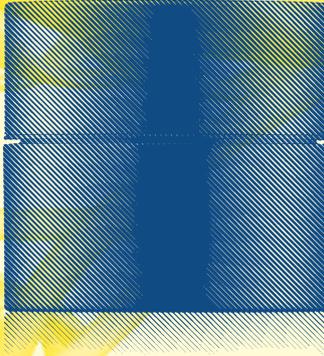


# PEPTIDES

## WHAT ARE PEPTIDES?

Peptides are chains of 2 to about 100 amino acids. Longer chains are called proteins and occur in all living organisms. Originally isolated from biological sources, nowadays peptides are synthesized chemically. The biological properties of peptides depend on the number of amino acids and their position in the chain. Just 20 natural amino acids are sufficient to produce an unimaginably large number of peptides, each with their own distinctive physical, chemical, and biological properties.



## COSMETICS

Peptides are used in high-quality cosmetic products, for example to counteract age-related wrinkles.

## CANCER THERAPIES

Peptides are used in oncology for imaging and cancer treatments.

## WHAT ARE PEPTIDES USED FOR?

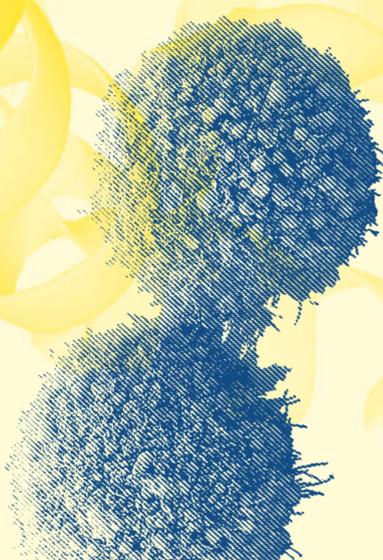
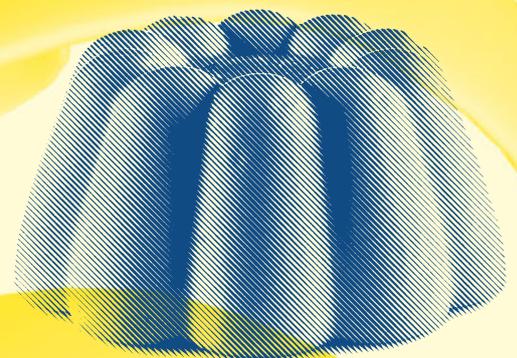
Peptides are mainly used as highly specific active pharmaceutical ingredients in medicines. In line with their diverse biological functions, they are used in a wide variety of applications. Cancer treatments, diabetes and obesity are three prominent pharmaceutical areas. Peptides are active substances that are much in demand for the treatment of cardiovascular and neurodegenerative diseases, renal failure, as antibiotics, in vaccines and in drugs for rare diseases.

## WHAT DOSAGE FORMS ARE AVAILABLE?

By providing the first oral dosage forms – for diabetes, for example – peptide applications have opened up new opportunities to maximize patient comfort in recent years. This has been possible thanks to targeted optimization of the peptide structure and of the formulation in the drug to prevent the active substances from undergoing the natural digestion process in the human body. In the past, peptide-based drugs had usually been administered by the parenteral route. In addition to conventional injections, depot formulations with durations of action ranging from a few days to several months and nasally administered drugs are increasingly being used.

## NUTRITION PRODUCTS

The sweetener aspartame is a dipeptide that is 200 times sweeter than table sugar.



# OLIGONUCLEOTIDES

A blue-toned illustration of a person's legs from the knees down to the feet, standing on a white surface. The background is a light blue with abstract geometric shapes.

## WHAT ARE OLIGONUCLEOTIDES?

Higher organisms store their genetic information in genes in the form of long deoxyribonucleic acid (DNA) chains. This information is translated into proteins using shorter ribonucleic acid (RNA) chains, for example mRNA. DNA and RNA are each made up of just four different components, which encode the information based on the number and sequence of the monomers. Short oligonucleotides are constructed from up to a 100 or so nucleotides and are manufactured on an industrial scale by chemical synthesis.

## TREATMENT OF GENE DEFECTS

Oligonucleotides can be used to treat Duchenne muscular dystrophy by skipping a defective sequence in precursor mRNA.

## HOW DO OLIGONUCLEOTIDES DIFFER FROM OTHER ACTIVE SUBSTANCES?

Antisense oligonucleotides and siRNA modify the genetic information read at RNA level before it is translated into proteins. Since they do not alter the genetic material, they do not count as gene therapies. Classical medicines and antibodies intervene only at the protein level. Since the siRNAs based on RNA interference can result in dosing intervals of six months, they have huge potential for the treatment of common disorders such as high cholesterol levels.

## GENETIC TESTS

Oligonucleotides can be used in genetic testing to clarify relationships and for diagnostic or forensic purposes.



## WHAT TYPES OF OLIGONUCLEOTIDES ARE USED AS TREATMENTS?

Single-stranded antisense oligonucleotides bind reversibly to mRNA, thereby inhibiting the translation into proteins. RNA interference forms the basis for the new active ingredient class known as siRNA. These double-stranded molecules utilize a natural mechanism to degrade mRNA, which likewise prevents protein synthesis. By contrast, mRNA can be administered so that a protein is specifically produced in the body itself. Longer mRNA sequences for use in vaccines are produced by molecular biological methods.

## METABOLIC DISORDERS

Oligonucleotides act against cardiovascular and metabolic disorders with elevated blood levels.

