Life Science business

We will promote the development of biopharmaceuticals and nucleic acid drugs, and aim to become an indispensable company in the pharmaceutical and medical care industries.

Business strengths

- Widely used in pharmaceutical and medical care fields
- World's No.1 share of activated PEG for DDS
- Contributing to the development of biopharmaceuticals and nucleic acid drugs
- Possession of the highly biocompatible material LIPIDURE®
- Expansion of LIPIDURE® lineup
- Support for pharmaceutical and medical device manufacturers from research to commercialization

Operating Officer
General Manager,
Life Science Division

Yuji Yamamoto

The spread of COVID-19 infections has led to technological innovations in drug delivery systems (DDS) in the pharmaceutical market at an astonishing speed. One of these is nucleic acid drugs (mRNA drugs) using lipid nanoparticles (LNPs), a technology that has been established and penetrated the market at a rate that would ordinarily be unfathomable. This new market is said to be growing at an accelerated pace.

The 2025 Mid-term Management Plan states that NOF is collaborating with universities, research institutions, and contracted development and manufacturing organizations (CDMO) to develop and propose more functional materials for biopharmaceuticals such as protein drugs and peptide drugs, as well as for nucleic acid drugs (mRNA drugs) applications, which are attracting attention. In addition, we will provide courteous customer support utilizing our overseas sales bases, strengthen our quality management system by introducing the latest information management system, and expand our production system at the LS Aichi Works. Further, in the fivelds of eye care, diagnostic pharmaceuticals, and medical devices, where the biocompatible material LIPIDURE® (MPC polymer) has seen growth as a key material, we will leverage business integration for further business development, aiming to secure an indispensable presence in the global pharmaceutical and medical care industries.

Leveraging the synergies from business integration, NOF's Life Science business will continue to contribute to technological innovation in the global pharmaceutical and medical care industries with highly functional life science-related materials.

Main products and uses

- **PEG derivatives**
  (for various pharmaceuticals)
  SUNBRIGHT® Series, PUREBRIGHT® Series
- **Functional lipids**
  COATSOME® series
- **Surfactant for drugs**
  (for injection and vaccine preparations)
  Polysorbate 80 (HX2)™
- **Biocompatible materials**
  (for contact lenses, drugs and diagnostic pharmaceuticals, medical devices, etc.)
  LIPIDURE®

Contribute to social issues

Contributing to improvement of patients' quality of life

(improving access to pharmaceuticals)

DDS is a technology that enhances the effects of drugs by adjusting their physiological activity, targeting lesions, yielding chemical stability, adjusting metabolic activity, and other means, so that they act at the required place in the body in the required amount for the required time. This technology makes it possible to reduce the side effects of drugs and the frequency of daily injections, thereby contributing to improving the QOL of patients who need these drugs and improving access to pharmaceuticals.

Focusing on the development of diagnostic pharmaceutical agent technologies in the wake of the outbreak of infectious disease

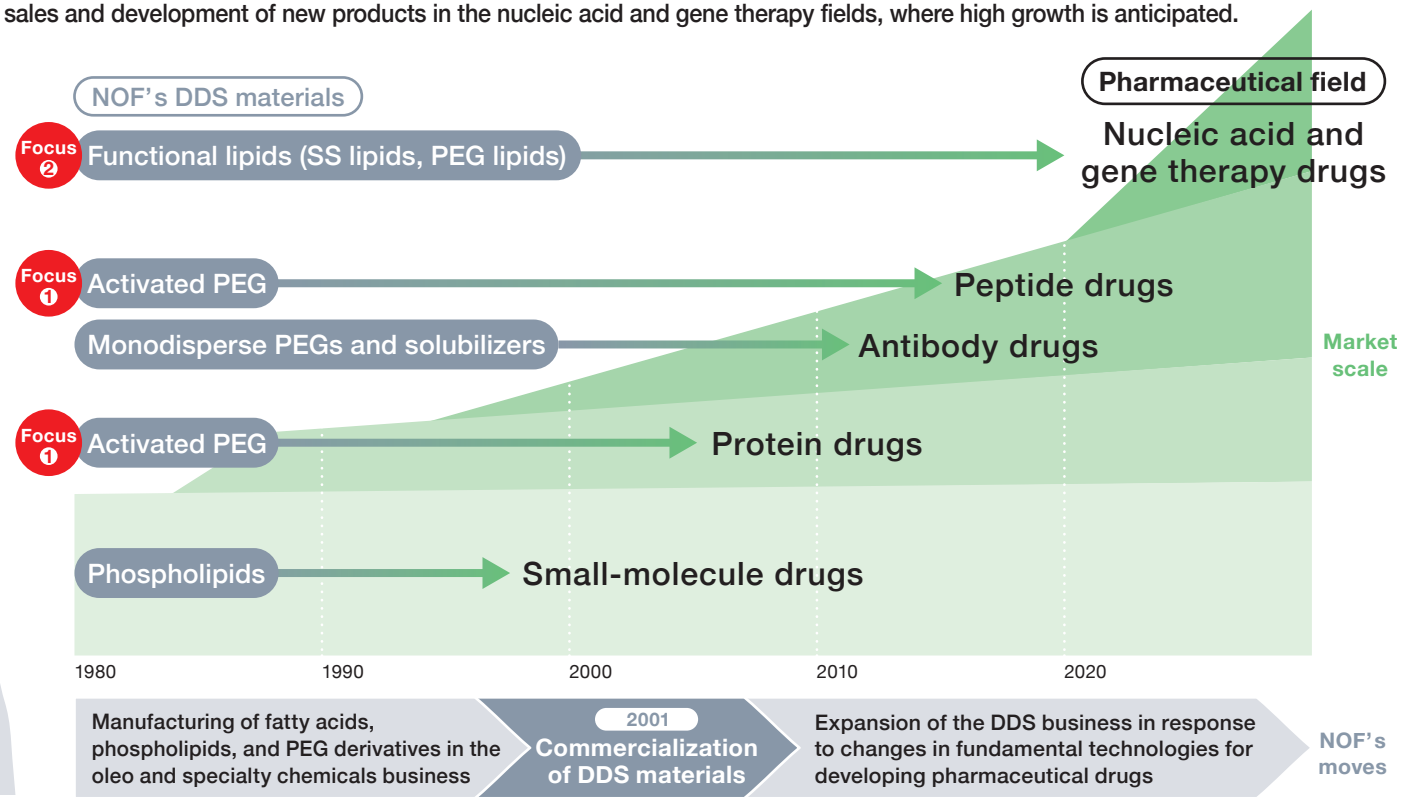
COVID-19 is raging around the world. PCR test kits and antigen test kits have been widely used as diagnostic pharmaceuticals. Going forward, as global warming progresses and new infectious diseases emerge, the demand for diagnostic pharmaceuticals is expected to increase. Therefore, NOF is promoting the development of technologies that contribute to improving the quality and performance of diagnostic pharmaceuticals. We make it possible to rapidly provide these to a wide range of people, thereby contributing to improved access and people's health and hygiene.

Expanding NOF's DDS materials in the biopharmaceutical field, where major growth is expected

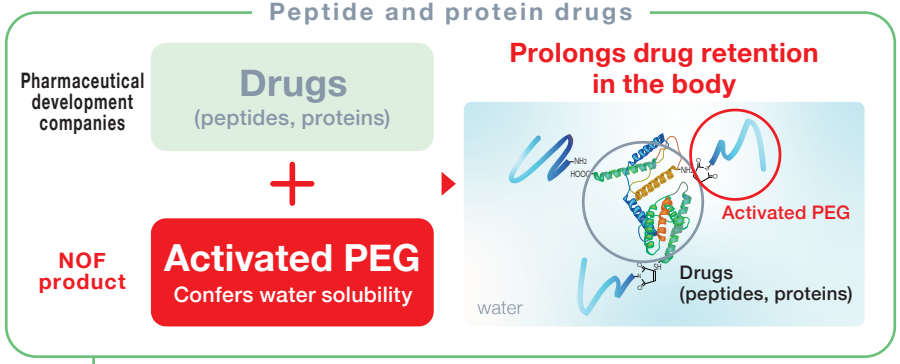
Harnessing the high purification and advanced molecular design technologies we developed in our business thus far, we launched our DDS materials business in 2001. Initially at the time of the business launch, we provided phospholipids for small-molecule drugs and activated PEG for protein drugs. Since then, we have expanded our business by developing new DDS materials in response to shifts in modality, such as antibody drugs, peptide drugs, and nucleic acid and gene therapy drugs. Between 2023 and 2028, the projected average annual growth rate of the market is 5% for small-molecule drugs, 9% for protein-based, peptide, and antibody drugs, and 42% for nucleic acid and gene therapy drugs. The NOF Group is focusing on the expansion of sales and development of new products in the nucleic acid and gene therapy fields, where high growth is anticipated.

What is a drug delivery system (DDS)

A DDS refers to a system designed to deliver drugs to the intended site in the body, at the appropriate timing, and in the necessary amount. These systems enable efficient drug transport to the affected area and enhance therapeutic effects while improving the retention of drugs in the body, thereby reducing the required number of doses. This reduces the burden on patients and improves quality of life.



Focus ❶ Activated PEG



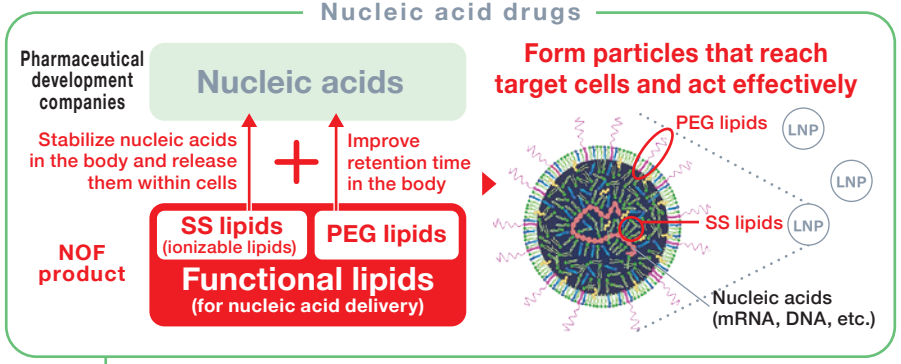
No. 1 share in the world

Activated PEG is hydrophilic and, when chemically conjugated with hydrophobic substances such as peptides or proteins, imparts high water solubility. In addition, peptide and protein drugs modified with activated PEG demonstrate improved retention in the body, enabling more efficient treatment. NOF holds the No. 1 global share in activated PEG, and increasing numbers of biopharmaceuticals have been made using our materials in recent years.

New plant construction and increased production capacity

We completed construction of our new activated PEG manufacturing facility at our Aichi Works, with operations scheduled to begin in fiscal 2025. With its large scale, the facility has about twice the production capacity of the existing DDS facility at our Kawasaki Works. In addition, this state-of-the-art manufacturing facility has three key characteristics: (1) GMP*1-compliant equipment that enables production at larger batch scales*2 than before, (2) Realization of a smart factory through the digital transformation (DX) of manufacturing and quality control, and (3) Contribution to carbon neutrality through the use of solar panels and energy-saving design features.

Focus ❷ Functional lipids (SS lipids, PEG lipids)



Development of proprietary lipids

For nucleic acid drugs and gene therapies to be effective, it is essential to safely deliver nucleic acids such as mRNA and DNA to specific organs. To achieve this, lipid nanoparticles (LNPs), which serve as capsules to transport nucleic acids, are used. The ionizable lipids and PEG lipids offered by NOF are vital components of LNPs and play a crucial role in efficiently delivering nucleic acids in the body. NOF has developed proprietary ionizable lipids called SS Lipids, which feature enhanced degradability within cells.

Start of collaboration with contracted drug development and manufacturing organizations

We have invested in Phosphorex, a contract development and manufacturing organization (CDMO) specialized in LNPs, and are further strengthening our business through this partnership. Until now, our role was mainly limited to supplying lipids. However, this partnership enables us to provide contracted development and manufacturing services for LNP formulations tailored to each customer's stage of development.

*1 Standards for the manufacturing and quality control of drugs, cosmetics, etc.

*2 The amount of material processed per cycle in a specific process stage

Functional Foods business

We will shift our focus from quantity to quality, promote R&D, and balance the sustainable development of the food industry with people's health.

Business strengths

- Functional food materials with a wide variety of functions
- Strong sales network for bread-making and confectionery production
- Developing new markets with healthcare food products

Operating Officer
General Manager,
Functional Foods Division
Hirofumi Kato

We will reform our profit structure through a strategic shift beyond the conventional food business, shift our focus from quantity to quality, and shift to the functional foods business.

In the processed edible oil business, we will focus on the development of functional food materials, promote R&D related to underutilized food resources, and contribute to sustainable food production and consumption. Furthermore, we will pursue functions to improve the physical properties of foods and address social issues such as greenhouse gas reduction and food loss to contribute to both the global environment and human health.

In the healthcare foods business, we will expand the domains of our proprietary materials for health foods and fats-coating technologies. With a mission to contribute to people's health, we will provide innovative products by making full use of the latest scientific knowledge and advanced technology. Furthermore, through public bidding invitations for industry-academia sponsored research, we aim to develop new processing technologies, create proprietary materials, and provide functions involved in biological regulation.

To achieve sustainable innovation, we will collaborate with external experts to respond to market changes and customer needs. The development of new processing technologies and the creation of innovative materials require a wide range of expertise and experience. Therefore, we actively promote the use of external human resources and collaborate with top-class experts to provide the highest level of quality and value.

We will support the development of high-quality products that consumers can use with peace of mind, contribute to the health of people around the world, and establish a sustainable business model by supporting the development of the food industry while also being considerate of the global environment.

Main products and uses

- **Edible oils, functional food materials**

  (for bread, confections, etc.)

  DELICIOUS RICH® Plus, LP-V™, NATULLE® CONC, CRUMB SOFT® SK, BREADY® SA, SUNSHORT®

  (for alternative foods made with plant materials, etc.)

  Delinul®, COOKRICH®

- **Healthcare food products**

  (for supplement, nutritional products, etc.)

  Komecosanol®, NICHIYU®PS50, NICHIYU®GPC85R

Delinul®, a processed soy protein food containing oil and fats

Contribute to social issues

Contribute to reducing the environmental impact of the food industry

In recent years, both reducing food waste and swapping meat with plant protein alternatives have been attracting a lot of attention. NOF provides functional materials for food that can maintain the softness and improve the texture and volume of breads and sweets, thereby contributing to reduction of food loss by preventing waste due to expiration. We are also working on the development of functional food materials that improve the taste and texture of plant proteins with the aim of promoting the use of plant proteins as an alternative to meat, which has a high environmental impact.

Contribute to the development of health foods through proprietary materials and technologies

(improved access to more nutritious foods)

The health food market continues to see further growth as people become more health conscious. On the other hand, many health food materials have distinctive flavors and physical properties, such as bitterness and stickiness, and this is an issue that needs to be resolved in product development by health food manufacturers. In addition to providing unique materials for health food, NOF is developing oil and fat coating technology to improve the flavor and physical properties of materials, thereby contributing to the further spread of health foods.