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How mRNA vaccines protect us from the coronavirus

Vaccines mostly consist of dead or attenuated viruses or fragments of viruses (RNA). They all mimic an infection in the body and utilise the memory of the immune system, because anyone who has recovered from an infection with a virus is usually equipped to combat that virus. If the immune system encounters the same pathogen again, the matching antibodies are already present in the blood and can quickly be replicated.

Traditional vaccines developed back in the 19th century involve the injection into the body of attenuated or dead viruses that have been rendered harmless by heating or other techniques. This is how vaccinations against measles or polio still work today.

The COVID-19 vaccines from Pfizer-BioNTech and Moderna are mRNA vaccines. In this method, a tiny fragment of the blueprint of the novel coronavirus (SARS-CoV-2) is used to prompt the body to produce a defensive response. Messenger ribonucleic acids (mRNA) are molecules that carry the blueprints of the pathogen into human cells, where a surface protein – known as a spike protein in the case of SARS-CoV-2 – is constructed according to these blueprints. The immune system identifies this protein as a foreign agent and forms antibodies against it. Thus the immune response is activated.

The advantages of this method are the relatively simple manufacture of the vaccine and the fact that no additional adjuvants are needed. The body completely degrades the intact RNA from the lipid nanoparticles within hours and the spike proteins within a few days.

Highly sensitive detection methods may be able to detect RNA fragments in some vaccinated individuals as lipid nanoparticles break down in the body.

Do we now need to be worried about the fact that mRNA vaccines infiltrate and modify our genetic material? No, this is extremely unlikely because the mRNA does not reach the cell nucleus where the genetic material (DNA) is stored. The mRNA is simply the blueprint for producing a single virus protein. According to the latest scientific findings, the mRNA vaccine is treated by the cells as their own mRNA.

Basic research using the cell model in preclinical studies has been carried out since the end of the 1990s. The RNA principle is derived from tumour research since modern cancer drugs are likewise targeted on immune responses. So this principle has not just arrived on the scene over the last year: its development stretches back over twenty years.

How an mRNA vaccine works is explained [here](#) in a video.