

# Drug delivery for the gastrointestinal tract – Novel carrier system through mucus layers

## Field of application

The human body has protective layers against pathogens such as e.g. mucosal layers in the stomach and the gastrointestinal tract, in the airway system and lungs, in the urogenital and female reproductive tract. While this is helpful against infections, the mucosal layer also presents an obstacle for the passage of pharmaceuticals. This leads to a strong need for a more efficient uptake of these drugs as most hydrophobic drugs are rapidly cleared from the delivery site at the mucus barrier.

Here we present an innovative and fully biocompatible delivery system that can, at the same time, transport a useful cargo and influence its environment to increase diffusion/transport.

## State of the art

There is no doubt that a lot of diseases could be treated more effectively if the penetration of pharmaceuticals through the human mucus layers could be improved. Therefore, a number of novel drug delivery technologies, based also on nanoparticles, have been developed. However, conventional nanoparticles still are likely to be eliminated or cannot penetrate without irreversibly damaging the mucus barrier.

## Innovation

In a project funded by Baden-Württemberg Stiftung gGmbH, scientists at the University of Stuttgart and the Max Planck Institute for Intelligent Systems have developed novel conjugate complexes that can be used for enhanced transport/diffusion performance through mucus. The complexes comprise a biological entity; a cargo moiety and an effector moiety that is capable of influencing a human protective layer e.g. mucus and also facilitate the movement of this carrier. The biological entity is a viral nanoparticle (VNP), virus like particle (VLP), bacteriophage or a proteinaceous assembly. In addition, further moieties providing functions such as sensing functions, catalytic activities, and tracking and/or marking functions can be included.

The conjugate complex (so called 'phagetool') is self-assembling, i.e. it forms spontaneously when all components are brought together in a suitable solution. The 'phagetool' diffuses and/or moves autonomously or can be moved in a directed manner by an external force e.g. an externally applied field.

## Your benefits at a glance

- ✓ Efficient carrier system that can be used for pharmaceuticals. It promises enhanced penetration through human protective layers like mucus linings, mucin, the vitreous humor of the eye, lymphatic system, brain (myelin)
- ✓ Carrier is self-assembling
- ✓ Carrier diffuses and/or moves autonomously or can be moved in a directed manner
- ✓ Additional functions like sensing functions, catalytic activities, and tracking functions possible
- ✓ Coupling of the cargo moiety, effector moiety and optional further moieties to the biological entity can be via covalent or non-covalent interactions
- ✓ Coupling strategies can include use of suitable linkers, e.g. bifunctional linkers, for covalent coupling, the use of peptide or protein tags, such as His-tag binding to nickel or cobalt chelate, or StrepTag binding to streptavidin, and the use of antibodies, antibody fragments, antibody mimetics aptamers or ionic coupling

## Technology transfer

Technologie-Lizenz-Büro GmbH is responsible for the exploitation of this technology and assists companies in obtaining licenses.

## Patent portfolio

EP and PCT patent applications are pending.

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