PRESS INFORMATION

Non-human papillomaviruses as gene shuttle

Nucleic acids such as DNA and RNA are being drawn upon more and more in modern medicine, with gene sequences, for instance, being applied in gene therapies and DNA vaccines. The latter of these offer multiple advantages compared with traditional vaccination methods as they are quick to manufacture, easy to adapt and are highly stable. Moreover, the coded antigens are produced by the body itself, meaning they are correctly modified and/or folded. Immunization using DNA vaccines activates both the cellular and the humoral immune defense, i.e. the production of antibodies by the B-lymphocytes, thus helping to provide effective protection against pathogens.

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The greatest challenge to the application of this technology lies in transferring the genetic material into human cells. There are various ways of doing this, yet many of them are not without their problems. Electroporation, for instance, is invasive, painful and requires special equipment. Other methods require similarly physical procedures, special equipment (pressure injection, gene gun) or contain chemicals that are partly poisonous (cationic liposomes, polyethylenimine, calcium nanoparticles).

Viral vectors have already proven to be powerful tools for gene transfer, not only in research but also in initial clinical applications. These include human papillomaviruses (HPVs), which have already been well researched. Their key properties include a high capacity to pack foreign DNA sequences and their stability. Good absorption via the mucous membranes also allows simple, injection-free and therefore non-invasive application.

What is problematic, however, is the fact that the human immune system builds up immunity against many subtypes of HPV as people often come into contact with HPV. A lot of people are also vaccinated against HPV, which involves several fragments or virus-like particles from different types of papilloma viruses being mixed into the vaccines. The inoculated organism subsequently builds up an immunity that is also

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directed against the viral vectors. A solution to this problem lies in non-human papillomaviruses, which humans do not usually come into contact with.

260 types of papillomavirus had been identified by 2013: 148 human and 112 non-human types.

Scientists from Fraunhofer IZI have now looked at ten non-human papillomaviruses with an eye to their ability to transfer DNA plasmids. In both cell culture and the animal model, two candidates have proven to be especially effective here. Both are viruses originally identified in macaques and pumas. They could prove suitable as vectors for gene therapeutics or as a vaccine platform and will now be investigated further.

Link to publication

The Fraunhofer Institute for Cell Therapy and Immunology IZI

The Fraunhofer Institute for Cell Therapy and Immunology IZI investigates and develops solutions to specific problems at the interfaces of medicine, life sciences and engineering. One of the institute's main tasks is to conduct contract research for companies, hospitals, diagnostic laboratories and research institutes operating in the field of biotechnology, pharmaceuticals and medical engineering. The Fraunhofer IZI develops, optimizes and validates methods, materials and products for the business units Cell and Gene Therapy, Drugs, Diagnostics and Biosystems Technology. Its areas of competence lie in cell biology, immunology, drug biochemistry, biomarker, bioanalytics and bioproduction as well as process development and automation. In these areas, research specifically focusses on the indications oncology, neuropathology, autoimmune and inflammatory diseases as well as infectious diseases and regenerative medicine.

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