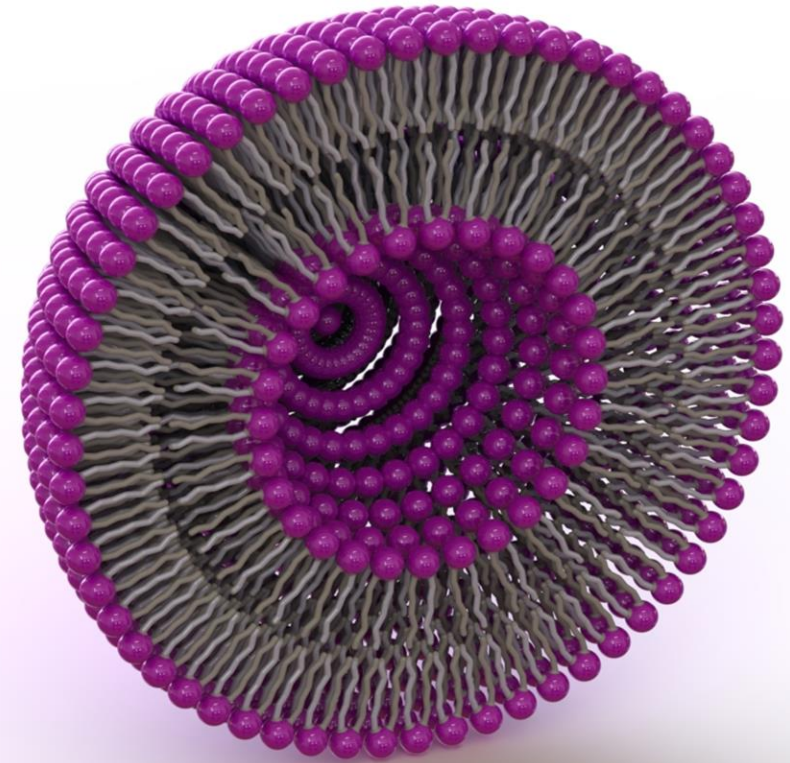


mRNA Lipid Nanoparticle Systems

Strong growth potential
in gene therapies

7 December 2020



Highlights

- ✓ **Evonik early recognized the potential of mRNA** and built up competencies in the last years
- ✓ Future growth potential in gene therapies **far beyond COVID-19 vaccines**
- ✓ **Evonik setup as integrated development partner** over the whole value chain
- ✓ **Potential to generate clear triple-digit million sales** over the next years

Setup Evonik Health Care

A Global Development Partner and Solutions Provider to Life Science Companies

Pharmaceutical

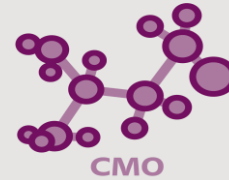
Parenteral Drug Delivery

- CDMO Lipid nanoparticles (LNPs)
- CDMO for polymeric microparticles
- RESOMER® bioresorbable polymers



Exclusive Synthesis

- Top 3 CMO for API & intermediates
- World's largest HPAPI capacity
- Portfolio of advanced technologies



Generic API & Intermediates

- Keto acids & controlled substances
- Chiral compounds, phosphonium salts
- Specialty intermediates, e. g. boronic acids



Oral Drug Delivery

- EUDRAGIT® functional polymers
- Formulation and scale-up services
- Oral drug delivery technologies



Pharmaceutical Amino Acids

- Amino acids, salts, derivatives
- Parenteral and enteric nutrition
- Amino acid API (LOLA)



Cell Culture Applications

- cQrex™ cell culture ingredients
- Oligopeptides, performance boosters
- Booster screening & development



Nutraceutical

Advanced food ingredients

- AvailOm® high-load omega-3 powder
- Healthberry® anthocyanin powders

Formulation Enhancement

- EUDRAGUARD® functional coatings
- Development & scale-up services



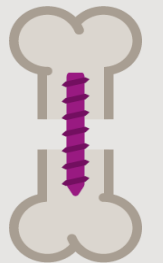
Medical Devices

Biomaterials

- RESOMER® bioresorbable polymers
- Endexo™ for surface modification

Application Services

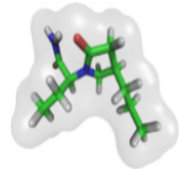
- Competence center, analytical labs
- 3D printing materials and services



mRNA technology with potential to revolutionize the pharma industry

Promising market potential as a gene therapy enabler

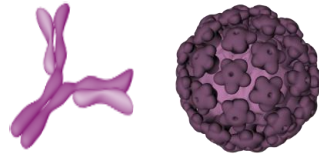
PAST – Chemical



Chemically synthesized small molecules

- Synthetic production utilizing complicated building blocks
- Testing millions of compounds necessary

PRESENT – Biological



Therapeutics like antibodies and vaccines biologically produced outside of the body

- Challenging development for each individual drug
- Production highly specified, cost and time intensive

FUTURE – mRNA



mRNA medicines provide the information for the human body to produce its own drug

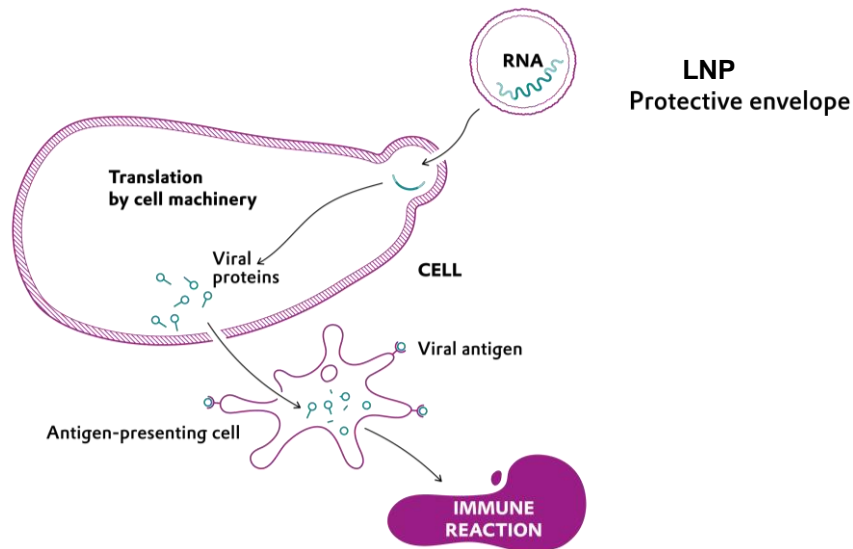
- Wide range of diseases that can be treated or prevented
- Technology platform with synergies – every product based on same principle
- Fast development process
- Future applications for personalized medicine

Next generation biologicals

mRNA potential as gene therapy enabler goes far beyond COVID-19 vaccine

Three disruptive application areas for gene therapies

mRNA – programming the body to heal itself



Lipid Nanoparticles: mRNA needs to be stabilized and delivered by LNPs into the target cell – LNP as most advanced mRNA delivery system today

Three disruptive areas of gene therapies

Vaccines

- ... for COVID-19, influenza, Zika, malaria, HIV among others
- “Cancer immunotherapy” expected to be second breakthrough of mRNA therapeutics

Gene editing

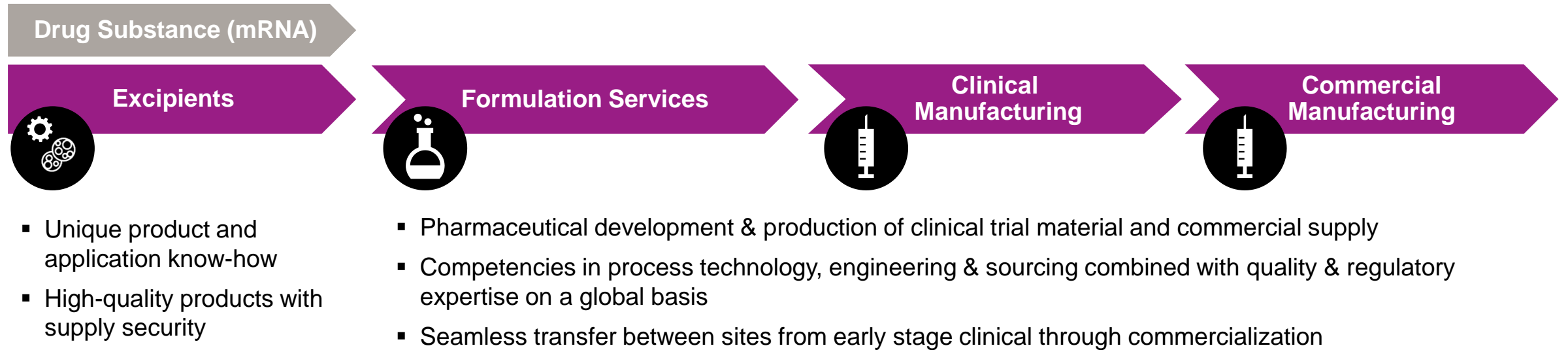
- mRNA systems can “edit” the genome of cells to correct error-causing diseases
- Commercialization could be available within five years

Protein replacement

- Protein replacement or production of therapeutic proteins
- mRNA-based therapies can potentially treat hereditary diseases such as cystic fibrosis

Evonik as reliable development partner over the whole value chain

Potential early recognized and competencies built up in the last years



Birmingham (USA) acquired in 2011

Evonik site for excipients, polymer-based drug delivery with clinical and commercial manufacturing for complex parenterals

Wilshire (USA) acquired 2020

Phytochol®, plant-based cholesterol for LNPs

Vancouver (CAN) acquired in 2016

Evonik site for LNP developments and clinical manufacturing

**Revenue generation along all steps of value chain
with total potential of clear triple digit million € over the next years**

Evonik with a unique setup as a fully integrated partner

Experience and capabilities enable to grasp full market potential



- Pioneer in the LNP field with a long-standing **reputation** and **experience**
- Evonik's **integrated approach** offers services along the **whole value chain** from early-stage developments through commercialization



- **Well-filled pipeline** with early-stage involvements in customer projects
- Until today, Evonik has been involved in **~100 LNP projects** across all three types of gene therapies



- **Multiple sources for revenue** streams from excipients, formulation services to manufacturing
- Strong focus on **high value projects** for complex parenteral products



- Evonik with expertise for fast and **flexible production processes** for „**personalized**“ medicines

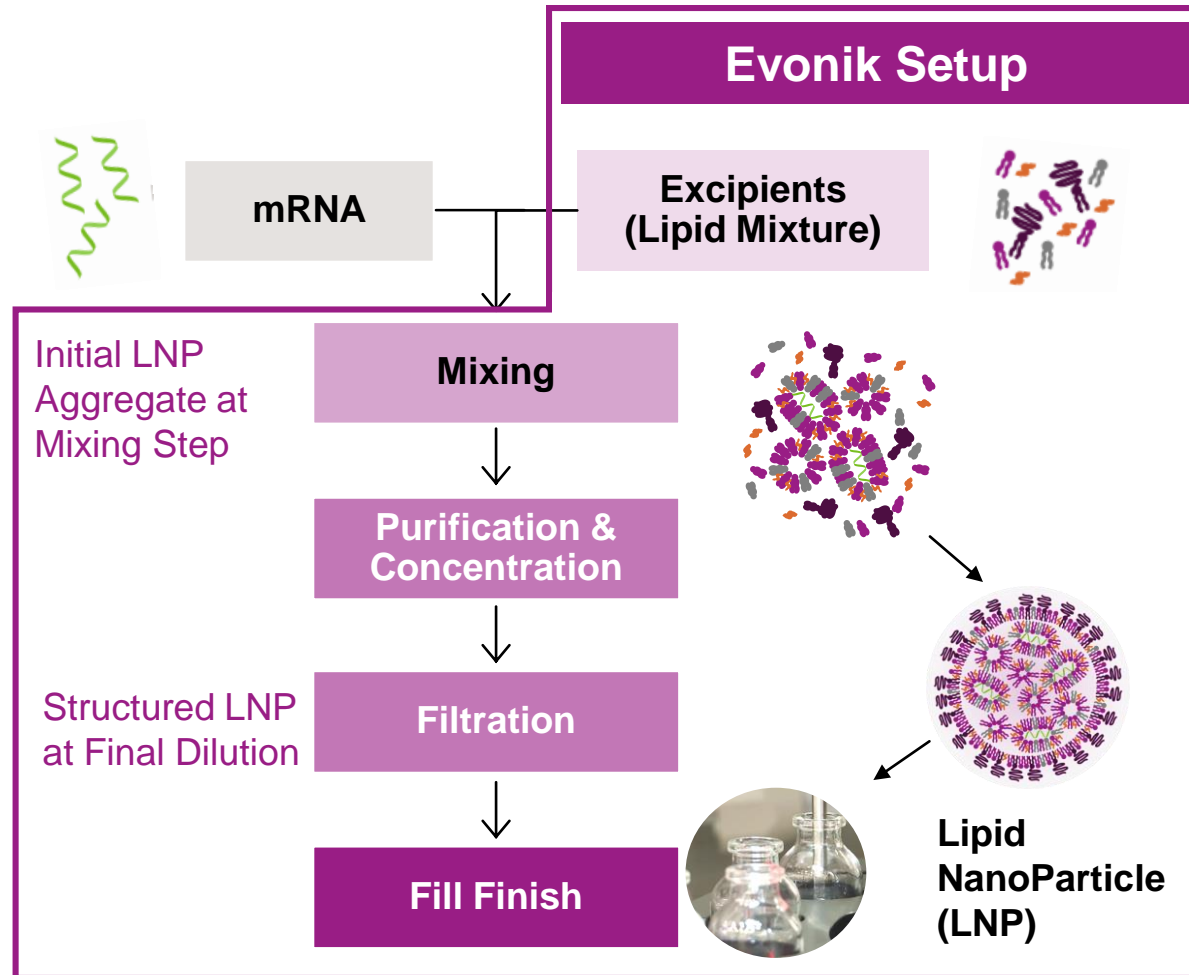


EVONIK

Leading Beyond Chemistry

mRNA therapeutics require LNP delivery technologies

Gold standard in drug delivery: Significant know-how and expertise required



Key Challenges of mRNA

- mRNA is intrinsically instable and is prone to degradation
- Naked mRNA cannot readily pass through cell membranes and thus cannot reach the therapeutic site of action in the cell

LNPs – The Solution for mRNA Delivery

- Lipid NanoParticles (LNP) protect mRNA from degradation in the bloodstream
- They enable both intracellular delivery of the mRNA and its release once transported into the cell