



# Keeping Platelets Safe: The Potential Role of Antimicrobial Peptides

*This report is the first proof-of-concept describing the inactivation potential of synthetic antimicrobial peptides on six medically important bacteria known to greatly increase the risk associated with transfusion of platelet concentrates and other blood components*

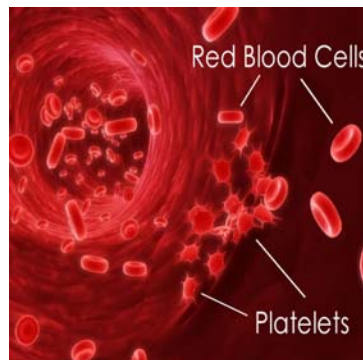
## ***Transfusion***

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### **Evaluation of antimicrobial peptides as novel bactericidal agents for room-temperature-stored platelets**

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## **The Need to Improve the Safety of Transfused Blood Products**

- Simple, safe and cost-effective pathogen inactivation method would help significantly to improve safety of donated plasma, platelets, and red blood cells used for transfusion
- Transfusion of room-temperature- stored platelets contaminated with infectious bacteria, such as *Staphylococcus aureus* and *Pseudomonas aeruginosa* can cause sepsis and other complications. Sepsis due to this threat is relatively rare but especially troublesome if bacteria are resistant to antibiotics

**There are a number of ways to inactivate bacteria and other microorganisms; for example, the addition of either psoralen or riboflavin to platelets followed by exposure to ultraviolet light. But such techniques are complex, are not always effective, and can damage blood components. Also, to date no such techniques have been licensed by FDA for platelets or component plasma. The results of this study are a promising proof-of-concept towards developing antimicrobial peptides (AMPs) as one of the alternatives to current pathogen inactivation techniques.**

## Antimicrobial Peptides (AMPs): The New Generation of Bactericidal Agents

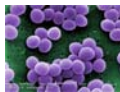
- Produced by a variety of cells in the human body including immune system cells called neutrophils and natural killer cells and platelets
- Diverse group of molecules that are usually less than 50 amino acids long
- Chemical structure that enables them to slip into the lipid bilayer surrounding bacteria to cause a variety of microbicidal effects, such as membrane disruption
- Can be chemically synthesized



Examples of human antimicrobial peptides (Wikimedia Commons)

**Based on these observations, the CBER scientists hypothesized that synthetic analogs of naturally occurring human thrombin-activated platelet derived antimicrobial peptides (AMP) that were already tested in therapeutic settings by others would be suitable candidates for reducing pathogens in platelet concentrates and other blood products.**

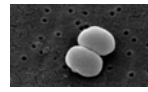
### **Novel Proof of Concept: Bactericidal Agents for Room-Temperature Stored Platelets**



*S. aureus*



*P. aeruginosa*



*S. epidermidis*



*K. pneumoniae*

### **Experimental Design and Results**

- CBER researchers investigated the bactericidal activities of nine synthetic AMPs: four derived from platelet-derived peptides (PD 1-4) and five repeat peptides composed of one to five Arg-Trp (RW) repeats (RW1-5).
- Investigators added AMPs to samples of plasma and room-temperature-stored platelet concentrates that were spiked with *Staphylococcus aureus*, *S. epidermidis*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, and *Bacillus cereus*
- Study identified RW3 as a particularly promising candidate for further study: bactericidal activity in both plasma alone and platelet concentrates, achieving a 3-log reduction of six medically important bacteria that commonly contaminate blood components and blood products: *Staphylococcus aureus*, *S. epidermidis*, *Escherichia coli*, *Pseudomonas aeruginosa*, and *Klebsiella pneumoniae*.
- Peptides PD4, RW2, RW3, and RW4 achieved about a 3-log reduction in specific bacteria in plasma alone: *S. epidermidis* and *P. aeruginosa* (PD4); *S. aureus* and *P. aeruginosa* (RW2); *S. aureus*, *S. epidermidis*, *E. coli*, *P. aeruginosa*, and *K. pneumoniae* (RW3); and *S. aureus* and *K. pneumoniae* (RW4)

**This CBER study suggests that screening of existing AMPs and identifying new AMPs for bactericidal activity might be a promising strategy for developing a simple alternative to current pathogen inactivation techniques designed to improve the safety of blood products.**