

TEM-PCR Technology in Microbial Challenges

Anti-Microbial Hydrogel Demonstrating Genomic Bactericidal Activity

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Introduction

According to the World Health Organization (WHO), hospital-acquired infections (HAIs) are the most frequently occurring adverse event in healthcare.¹ It's estimated at any given time, more than 1.4 million patients worldwide are suffering from an HAI.² HAIs increase the length of hospital stay (further increasing the risk of additional HAIs), cost the healthcare system billions of dollars, and increase patient mortality.³ Economics of healthcare, at the forefront of technology advances, requires time efficient management of diagnosis to align specific treatments. In infection, recognizing what you are treating and what potential resistance is present is critical.

References

- [1] Steward, S et al. (2021). Epidemiology of healthcare-associated infection reported from a hospital wide incidence study: considerations for infection prevention and control. The Journal of Hospital Infection. 114: 10-22.
- [2] Haque, M et al. (2020). Strategies to prevent healthcare-associated infections: a narrative overview. Risk Management Healthcare Policy. 13: 1765-1780.
- [3] Monegro, A, Muppidi, V, & Regunath. H. (2022). Hospital acquired infections. NIH StatPearls.

Methods

TEM-PCR technology is a proprietary, multiplex amplification platform developed to overcome the challenges that exist with conventional laboratory methods and real-time PCR applications. The TEM-PCR™ panel process consists of three major steps: *extraction*, *amplification*, and *detection*. The extraction step separates and purifies pathogen genetic material (template) from inhibitory substances. During the amplification stage, TEM-PCR™ or other multiplex PCR methods, enrich and amplify specific regions of the pathogen's genetic material. The presence or absence of the pathogen in the sample can then be determined during the detection stage using a microarray with broad context of current and evolving strains. (Figure 1)

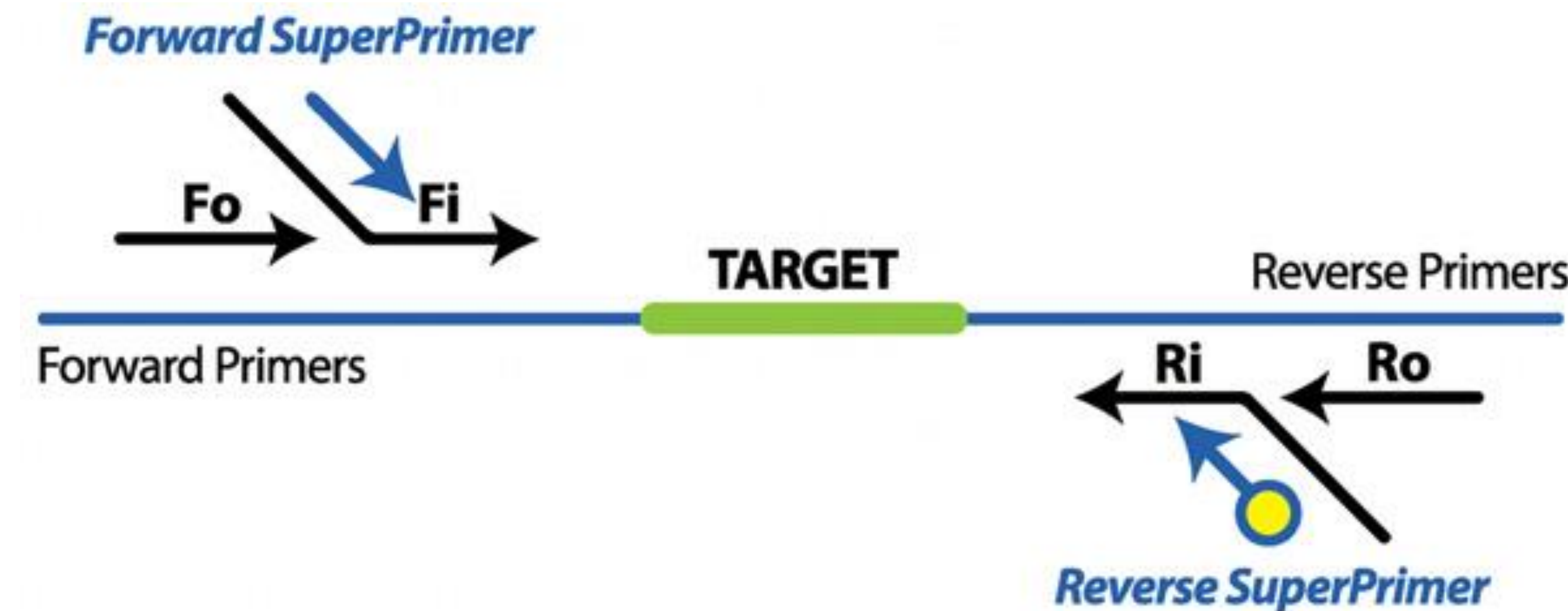


Figure 1 The core of TEM-PCR™ consists of test-specific primer mixes consists of short segments of synthetic DNA, and oligonucleotides complementary to regions in the pathogen's genetic material. These primer mixes and how they allow the enrichment of multiple targets. The use of target-specific nested primers (*shown above*) at low concentrations at the initial enrichment step allows high specificity of multiplexing amplification. After initial target enrichment is complete, SuperPrimers within the reaction carry out the exponential amplification and produce tagged PCR products for subsequent detection

Results

INFECTIOUS DISEASE PANEL		
	DETECTED	NOT DETECTED
Acinetobacter baumannii		X
Escherichia coli		X
Enterobacter aerogenes		X
Enterobacter cloacae		X
Enterococcus faecalis		X
Enterococcus faecium		X
Klebsiella pneumoniae		X
Proteus mirabilis		X
Pseudomonas aeruginosa		X
Serratia marcescens		X
Stenotrophomonas maltophilia		X
Streptococcus pyogenes		X
MRSA - Methicillin-resistant Staphylococcus aureus		X
Staphylococcus aureus		X
Panton-Valentine leukocidin (PVL) gene		X
Methicillin-resistant coagulase negative Staphylococcus		X
Coagulase negative Staphylococcus (CoNS)		X
Staphylococcus epidermidis		X
Antibiotic resistances:		X
Aminoglycoside resistance		X
Cephalosporin resistant (Staphylococcus)		X
Erythromycin/Clindamycin resistance		X
Methicillin resistance (Staphylococcus)		X
Tetracycline resistance		X
Vancomycin resistance Enterococcus		X

None of the microbial genome demonstrated viability, none of the resistance genes which can be passed on demonstrated any reactivity. In summary, overnight treatment of infected wound with known pathogens resistance to anti-bacterial treatment were rendered harmless. Floraseptic Hydrogel offered activity across a range of pathogens in a single exposure. (Figure 2).

Discussion

Technology advancement comes in many forms but fundamental criteria for adoption, utilization, and clinical confidence emerge from accurate data that can be quickly obtained. A combination of antimicrobial treatment coupled to genomic assessment provides for an advanced product accountable to emerging technology.