indifferent, or antagonistic—we developed a modified checkerboard assay based on ASM and CLSI guidelines. First, a two-dimensional concentration gradient of the PS and the antimicrobial agent is prepared and irradiated in 96-well plates. Following an incubation period, optical density data obtained by a plate reader is used in a custom-made calculator that automatically determines the minimum inhibitory concentrations and fractional inhibitory concentration indexes. This approach provides basis for a standard method that objectively characterizes the type of interaction between aPDT and antimicrobial compounds.

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