

**Project title:** Chicken Feather Keratin in 3 Flavors for Wound Healing

**Project leader:** Dr. Menno Knetsch

**Function:** Associate Professor: Dept. Biobased Materials, Maastricht University & Aachen Maastricht Institute for Biobased Materials, Maastricht University, Maastricht, The Netherlands.

**Collaborators:** Dr. Katie Saralidze, Prof. Stefan Jockenhövel: Aachen Maastricht Institute for Biobased Materials, Maastricht University, Maastricht, The Netherlands.

**Proposal (250 words):**

**Introduction:** Chronic wounds, like diabetic ulcers, are a major problem in medicine. They are associated with limb-loss (diabetic foot) and morbidity as well as high costs because of the need of constant care. Many different wound dressings have been developed, but none of them has shown satisfactory healing combined with ease of use.<sup>1,2</sup> In addition, wounds have to be monitored frequently, increasing health-care costs. The main problem of current wound dressings is that they are passive and don't automatically respond to wound status, like infection, increased exudate, inflammation or elevated temperature.

**Hypothesis and Objectives:** Main objective is development of a novel type wound dressing containing three different keratin materials: fibers, hydrogel, nanoparticles. The responsive wound dressing will improve wound healing by automatic regulated drug release.

**Setting and Methods:** Poultry/chicken feathers will be used as feedstock. Isolated keratin will be formed in 3 different materials: fibers, hydrogels, nanoparticles.<sup>3,4,5</sup> These three materials will be combined to make a novel type wound dressing. Fibers will be used to strengthen and contain the hydrogel, which will adsorb wound exudate and release bioactive compounds. Keratin nanoparticles will be incorporated in the hydrogel as drug carriers. Using organic chemistry and biochemistry, the hydrogel with nanoparticles will be designed to respond to changing wound status (pH, water content, temperature) and hereby regulate drug release to enhance wound healing.

**Impact:** A wound dressing containing sensing ability coupled to drug release would improve wound healing next to diminishing wound inspection frequency and reduce health care and burden for patients.

**Requirements candidate:** Highly motivated student with good English communication skills and proactive and resolute attitude.

**Keywords:** wound healing, wound dressing, hydrogel, fibers, nanoparticles, chemistry, protein, keratin, chicken feather, life science, health-care

**Top 5 selected, relevant publications:**

1. **MLW Knetsch** & LH Koole. New Strategies in the Development of Antimicrobial Coatings: The Example of Increasing Usage of Silver and Silver Nanoparticles (2011) *Polymers* **3(1)**, 340-366. (191 citations)
2. K Saralidze, CSJ van Hooy-Corstjens, LH Koole, **MLW Knetsch**. New acrylic microspheres for arterial embolization: Combining radiopacity for precise localization with immobilized thrombin to trigger local blood coagulation. (2007) *Biomaterials* **28(15)**, 2457-2464. (40 citations)
3. KN Stevens, S Croes, RS Boersma, EE Stobberingh, C van der Marel, FH van der Veen, **MLW Knetsch**, LH Koole. Hydrophilic surface coatings with embedded biocidal silver nanoparticles and sodium heparin for central venous catheters. (2011) *Biomaterials* **32(5)**, 1264-1269. (43 citations)
4. K Saralidze, LH Koole, **MLW Knetsch**. Polymeric microspheres for medical applications. (2010) *Materials* **3(6)**, 3537-3564. (35 citations).
5. Zhengwen Li & **MLW Knetsch**. Antibacterial strategies for wound dressings: preventing infection and stimulating healing (2017) *Current Pharmaceutical Design*, accepted for publication.