Hydrogel for Wound Dressings

Interview with inventors of University of Siegen & Amsterdam University Medical Center

The effective treatment of chronic and infected wounds is a key challenge in healthcare. The market for wound care technologies is growing steadily, as both the aging population and the increase in chronic diseases such as diabetes are driving demand for innovative solutions. At the same time, great importance is attached to the development of safe and effective products that promote the healing process and minimize the risk of complications such as infections. Of particular interest are solutions that also prevent and combat infections caused by multi-resistant bacteria. Prof. Dr. Ulrich Jonas, University of Siegen, and Dr. Sebastian Zaat, Amsterdam University Medical Center, invented a therapeutic hydrogel specially developed for wound dressings.

As the central service provider for the innovation2business.nrw network, PROvendis supports the inventors with intellectual property rights issues and the commercialization of their invention.

In this interview, Prof. Ulrich Jonas and Dr. Sebastian Zaat explain how the hydrogel can benefit patients, physicians, and the healthcare system as a versatile and advanced solution for modern wound care.

What are the current challenges in treating chronic and infected wounds?

Dr. Zaat: Due to an increasing number of patients with predisposing factors like diabetes, obesity or sedentary lifestyle the numbers of patients with chronically infected wounds are rising. The current challenges in treating such impaired wounds include the increasing antibiotic resistance of bacterial pathogens as well as the growing antifungal resistance of fungal pathogens.

Prof. Jonas: One of the most significant challenges is biofilm formation: microorganisms such as bacteria and fungi can organize into complex, well-protected communities embedded in a self-produced matrix. These biofilms are highly resistant to antibiotics and evade the body’s immune defenses, resulting in persistent infections and chronic inflammation that severely hinder the healing process.

Accurately diagnosing wound infection also remains challenging as well as access to specialized wound care and the high cost of chronic wound care. Ultimately, these challenges have a profound impact on patient quality of life, causing pain, reduced mobility, prolonged treatment periods, and significant psychological and social strain.

Why is the development of new wound dressings important for healthcare?

Dr. Zaat: Chronic and infected wounds place a substantial burden on healthcare systems as well as on patients themselves. To meet the above challenges antimicrobial systems with activity against antimicrobial resistant microbial pathogens are desired. Antimicrobial peptides have a low risk of resistance development and therefore offer a potentially good solution.

Prof. Jonas: New wound dressings can thus move beyond simple protection and become active therapeutic tools for intelligent and cost-effective therapy.

How does your therapeutic hydrogel differ from conventional wound dressings?

Prof. Jonas: Our therapeutic hydrogel differs from conventional wound dressings by offering active, multifunctional properties rather than serving as a passive covering. The hydrogel acts both as a potent antimicrobial agent and as a diagnostic tool. A key distinguishing feature is that the hydrogel carries the antimicrobial peptide SAAP-148, which is known for its strong activity against a broad range of pathogens, including those found in chronic and infected wounds. By coupling this peptide – or another antimicrobial protein if desired – directly to the hydrogel matrix, a highly favorable specificity window is achieved. This means the material provides a high bactericidal capacity at the wound surface while avoiding cytotoxic effects on surrounding human cells.

Furthermore, the hydrogel is produced using a photocrosslinking strategy, which enables it to be stably integrated as a surface layer or coating on a wide variety of organic and polymeric materials.

How exactly is the antimicrobial effect achieved, especially against multi-resistant bacteria?

Prof. Jonas: The antimicrobial activity of the SAAP-148-functionalized hydrogel is based on a rapid contact-killing mechanism that targets the physical integrity of the bacterial cell membrane rather than biochemical pathways. Upon contact, the peptide disrupts the membrane, leading to swift bacterial death and lysis within minutes, leaving no time for adaptive responses.

This mode of action is highly effective against multidrug-resistant pathogens, including notoriously difficult-to-treat ESKAPE bacteria. Efficacy has been demonstrated against *Escherichia coli, Staphylococcus aureus, Pseudomonas aeruginosa, and Acinetobacter baumannii*. Because bacteria cannot easily alter the fundamental structure of their cell membranes, the development of resistance is considered highly unlikely.

What advantages does the combination of antimicrobial effect and infection detection offer in everyday clinical practice?

Dr. Zaat: The combination of antimicrobial activity and infection detection offers clear advantages in everyday clinical practice. If an infection were to develop despite the antimicrobial effect, it would be detected at an early stage, providing immediate information on the wound status.

This enables clinicians to make more informed decisions about wound management, such as determining the optimal timing for dressing changes. Unnecessary dressing removal can be avoided, and antibiotic treatment can be initiated only when truly indicated. As a result, resources are used more efficiently, costs and clinical time are reduced.

For which types of wounds is the hydrogel particularly suitable?

Prof. Jonas: The hydrogel is suitable for chronic infected wounds such as Diabetic Foot Ulcers (DFUs), postoperative wounds with an increased risk of infection or acute injuries that are difficult to heal, e. g. severe burns.

What are the possible fields of application *in human medicine in addition to wound care?*

Dr. Zaat: Beyond wound care, the antimicrobial hydrogel can be applied as a coating on medical devices to prevent device-associated infections, a leading cause of device failure. Polymer-based devices are particularly suitable, including various catheters, endotracheal tubes, and surgical meshes used in abdominal wall or pelvic floor surgery.

Looking further ahead, the hydrogel also holds potential as a platform for localized drug delivery and as a biocompatible scaffold for tissue engineering, supporting controlled therapy release and tissue regeneration.

When did you realize that you needed to protect your invention with intellectual property rights?

Prof. Jonas: Protecting the invention with intellectual property rights was a natural and early consideration, as it is an integral part of our mindset in translational medical research. From the outset, it was clear that robust IP protection is essential to bridge the gap between academic discovery and clinical application, enabling further development, investment, and ultimately patient benefit.

What support did you receive from PROvendis?

Prof. Jonas: PROvendis provided essential support, particularly in patent drafting, including the identification of key claims, screening of existing prior art, and

coordination with patent attorneys. In addition, PROvendis supported the initial search for industrial partners, helping to pave the way toward translation and application.

What are the next concrete steps in your project?

Dr. Zaat: The next concrete steps focus on translation and scale-up. This includes the search for licensing partners through PROvendis, identifying partners for animal testing, and engaging industrial partners capable of scaling up demonstrators and material production as well as engaging in the regulatory affairs for getting approval of medical devices.

What impact could your invention have in the long term?

Prof. Jonas: In the long term, the invention has the potential to significantly improve the prevention and treatment of chronic infected wounds and to reduce infections associated with medical devices across multiple clinical fields. By helping to combat antimicrobial resistance, it addresses a major global public health challenge while also contributing to the economic sustainability of wound care.

In addition, the diagnostic, color-changing detection feature opens pathways toward more personalized and remote medicine, enabling better monitoring of wound status. Beyond healthcare, the technology could be expanded to a broad range of medical and even industrial devices, further amplifying its impact.

Further Information

↗ https://www.uni-siegen.de/news/patentiertes-hydrogel-neuer-ansatz-fuer-eine-sichere-wundheilung