# PhageMatch: AI-Powered Precision Phage Therapy

## Introduction to PhageMatch

Antibiotic resistance claims 1.2 million lives annually (WHO, 2022), and traditional phage therapy, using viruses to target bacteria, is slow and costly, often requiring weeks and thousands of euros per patient. PhageMatch is like Google Maps for phage therapy, guiding clinicians to optimal phage "routes" to treat drug-resistant infections in hours. Our AI platform could save lives by making phage therapy faster and more affordable. With the Saarland Accelerator, our interdisciplinary team will validate our approach, build a prototype, and collaborate with Germany's phage therapy ecosystem to combat multidrug-resistant infections.

## Unique Selling Proposition

PhageMatch uses advanced AI to predict effective phage-bacteria matches, combining genomic, proteomic, and phenotypic data. Unlike lab-based methods reliant on manual testing, our platform uses models like Random Forests and neural networks to enhance prediction accuracy and scalability (Krusche et al., 2025). Literature confirms that receptor-binding protein (RBP) analysis enables reliable host range prediction, supporting the feasibility of our approach. By employing Self-Supervised Learning to learn from unlabeled data, PhageMatch overcomes limited experimental datasets, delivering rapid, reliable predictions for healthcare and agriculture(Krusche et al., 2025).

## Current Stage and Accelerator Goals

PhageMatch is developing a prototype pipeline that processes bacterial and phage data to recommend optimal phage cocktails. We have curated datasets from Phagen Biotechnology Lab, public databases, and are engineering features like host taxonomy, phage lifestyle, and protein embeddings using models like ProtT5. Our AI models aim to predict phage-host interactions with high precision.

During the Saarland Accelerator, we will:

1. Validate Predictions: Test our pipeline with real-world data to confirm accuracy.

2. Build an MVP: Develop a user-friendly interface for clinicians to input bacterial data and receive phage recommendations.

3. Leverage Workshops: Use business model and pitching workshops to refine our strategy and prepare a strong EXIST program application.

4. Forge Partnerships: Collaborate with University Hospital Frankfurt, supported by Dr. Silvia Würstle's letter of intent, for pilot testing to validate our healthcare use case. Dr. Würstle, an Advanced Clinician Scientist and head of a phage research group at the University Hospital Frankfurt.

## Market and Use Case

PhageMatch targets German hospitals treating multidrug-resistant infections, a €1.24 billion problem (Federal Ministry of Health, 2023). By automating phage selection, our platform reduces therapy time from weeks to hours, enabling affordable, personalized treatment. We will validate our healthcare use case through pilot studies at the University Hospital Frankfurt, supported by Dr. Silvia Würstle, to demonstrate real-world impact. Future collaborations with German phage therapy leaders, such as Fraunhofer ITEM and Leibniz Institute DSMZ, will expand agriculture applications, addressing bacterial infections in crops and livestock, and support biotech innovation.

## Team and Expertise

- Abdullah Hanif (Lead): Bioinformatician and ML Engineer.

- Dr. Oliver Köhn: Data & AI Specialist.

- Zahra Asgharzada: Microbiological Quality Control and Diagnostics Specialist.

This synergy bridges computational innovation with practical microbiology, positioning PhageMatch for success.

## Why Saarland Accelerator?

The Saarland Accelerator's workshops, coaching, and network will refine PhageMatch's business model and strengthen our application for the EXIST program. We will use pitching sessions to prepare for Demo Day, showcasing our vision to German phage therapy stakeholders, including Fraunhofer-based biotech groups. Our collaboration with University Hospital Frankfurt, backed by Dr. Würstle's expertise, will enhance our credibility and regional impact in Germany.

## Future Vision and Impact

PhageMatch aims to make phage therapy a cornerstone of German healthcare. Post-Accelerator, we plan to:

- Conduct clinical trials at University Hospital Frankfurt to advance phage treatment approach, improving outcomes for resistant infections.

- Expand our database with real-world genomic and clinical data to refine predictions.

- Partner with German phage therapy organizations to integrate PhageMatch into clinical practice.

By reducing costs and therapy time, PhageMatch will save lives and combat antibiotic resistance across Germany's healthcare and agricultural sectors.

## Call to Action

Join PhageMatch in revolutionizing phage therapy in Germany. We seek the Saarland Accelerator's support to validate our AI platform, build our MVP, and strengthen our EXIST program application. Contact us at `abha00004@stud.uni-saarland.de` to shape the future of precision medicine.

# References

- Krusche, J., et al. (2025). Characterization and host range prediction of Staphylococcus aureus phages through receptor-binding protein analysis. *Cell Reports*, 44, 115369.

- WHO. (2022). Global antimicrobial resistance and use surveillance system (GLASS) report.

- Federal Ministry of Health. (2023). Health economic analysis of antibiotic resistance in Germany.