Gerald Auer
Public Relations and Event Management
Head of Organizational Unit

Medical University of Graz
Neue Stiftingtalstraße 6
8010 Graz
gerald.auer@medunigraz.at

Press release
For immediate publication

Iron oxide nanoparticles for targeted delivery of active substances
Substances enter the cell directly by "remote control"

Graz, 15 November 2023: Nanotechnology may be applied in a large number of ways for pharmaceutical development and targeted delivery of active substances. One interesting innovation is the use of iron oxide nanoparticles that have a special coating to bring substances safely and directly into specific cells. An international team of researchers with the prominent participation of the Medical University of Graz has recently published research findings that point out potential areas of application in the treatment of infections or cancer.

Active substances in a "protective suit" in the fight against bacteria

Antimicrobial peptides (AMPs) are natural substances that attack bacteria by destroying their cell membrane. They may be used to treat bacterial infections as they have the advantage over conventional antibiotics that they can reduce the development of antibiotic resistance. Sebastian Schwaminger from the Med Uni Graz Division of Medicinal Chemistry reveals why AMPs cannot be easily used: "Some AMPs can become dangerous not only for bacterial cells but also for human cells, which currently limits their applicability.

An international team of researchers from the Technical University of Munich, the University of Limerick (Ireland), Eindhoven University of Technology (the Netherlands) and the Medical University of Graz have taken up this challenge and published a potential solution that employs nanotechnology to enable the widespread use of AMPs. It primarily relies upon the AMP lasioglosin III (LL), which has an extremely antimicrobial effect.

Magnetic remote control brings the substance directly to the site of application

The iron oxide nanoparticles developed by the researchers have a supramolecular ureido-pyrimidinone coating that increases the antimicrobial activity of the peptide. The large molecules of the supramolecular coating interlock like pieces of wood in a parquet floor and stabilize each other. But that's not all, Sebastian Schwaminger explains: "The iron oxide in the nanoparticles we have described can be controlled using magnetism so that the drug is released exactly where it should be." This innovation is associated with a number of advantages for patients:

- Lower dosage of AMPs and reduced risk of side effects
- Targeted drug delivery at the site of infection or disease
- Improvement in safety thanks to the combination of nanoparticles and AMPs, which in turn reduces toxicity to human cells

Laboratory models to test potential applications

"Our research findings could revolutionize the way we treat disease in the foreseeable future," predicts Sebastian Schwaminger. It was possible to show that the particles work against cancer cells as well as microorganisms (bacteria). Before it can be implemented in therapy, the next step in the development of these innovative materials is laboratory model testing.

Contact
Sebastian Schwaminger
Medical University of Graz
Otto Loewi Research Center
Division of Medicinal Chemistry
Tel.: +43 316 385 72125
sebastian.schwaminger@medunigraz.at

Publication
Iron Oxide Nanoparticles with Supramolecular Ureido-Pyrimidinone Coating for Antimicrobial Peptide Delivery
https://www.mdpi.com/1422-0067/24/19/14649

Profile: Sebastian Schwaminger

In February 2022 Sebastian Schwaminger took charge of research on nanomaterials for the transport of biomolecules at the Division of Medicinal Chemistry of the Otto Loewi Research Center at the Medical University of Graz. After graduating from the Technical University of Munich with a degree in chemical engineering (2007-2013), he completed his doctorate on nanotechnology there in the bioseparation engineering group. During research stays in Lund (2011), Dublin (2018) and Ljubljana (2022), he gained experience with nanoparticle systems and their interactions with biomolecules and organisms. Funded by an EU Marie Skłodowska-Curie Fellowship, he led a research project on electric control of the binding behavior of biomolecules to nanoparticles at the Massachusetts Institute of Technology (2021). At the Otto Loewi Research Center, he conducts circulatory and vascular research on the synthesis and characterization of nanomaterials. His focus is on magnetic nanomaterials in medical and pharmaceutical applications. The goal is to use iron oxide-based nanomaterials in particular to enable magnetically controlled substance transport.