



Lipid Nanoparticles



RNA-based therapeutics have been under development for over 30 years however, the COVID-19 pandemic has rapidly accelerated their development, chiefly with mRNA-based vaccines against the SARS-Cov2 virus by Moderna and BioNTech/Pfizer. A key part of the technology are the lipid nanoparticles (LNPs) used to deliver RNA. Naked RNA cannot simply be injected as it is immunogenic, easily susceptible to enzymatic degradation, and is not taken up by cells. To overcome these problems, RNA is packaged up in LNPs that protect it from degradation while circulating, allow it to enter cells, then release the contents into the cytoplasm so the RNA can be used by ribosomes for protein synthesis.



ALC-0315 (Cat # N-2010)

ALC-0159 is a PEGylated lipid which has been used to form lipid nanoparticles for delivery of RNA. ALC-0159 is one of the components in the mRNA vaccines against SARS-CoV-2.



SM-102 (Cat # N-1102)

SM-102 is an ionizable amino lipid that can be used in combination with other lipids to form LNPs. SM-102 has been used in the development of mRNA-based vaccines.

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cKK-E12 (Cat # N-1012)

cKK-E12 has been used to deliver siRNA in mice, rats, and primates (ED50 = 0.002, 0.01, & 0.3 mg/kg respectively). It shows low toxicity and is selective for liver parenchymal cells over liver, heart, lung, and kidney endothelial cells.



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For most LNPs, four types of lipids are required for formation:

Ionizable Lipid: This is the key component of the LNP (35-50%) which binds and releases the RNA in the cell.

Examples: ALC-0315, cKK-E12, SM-102, and Dlin-MC3-DMA

PEGylated Lipid: Small amounts of a PEG derivatized lipid (0.5-3%) is incorporated to increase the circulatory half-life in the body.

Examples: ALC-0159, DSPE-mPEG, and DMG-mPEG

Cholesterol: Cholesterol is a structural "helper" lipid that makes up a significant part of the LNP (40-50%) and improves efficacy possibly by promoting membrane fusion and promoting endosomal escape.

Neutral phospholipids: Synthetic phospholipids (~10%) are also commonly used as structural "helper" lipids in LNP formulation to promote cell binding.

