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Editorial Note

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Nanomedicine in Covid

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A new extreme acute respiratory syndrome coronavirus 2 (nCoV or SARS-CoV-2) emerged in December 2019 and quickly developed into a global pandemic, which was announced on March 2020. Though treatment options are still limited, medical and science experts have been working together to develop effective therapies that will reduce the pandemic's severity. Viruses are naturally occurring nanoparticles that run at the same metric scale as other nanomaterials. For years, the nanomedicine community has worked hard to mimic virus behaviour by creating viral-like nanoparticles that can be used for targeted therapy and gene delivery. It's not shocking, then, that nanotechnology techniques have proven to be extremely useful in the current pandemic, with applications ranging from viral neutralisation and identification to vaccine production and treatment. Using nanotechnology platforms, a new class of DNA and RNA based vaccines delivers the genetic sequence of unique viral proteins to host cells. Traditional vaccines, on the other hand, elicit immune responses by injecting whole viruses into the body, such as attenuated live viruses, inactivated viruses, or engineered viruses. In clinical trials, both forms of vaccines are being tested against COVID19 mRNA based treatments have a number of benefits over other methods. Since mRNA is not infectious and cannot be inserted into the host genome, it is a better option than whole virus or DNA transmission. Unlike DNA, which must enter the nucleus to be decoded, mRNA is processed directly in the cytosol. Finally, mRNA has a short half-life which can be controlled by molecular design; it is immunogenic, which can be beneficial in vaccine development, but its immunogenicity can be modulated using molecular engineering techniques mRNA, on the other hand, requires a carrier to be transported *in vivo* without being degraded in the circulation and to enter the cytosol through the cellular plasma membrane. Lipid nanoparticles are the preferred delivery system for many mRNA-based therapeutics, including BNT162b2 and mRNA1273. When mRNA is complexed with positively charged lipids, it becomes more stable and resistant to RNase mediated degradation, forming self-assembled virus sized particles that can be delivered via various routes. When the lipid nanopSarticles are endocytosed, they facilitate endosomal escape and release their genetic cargo in the cytosol, where the mRNA is converted into antigenic proteins, causing the immune system to produce neutralising antibodies. Both BNT162b2 and mRNA 1273 deliver SARSCoV2 spike protein genetic variants that are more stable and immunogenic than the nat. One current disadvantage of these formulations is that they need low temperatures for long term storage, which poses logistical challenges for their potential distribution and administration, especially in developing countries. These vaccines are also a big step forward for molecular medicine and biotechnology. They also mark a significant step forward for nanomedicine, which has struggled to gain mainstream acceptance due to translation issues. They are a triumph for all scientists who have worked to improve nanoformulations for the packaging and distribution of genetic material. They exemplify some of the concepts behind drug delivery and the founding principles of nanomedicine, namely that biocompatible rationally engineered materials can protect drug cargos from degradation and offer control over their bio distribution, intracellular localization, and release due to their nanosize and physicochemical characteristics.

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