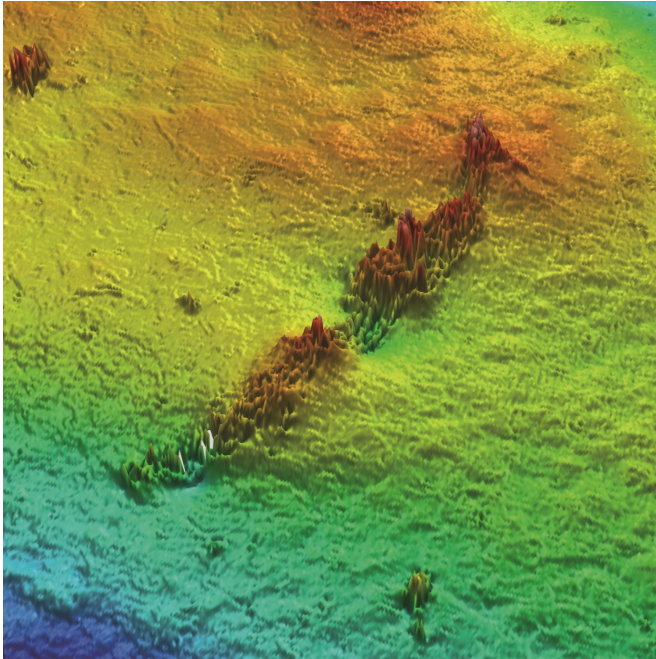


# Contact lenses: A molecule from pig stomach mucus prevents corneal damage

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Three-dimensional topographical image of a local tissue damage (stripe in the middle of the image) on a cornea sample after a friction experiment with an uncoated contact lens. Credit: Benjamin Winkeljann / Technical University of Munich

After a long day of working at the computer, scratchy contact lenses are not only painful, over longer periods of time they can also damage ocular tissue. Relief may be in sight from a natural mucus component referred to as a mucin. A team from the Technical University of Munich (TUM) has now succeeded in demonstrating that contact lenses coated with purified porcine gastric mucin do not cause damage to the eye anymore.

Mucins are molecules capable of binding lots of water, thus they can act as a natural lubricant. Our tears contain such mucins, which also occur in the mucous layer protecting the stomach and intestines. The tear fluid of patients suffering from

[dry eyes](#) usually does not contain enough of this molecular lubricant, the mucin MUC5AC.

Such a lack of MUC5AC can be problematic in particular for those of us who wear contact lenses: Without a protective lubricant film between the eye and the [contact lens](#), the tissue of the cornea can be injured. Thus, a group of scientists led by Prof. Oliver Lieleg, professor for Biomechanics and head of the "Biopolymers and Bio-Interfaces" lab at the Munich School of BioEngineering, had the idea to apply the missing mucin directly to the contact [lens](#).

## Mucin coating prevents tissue damage

For their experiments, the researchers needed large quantities of the molecule, which eliminated human tears as a possible source. Therefore, the team optimized a method for isolating the necessary mucin MUC5AC from the stomachs of pigs. The chemical structure of this pig mucin is very similar to the human molecule. The purification procedure has to be conducted carefully to ensure that the purified molecule retains its characteristic property as a lubricant and does not suffer from chemical changes during the purification process. "Most of the commercially available mucins, which are already used e.g. for the treatment of oral dryness, have lost exactly this ability; we were able to demonstrate this in a series of experiments. These commercial mucins are therefore not suitable for treating dry eyes," Lieleg explains.

In experiments with porcine eyes they tested how their lab-isolated mucins affected the performance of contact lenses. Oliver Lieleg's team was able to prove that the lenses caused no tissue damage when they were coated with mucins. "We showed that the mucin passively adsorbs to the contact lens material and forms a lubricating layer between the contact lens and the cornea," explains Benjamin Winkeljann, first author of the study. Thus, in the opinion of the scientists, it should be sufficient to soak the [contact lenses](#) overnight in a mucin

solution to obtain the protective effect.

### **Long-term protection without applying eye drops**

The mucin coating offers several advantages: Conventional products for treating dry eyes are primarily based on hyaluronic acid. However, in contrast to mucin, this molecule does not occur naturally in the tear fluid. Also, hyaluronic acid has to be applied to the eye in the form of drops, requiring repeated applications throughout the day. Mucin, on the other hand, adheres directly to the contact lens, thus providing the eye with long-term protection. Before it is ready for application in humans, the pig stomach mucin will undergo further testing in the lab.

**More information:** Benjamin Winkeljann et al, Mucin Coatings Prevent Tissue Damage at the Cornea-Contact Lens Interface, *Advanced Materials Interfaces* (2017). [DOI: 10.1002/admi.201700186](https://doi.org/10.1002/admi.201700186)

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