

P E E R L E S S

R E S E A R C H P E P T I D E S

Peptide Research Guide

Plain answers to the first questions people ask about peptides, and a survey of 28 research compounds in 11 classes: what each is, what is being studied in laboratory and preclinical models, the key published papers, and how the material is stored.

EDITION 1 · REVIEWED OCTOBER 2, 2026

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Not for human or veterinary use.

[Contents](https://peerlesspeptides.com/research/guide)
peerlesspeptides.com/research/guide

About this guide

This guide has two parts. **Start here** answers, in plain English and with sources, the questions people most often ask about peptides. The **compound pages** that follow give a one-page survey of each of 28 research peptides, grouped into 11 structural and receptor classes. Each class opens on a navy page, and a numbered tab on the page edge marks the class throughout.

What the entries are

Survey-length summaries of the published literature: what each compound is, where it came from, and what has been examined in cell, animal and early clinical research. Evidence strength and single-laboratory concentration are stated where they matter.

What this guide does not contain

No instructions for preparing or using any compound, and no claim that any compound is safe or effective for any purpose. Summaries describe what studies examined; they are not statements about any product.

Where the full research lives

Every compound page links to that compound's research page at peerlesspeptides.com, which carries the full mechanism discussion, research applications and complete reference list.

Sources

Key papers are cited in full with PubMed or DOI identifiers (80 distinct papers in total). Start-here answers cite public sources such as the FDA and the NIH.

For laboratory research use only. The materials described in this guide are not approved for human or veterinary use. The statements in this guide have not been evaluated by the U.S. Food and Drug Administration. Edition 1, reviewed October 2, 2026.

Contents

About this guide	2	05 GROWTH HORMONE SECRETAGOGUES	21
Start here	4	11 Sermorelin	22
What are peptides?	4	12 Tesamorelin	23
Are peptides steroids?	4	13 CJC-1295	24
Research and evidence	5	14 Ipamorelin	25
Are peptides safe?	5	15 GHRP-2	26
Research use only and legality	5	06 GH-FRAGMENT AND IGF-1 ANALOGS	27
Telling real from fake	6	16 AOD-9604	28
Storage	6	17 IGF-1 LR3	29
01 PROTEIN-FRAGMENT PEPTIDES	7	07 KHAVINSON BIOREGULATORS	30
01 BPC-157	8	18 Epitalon	31
02 ARA-290	9	19 Pinealon	32
02 THYMOSINS AND HOST-DEFENSE PEPTIDES	10	08 RUSSIAN NEUROPEPTIDES	33
03 TB-500	11	20 Selank	34
04 Thymosin Alpha-1	12	21 Semax	35
05 LL-37	13	09 NEUROENDOCRINE PEPTIDES	36
03 TRIPEPTIDES	14	22 DSIP	37
06 GHK-Cu	15	23 Kisspeptin-10	38
07 KPV	16	24 Oxytocin	39
08 Glutathione	17	10 MELANOCORTIN-RECEPTOR PEPTIDES	40
04 MITOCHONDRIAL PEPTIDES	18	25 Melanotan-2	41
09 MOTS-c	19	26 PT-141	42
10 SS-31	20	11 INCRETIN AND AMYLIN RECEPTOR AGONISTS	43
		27 Cagrilintide	44
		28 Semaglutide	45
		Verifying a lot, and research use	46

Start here

Seven plain-English answers to the questions asked most often about research peptides, with sources. The compound classes follow.

QUESTION 1

What are peptides?

Peptides are short chains of amino acids joined by peptide bonds. The National Human Genome Research Institute describes a peptide as typically 2 to 50 amino acids long. Longer chains are called polypeptides, and proteins are built from one or more of them. The boundary is a naming convention rather than a sharp chemical line.

Length changes behavior. Most peptides are too short to fold into the stable three-dimensional shapes that proteins depend on, and many work as signals, binding a receptor on a cell and switching a pathway on or off. The body makes many peptides of its own, including peptide hormones such as insulin and oxytocin. The compounds in this guide range from three amino acids (KPV, pinealon) to 83 (IGF-1 LR3), which is long enough to count as a small protein.

SOURCES National Human Genome Research Institute, Talking Glossary: Peptide; McLaughlin MB, Jialal I. Biochemistry, Hormones. StatPearls, 2023

QUESTION 2

Are peptides steroids?

No. They are different kinds of molecules. Steroids are fat-soluble compounds built on a four-ring carbon skeleton that the body makes from cholesterol; the steroid hormones include cortisol, estrogen and testosterone. Peptides are chains of amino acids.

The confusion comes from hormones, because both classes include them. Peptide hormones, such as insulin, oxytocin and growth hormone, are assembled from amino acids and act on receptors on the outer surface of a cell. Steroid hormones pass through the cell membrane and act on receptors inside the cell. Several peptides in this guide are studied for how they act on hormone-releasing systems, such as the pituitary receptors that govern growth hormone release, but acting on a hormone system does not make a molecule a steroid.

SOURCES McLaughlin MB, Jialal I. Biochemistry, Hormones. StatPearls, 2023

QUESTION 3

What are researchers studying peptides for, and how strong is the evidence?

Peptide research spans receptor pharmacology, immune signaling, mitochondrial biology, tissue-injury models, neuroendocrine signaling and cell-culture methods. How much a finding means depends on where it was made.

Evidence usually builds in three stages: cells in a dish, then animals, then people, first in small safety studies and later in controlled trials. Each stage filters out results that do not carry over. In an analysis of more than 21,000 compounds, only about 14 percent of drug programs that entered human trials went on to approval. Most compounds in this guide sit at the cell and animal stages, with little or no controlled human data, and several rest largely on the work of a single laboratory. Each compound entry is tagged with the stages its evidence has reached.

SOURCES U.S. Food and Drug Administration. The Drug Development Process; Wong CH, Siah KW, Lo AW. Estimation of clinical trial success rates and related parameters. *Biostatistics*. 2019;20(2):273-286. PMID 29394327

QUESTION 4

Are peptides safe?

For most research peptides the honest answer is that no one knows, because their safety in people has not been tested. Most have never been through a human trial, and many of the rest have only small, early studies. That is why they are sold for laboratory research only and are not approved medicines.

Two related points are often missed. When a molecule is also the active ingredient of an FDA-approved drug, the approval covers that specific finished product, made and tested to its approved standard; it does not carry over to research-grade material. And product quality is a separate question: in its compounding reviews, the FDA flagged immunogenicity and peptide-related impurities as concerns for some peptides.

SOURCES U.S. Food and Drug Administration. Certain Bulk Drug Substances for Use in Compounding that May Present Significant Safety Risks; U.S. Food and Drug Administration. The Drug Development Process

QUESTION 5

What does research use only mean, and are peptides legal?

Research use only means a material is sold for laboratory research. It is not a drug, a dietary supplement or a cosmetic, and it is not for human or veterinary use. None of the research materials in this guide is FDA-approved. A label alone does not settle how a product is regulated: under 21 CFR 201.128, the FDA judges intended use from labeling, advertising and the circumstances of sale.

Separately, the FDA decides which substances pharmacies may compound. In September 2023 it placed a number of peptides in Category 2, substances that may present significant safety risks. In April 2026 it removed 12 of them from that category, and an FDA advisory committee reviewed seven in July 2026. Those steps concern pharmacy compounding, not research supply, and none of them is an approval. Rules also differ by state and country. This is not legal advice.

The July 2026 advisory committee review, in detail: peerlesspeptides.com/blog/fda-pcac-peptide-vote-july-2026
Research-use acknowledgement: peerlesspeptides.com/research-use-acknowledgement

SOURCES 21 CFR 201.128, Meaning of intended uses; U.S. Food and Drug Administration. Certain Bulk Drug Substances for Use in Compounding that May Present Significant Safety Risks

QUESTION 6

How to tell a real peptide from a fake

The only reliable check is analytical testing of the specific lot, documented in a certificate of analysis (COA). A useful COA names an independent laboratory, identifies the lot it covers, and reports more than one test: identity, which confirms the molecule is what the label says, usually by mass spectrometry; purity by HPLC, the share of the sample that is the target peptide; and contaminant screens such as endotoxin, sterility and heavy metals.

Warning signs include a COA with no lot number, one certificate reused across many batches, a purity figure with no identity test, and no way to confirm the document with the laboratory that issued it. Every Peerless vial carries a lot number and a QR code that opens the certificate for that lot, from an independent US laboratory.

Certificates of analysis by lot: peerlesspeptides.com/coa

QUESTION 7

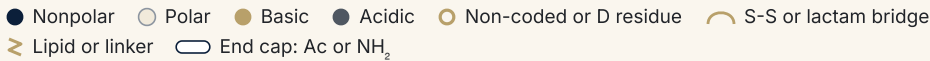
How are research peptides stored?

Most research peptides are supplied lyophilized, meaning freeze-dried to a dry powder, because peptides are far more stable dry than dissolved. Lyophilized material is typically stored at -20°C in a sealed container, protected from light and moisture; a desiccant helps keep it dry.

The main threats are water, heat, light and oxygen, which drive chemical degradation such as oxidation of methionine, cysteine and tryptophan residues and deamidation of asparagine. Kept that way, most compounds in this guide list a lyophilized shelf life of 18 to 36 months, and each entry gives its own storage conditions. Every Peerless vial label also carries a lot number and an expiration date.

SOURCES Manning MC, Chou DK, Murphy BM, Payne RW, Katayama DS. Stability of protein pharmaceuticals: an update. *Pharm Res.* 2010;27(4):544-575. PMID 20143256

HOW TO READ A COMPOUND PAGE

CLASS TAB	The numbered tab on the page edge marks the class; each class opens on a navy page listing its compounds.
EVIDENCE TAGS	Where the findings described come from: In vitro (cells or molecules in the lab), Animal model, or Human study.
SEQUENCE GRAPHIC	One bead per amino acid in chain order, coloured by residue class, with modifications drawn on the chain. 
WHAT IT IS	Identity, structure and origin of the compound.
WHAT IS BEING STUDIED	The research so far, and how strong and how independent that evidence is.
KEY PAPERS	Two or three characterization or mechanism papers, cited in full.
STORAGE	Conditions for the lyophilized material and its shelf life.

CLASS 01 OF 11 · 2 COMPOUNDS

Protein-fragment peptides

Synthetic peptides that correspond to a short segment of a larger parent protein, studied for the activity the fragment retains on its own.

01	BPC-157	8
02	ARA-290	9

SEQUENCE GRAPHIC KEY

○ Nonpolar ● Polar ● Basic ● Acidic ● Non-coded or D residue ⤵ S-S or lactam bridge
➤ Lipid or linker — End cap: Ac or NH₂

01 / 28

BPC-157

Body Protection Compound 157, synthetic pentadecapeptide

EVIDENCE

In vitro

Animal model



CAS NUMBER

137525-51-0

FORMULA

C62H98N16O22

MOLECULAR WEIGHT

1419.54 g/mol

WHAT IT IS

BPC-157 is a synthetic 15-residue peptide first described by a University of Zagreb group in the early 1990s as a fragment of a putative gastric protein. That parent protein has never been sequenced, and no specific high-affinity receptor for the peptide has been identified.

WHAT IS BEING STUDIED

Most published work uses rat models of gastric mucosal injury, tendon transection and skin wounds, with nitric oxide signaling and the VEGFR2 angiogenesis pathway as the leading mechanism proposals. About 87 percent of the roughly 200 indexed papers come from the originating laboratory. The only independent pharmacokinetic study reported plasma half-lives measured in minutes in rats and dogs.

KEY PAPERS

- [1] Sikirić P, Seiwert S, Rucman R, et al. Stable gastric pentadecapeptide BPC 157-NO-system relation. *Curr Pharm Des.* 2014;20(7):1126-1135. [PMID 23755725](#)
- [2] Xu T, Zhang Z, et al. Pharmacokinetics, bioavailability, and tissue distribution of body protection compound 157 (BPC 157) in rats and beagle dogs. *Front Pharmacol.* 2022;13:1052033. [PMID 36588717](#)
- [3] Józwiak K, et al. Angiogenesis and nitric oxide targeting mechanisms of BPC 157: a non-Zagreb synthesis review. *Pharmaceuticals.* 2025;18(2):185. [PMID 40005999](#)

STORAGE

Lyophilized -20°C, dry, dark, 24-36 months
Shelf life 24-36 months lyophilized

[FULL RESEARCH](#)
peerlesspeptides.com/peptides/bpc-157

02 / 28



01

ARA-290

Cibinetide, an 11-amino-acid pyroglutamate helix B surface peptide (pHBSP) derived from erythropoietin

EVIDENCE

Animal model

Human study

CAS NUMBER

1208243-50-8

FORMULA

C₅₁H₈₄N₁₆O₂₁

MOLECULAR WEIGHT

1257.3 g/mol

WHAT IT IS

ARA-290 (cibinetide) is an 11-residue peptide matching the outer face of helix B of erythropoietin, stabilized with an N-terminal pyroglutamate. It was engineered so that it does not engage the erythropoietin receptor homodimer that drives red blood cell production.

WHAT IS BEING STUDIED

Research centers on a proposed innate repair receptor, described as a complex of the erythropoietin receptor and the beta-common receptor (CD131). In rodent nerve-injury models, the reported changes in pain-behavior readouts were absent in beta-common receptor knockout mice. Most mechanism and clinical work comes from the developer and its collaborators. One independent study questioned the proposed receptor pairing, and no trial has advanced beyond Phase 2.

KEY PAPERS

- [1] Brines M, Patel NS, Villa P, et al. Nonerythropoietic, tissue-protective peptides derived from the tertiary structure of erythropoietin. *Proc Natl Acad Sci U S A*. 2008;105(31):10925-10930. doi:10.1073/pnas.0805594105 PMID 18676614
- [2] Brines M, Cerami A. The receptor that tames the innate immune response. *Mol Med*. 2012;18(1):486-496. doi:10.2119/molmed.2011.00414 PMID 22183892
- [3] Cheung Tung Shing KS, Broughton SE, Nero TL, et al. EPO does not promote interaction between the erythropoietin and beta-common receptors. *Sci Rep*. 2018;8(1):12457. doi:10.1038/s41598-018-29865-x PMID 30127368

STORAGE

Lyophilized -20°C, dry, dark, 24-36 months

Shelf life 24-36 months lyophilized

FULL RESEARCH

peerlesspeptides.com/peptides/ara-290

Thymosins and host-defense peptides

Peptides derived from the thymosin proteins and from the human cathelicidin, studied in cytoskeletal, immune-signaling and antimicrobial research.

03	TB-500	11
04	Thymosin Alpha-1	12
05	LL-37	13

SEQUENCE GRAPHIC KEY

○ Nonpolar ● Polar ● Basic ● Acidic ● Non-coded or D residue ⤵ S-S or lactam bridge
➤ Lipid or linker — End cap: Ac or NH₂

03 / 28



TB-500

Synthetic heptapeptide Ac-LKKTETQ, residues 17-23 of thymosin beta-4

EVIDENCE

In vitro

Animal model

CAS NUMBER

885340-08-9

FORMULA

C38H68N10O14

MOLECULAR WEIGHT

889.02 g/mol

WHAT IT IS

TB-500 is the synthetic acetylated heptapeptide Ac-LKKTETQ, residues 17 to 23 of thymosin beta-4, the region that carries the protein's actin-binding motif. Full-length thymosin beta-4, more than five times the mass, is the molecule used in sponsored clinical programs.

WHAT IS BEING STUDIED

The best-characterized biology is actin sequestration: thymosin beta-4 binds monomeric G-actin through the LKKTET motif, a contact confirmed by X-ray crystallography. Work on the seven-residue fragment itself is concentrated in endothelial migration and aortic-ring sprouting assays and a small number of rodent dermal-wound studies. Whether the fragment reproduces other reported activities of the full protein has not been tested in head-to-head studies.

KEY PAPERS

- [1] Safer D, Elzinga M, Nachmias VT. Thymosin β 4 and Fx, an actin-sequestering peptide, are indistinguishable. J Biol Chem. 1991;266(7):4029-4032. [PMID 1996337](#)
- [2] Irobi E, Aguda AH, Larsson M, et al. Structural basis of actin sequestration by thymosin- β 4: implications for WH2 proteins. EMBO J. 2004;23(18):3599-3608. [PMID 15329672](#)
- [3] Sosne G, Qiu P, Goldstein AL, Wheeler M. Biological activities of thymosin β 4 defined by active sites in short peptide sequences. FASEB J. 2010;24(7):2144-2151. [PMID 20179146](#)

STORAGE

Lyophilized -20°C, dry, dark
Shelf life 24 months lyophilized

FULL RESEARCH

peerlesspeptides.com/peptides/tb-500

04 / 28

Thymosin Alpha-I



28-amino-acid N-acetylated synthetic peptide derived from prothymosin alpha (UniProt P06454)

EVIDENCE

In vitro

Animal model

CAS NUMBER

62304-98-7

FORMULA

C₁₂₉H₂₁₅N₃₃O₅₅

MOLECULAR WEIGHT

3108.32 g/mol

WHAT IT IS

Thymosin alpha-1 is a 28-residue N-acetylated peptide corresponding to residues 2 to 29 of prothymosin alpha, a nuclear protein encoded by the PTMA gene. It was first isolated and sequenced from thymic tissue in 1977.

WHAT IS BEING STUDIED

Mechanism research has focused on dendritic cells. Work from the University of Perugia characterized the peptide as an agonist of Toll-like receptors 2 and 9, and mice lacking TLR2, TLR9 or MyD88 did not show the dendritic-cell responses seen in wild-type animals. A second line of work reported indoleamine 2,3-dioxygenase induction and regulatory T-cell generation in plasmacytoid dendritic-cell preparations.

KEY PAPERS

- [1] Romani L, Bistoni F, Gaziano R, et al. Thymosin alpha1 activates dendritic cells for antifungal Th1 resistance through Toll-like receptor signaling. Blood. 2004;103(11):4232-4239. doi:10.1182/blood-2003-11-4036 PMID 14982877
- [2] Romani L, Bistoni F, Perruccio K, et al. Thymosin alpha1 activates dendritic cell tryptophan catabolism and establishes a regulatory environment for balance of inflammation and tolerance. Blood. 2006;108(7):2265-2274. PMID 16741252
- [3] Goldstein AL, Low TLK, McAdoo M, et al. Thymosin alpha1: isolation and sequence analysis of an immunologically active thymic polypeptide. Proc Natl Acad Sci USA. 1977;74(2):725-729. PMID 265536

STORAGE

Lyophilized -20°C, dry, dark, 18-24 months
Shelf life 18-24 months lyophilized

FULL RESEARCH

peerlesspeptides.com/peptides/thymosin-alpha-1

05 / 28

LL-37

Endogenous human cathelicidin α -helical antimicrobial peptide, 37 amino acids



EVIDENCE **In vitro**

CAS NUMBER	FORMULA	MOLECULAR WEIGHT
154947-66-7	C205H340N60O53	4493.34 g/mol

WHAT IT IS LL-37 is the 37-residue alpha-helical peptide cleaved from hCAP-18, the only known human cathelicidin. The precursor is stored in neutrophil granules and cleaved by proteinase 3 after release. Two groups identified the peptide independently in 1995.

WHAT IS BEING STUDIED Three activities dominate the literature: disruption of microbial membranes, binding of bacterial lipopolysaccharide, and signaling through several host receptors including FPR2, P2X7 and TLR9. Reported effects on tumor cells run in opposite directions depending on tumor type, and the membrane activity that acts on microbes is cytotoxic to host cells at higher concentrations. The corpus is large and multi-laboratory, at roughly 3,500 indexed papers.

KEY PAPERS

- [1] Sørensen OE, Follin P, Johnsen AH, Calafat J, Tjabringa GS, Hiemstra PS, Borregaard N. Human cathelicidin, hCAP-18, is processed to the antimicrobial peptide LL-37 by extracellular cleavage with proteinase 3. *Blood*. 2001;97(12):3951-3959. [PMID 11389039](#)
- [2] Agerberth B, Gunne H, Odeberg J, Kogner P, Boman HG, Gudmundsson GH. FALL-39, a putative human peptide antibiotic, is cysteine-free and expressed in bone marrow and testis. *Proc Natl Acad Sci USA*. 1995;92(1):195-199. [PMID 7529412](#)
- [3] De Yang, Chen Q, Schmidt AP, et al. LL-37, the neutrophil granule- and epithelial cell-derived cathelicidin, utilizes formyl peptide receptor-like 1 (FPR1) as a receptor to chemoattract human peripheral blood neutrophils, monocytes, and T cells. *J Exp Med*. 2000;192(7):1069-1074. [PMID 11015447](#)

STORAGE	Lyophilized	-20°C, dry, dark, 24+ months
	Shelf life	24+ months lyophilized

FULL RESEARCH

peerlesspeptides.com/peptides/ll-37

Tripeptides

Three-residue peptides: a copper coordination complex, a fragment of alpha-melanocyte-stimulating hormone, and the principal thiol of mammalian cells.

06	GHK-Cu	15
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07	KPV	16
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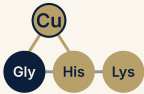
08	Glutathione	17
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SEQUENCE GRAPHIC KEY

○ Nonpolar ● Polar ● Basic ● Acidic ○ Non-coded or D residue ⤵ S-S or lactam bridge
⤵ Lipid or linker ▬ End cap: Ac or NH₂

06 / 28

GHK-Cu



Glycyl-L-histidyl-L-lysine copper(II) complex, ATCUN-motif tripeptide

EVIDENCE

In vitro

CAS NUMBER
89030-95-5

FORMULA
C₁₄H₂₂CuN₆O₄

MOLECULAR WEIGHT
402.9 g/mol

WHAT IT IS

GHK-Cu is the 1:1 complex of the tripeptide Gly-His-Lys with copper(II), first isolated from human plasma in 1973. The Gly-His-Lys sequence also occurs inside larger proteins, including the alpha-2 chain of type I collagen.

WHAT IS BEING STUDIED

The coordination chemistry is well characterized: GHK binds Cu(II) tightly enough to take it from albumin in vitro, and the bound geometry dampens copper redox cycling. Fibroblast-culture work from a group in Reims reported collagen-synthesis and matrix metalloproteinase readouts at nanomolar concentrations. Widely repeated gene-expression claims trace to a secondary reanalysis of cancer cell-line microarray data.

KEY PAPERS

- [1] Beck WT, et al. The redox chemistry of the Cu(II)-glycylhistidyllysine complex: implications for biological activity. J Inorg Biochem. 2007;101(1):131-138. [PMID 17017991](#)
- [2] Maquart FX, Pickart L, Laurent M, Gillery P, Monboisse JC, Borel JP. Stimulation of collagen synthesis in fibroblast cultures by the tripeptide-copper complex glycyl-L-histidyl-L-lysine-Cu²⁺. FEBS Lett. 1988;238(2):343-346. [PMID 3169264](#)
- [3] Simeon A, Emonard H, Hornebeck W, Maquart FX. The tripeptide-copper complex glycyl-L-histidyl-L-lysine-Cu²⁺ stimulates matrix metalloproteinase-2 expression by fibroblast cultures. Life Sci. 2000;67(18):2257-2265. [PMID 11045606](#)

STORAGE

Lyophilized -20°C, sealed amber vial with desiccant, dark; 18-24 months
Shelf life 18-24 months lyophilized

FULL RESEARCH

peerlesspeptides.com/peptides/ghk-cu

07 / 28



KPV

α-MSH 11-13 tripeptide, C-terminal fragment Lys-Pro-Val

EVIDENCE

In vitro

Animal model

CAS NUMBER
67727-97-3

FORMULA
C16H30N4O4

MOLECULAR WEIGHT
342.44 g/mol

WHAT IT IS

KPV (Lys-Pro-Val) is the C-terminal tripeptide of alpha-melanocyte-stimulating hormone, residues 11 to 13. It lacks the central His-Phe-Arg-Trp motif that the parent hormone uses to bind melanocortin receptors.

WHAT IS BEING STUDIED

Primary studies reported that KPV activity in inflammatory-signaling models does not run through melanocortin receptors: it did not raise cAMP in a mouse peritonitis model, and in human bronchial epithelial cells it entered the nucleus and competed with NF-κB p65 for importin binding. The intestinal transporter PepT1 carries KPV into epithelial cells, and most in vivo work uses murine colitis models.

KEY PAPERS

- [1] Getting SJ, Schiöth HB, Perretti M. Dissection of the anti-inflammatory effect of the core and C-terminal (KPV) alpha-melanocyte-stimulating hormone peptides. J Pharmacol Exp Ther. 2003;306(2):631-637. [PMID 12750433](#)
- [2] Land SC. Inhibition of cellular and systemic inflammation cues in human bronchial epithelial cells by melanocortin-related peptides: mechanism of KPV action and a role for MC3R agonists. Int J Physiol Pathophysiol Pharmacol. 2012;4(2):59-73. [PMID 22837805](#)

STORAGE

Lyophilized -20°C, dry, dark, sealed amber vial with desiccant
Shelf life 24+ months lyophilized at -20°C

FULL RESEARCH

peerlesspeptides.com/peptides/kpv

08 / 28

Glutathione



γ -Glutamyl-cysteinyl-glycine tripeptide intracellular redox cofactor

EVIDENCE

In vitro

CAS NUMBER	FORMULA	MOLECULAR WEIGHT
70-18-8 (GSH); 27025-41-8 (GSSG)	C10H17N3O6S (GSH); C20H32N6O12S2 (GSSG)	307.32 g/mol (GSH); 612.63 g/mol (GSSG)

WHAT IT IS

Glutathione (γ -Glu-Cys-Gly) is a tripeptide joined through a non-standard gamma-glutamyl bond and the principal non-protein thiol in mammalian cells. It cycles between a reduced monomer (GSH) and an oxidized disulfide-linked dimer (GSSG).

WHAT IS BEING STUDIED

It is one of the most thoroughly characterized molecules in biochemistry. Research covers its role as the reductant for selenium-dependent glutathione peroxidases, its regeneration by NADPH-dependent glutathione reductase, and its use as a substrate for glutathione S-transferase conjugation. The GSH to GSSG ratio is a standard readout of cellular redox state. Intracellular concentrations run about a thousand times higher than plasma levels, which complicates any experiment that adds glutathione from outside the cell.

KEY PAPERS

- [1] Sies H. Glutathione and its role in cellular functions. *Free Radic Biol Med*. 1999;27(9-10):916-921. [PMID 10569624](#)
- [2] Meister A, Anderson ME. Glutathione. *Annu Rev Biochem*. 1983;52:711-760. [PMID 6137189](#)
- [3] Lu SC. Glutathione synthesis. *Biochim Biophys Acta*. 2013;1830(5):3143-3153. [doi:10.1016/j.bbagen.2012.09.008](#) [PMID 22995213](#)

STORAGE

Lyophilized -20°C, dry, dark, desiccated, inert-gas headspace; sealed amber vial. Refrigerated (2-8°C) storage acceptable for shorter durations.

Shelf life 36 months lyophilized at -20°C with desiccant and inert-gas headspace; 24 months is the conventional pharmacopeial claim. 12-18 months at 4°C; 6-12 months at room temperature with humidity and oxygen acceleration of the oxidation-to-GSSG failure mode.

FULL RESEARCH

peerlesspeptides.com/peptides/glutathione

Mitochondrial peptides

04

Peptides encoded by the mitochondrial genome or targeted to the inner mitochondrial membrane.

09	MOTS-c	19
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10	SS-31	20
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SEQUENCE GRAPHIC KEY

○ Nonpolar ● Polar ● Basic ● Acidic ○ Non-coded or D residue ⤵ S-S or lactam bridge
➤ Lipid or linker ▬ End cap: Ac or NH₂

09 / 28

MOTS-c

16-amino-acid mitochondrial-derived peptide encoded by the mtDNA 12S rRNA gene (MT-RNR1)



EVIDENCE

In vitro

Animal model

Human study

CAS NUMBER

1627580-64-6

FORMULA

C101H152N28O22S2

MOLECULAR WEIGHT

2174.6 g/mol

WHAT IT IS

MOTS-c is a 16-residue peptide encoded by a short open reading frame inside the mitochondrial 12S rRNA gene (MT-RNR1). It was first characterized at the University of Southern California in 2015 and belongs to a small family of mitochondrial-derived peptides.

WHAT IS BEING STUDIED

The proposed mechanism is indirect: in cell and rodent models, MOTS-c inhibited the folate cycle, leading to accumulation of AICAR and activation of AMP-activated protein kinase (AMPK). Later work reported that the peptide moves into the nucleus under cellular stress, and that endogenous MOTS-c levels in human skeletal muscle rise during exercise. No receptor for it has been identified.

KEY PAPERS

- [1] Kim KH, Son JM, Benayoun BA, Lee C. The mitochondrial-encoded peptide MOTS-c translocates to the nucleus to regulate nuclear gene expression in response to metabolic stress. *Cell Metab.* 2018;28(3):516-524. doi:10.1016/j.cmet.2018.06.008 PMID 29983246
- [2] Hyatt JK. MOTS-c increases in skeletal muscle following long-term physical activity and acute exercise: a brief report. *Physiol Rep.* 2022;10(2):e15161. doi:10.14814/phy2.15161 PMID 35075810
- [3] Merry TL, Chan A, Woodhead JST, Reynolds JC, Kumagai H, Kim SJ, Lee C. Mitochondrial-derived peptides in energy metabolism research. *Am J Physiol Endocrinol Metab.* 2020;319(4):E659-E666. doi:10.1152/ajpendo.00249.2020 PMID 32776825

STORAGE

Lyophilized -20°C, dry, dark, argon-flushed amber vials, 18-24 months
Shelf life 18-24 months lyophilized

FULL RESEARCH

peerlesspeptides.com/peptides/mots-c

10 / 28



SS-31

Synthetic mitochondria-targeted cardiolipin-binding tetrapeptide, D-Arg-Dmt-Lys-Phe-NH₂ (elamipretide)

EVIDENCE

In vitro

Animal model

CAS NUMBER

736992-21-5 (free base);
72244098-12-0 (hydrochloride)

FORMULA

C₃₂H₄₉N₉O₅

MOLECULAR WEIGHT

639.80 g/mol (free base)

WHAT IT IS

SS-31 (elamipretide) is the four-residue peptide D-Arg-Dmt-Lys-Phe-NH₂, which contains two non-natural residues. It was developed at Weill Cornell Medicine in the early 2000s. Elamipretide is also the active ingredient of an FDA-approved finished drug product; that approval does not extend to research-grade material.

WHAT IS BEING STUDIED

Research centers on cardiolipin, the anionic phospholipid of the inner mitochondrial membrane. The originating laboratory reported that SS-31 binds cardiolipin and preserves cristae structure in a rat kidney-ischemia model. An independent University of Connecticut study found that the binding tracks membrane surface charge rather than the cardiolipin headgroup itself, and cross-linking mass spectrometry has mapped the peptide's contacts with inner-membrane proteins.

KEY PAPERS

- [1] Birk AV, Liu S, Soong Y, et al. The mitochondrial-targeted compound SS-31 re-energizes ischemic mitochondria by interacting with cardiolipin. *J Am Soc Nephrol.* 2013;24(8):1250-1261. [PMID 23813215](#)
- [2] Mitchell W, Ng EA, Tamucci JD, et al. The mitochondria-targeted peptide SS-31 binds lipid bilayers and modulates surface electrostatics as a key component of its mechanism of action. *J Biol Chem.* 2020;295(21):7452-7469. [PMID 32253237](#)
- [3] Chavez JD, Tang X, Campbell MD, et al. Mitochondrial protein interaction landscape of SS-31. *Proc Natl Acad Sci USA.* 2020;117(26):15363-15373. [PMID 32554501](#)

STORAGE

Lyophilized -20°C, dry, dark, 24+ months
Shelf life 24+ months lyophilized; 12-18 months at 4°C

FULL RESEARCH

peerlesspeptides.com/peptides/ss-31

Growth hormone secretagogues

Peptides that act on the two receptors governing pituitary growth hormone release: the GHRH receptor and the ghrelin receptor, GHS-R1a.

11	Sermorelin	22
12	Tesamorelin	23
13	CJC-1295	24
14	Ipamorelin	25
15	GHRP-2	26

SEQUENCE GRAPHIC KEY

○ Nonpolar ● Polar ● Basic ● Acidic ○ Non-coded or D residue ⤵ S-S or lactam bridge
 ⚡ Lipid or linker ▬ End cap: Ac or NH₂

11 / 28

Sermorelin

29-amino-acid synthetic GHRH 1-29 analog with C-terminal amide



EVIDENCE

In vitro

Human study

CAS NUMBER

86168-78-7 (free base); 114466-38-5 (acetate)

FORMULA

C149H246N44042S

MOLECULAR WEIGHT

3357.93 g/mol

WHAT IT IS

Sermorelin is the synthetic amidated peptide matching residues 1 to 29 of human growth hormone-releasing hormone (GHRH), the shortest fragment that keeps the full activity of the 44-residue parent. Its former FDA approvals were discontinued in 2008 for commercial reasons.

WHAT IS BEING STUDIED

Sermorelin binds the GHRH receptor on anterior pituitary somatotrophs, which signals mainly through G α s and cyclic AMP; it does not bind the ghrelin receptor. Cleavage by dipeptidyl peptidase IV limits its plasma half-life to roughly 11 to 12 minutes. That short, pulse-like receptor signal makes it the reference point for native-length GHRH pharmacology, against which longer-acting analogs of the same receptor are characterized.

KEY PAPERS

- [1] Guillemin R, Brazeau P, Böhlen P, Esch F, Ling N, Wehrenberg WB. Growth hormone-releasing factor from a human pancreatic tumor that caused acromegaly. *Science*. 1982;218(4572):585-587. [PMID 6812220](#)
- [2] Rivier J, Spiess J, Thorner M, Vale W. Characterization of a growth hormone-releasing factor from a human pancreatic islet tumour. *Nature*. 1982;300(5889):276-278. [PMID 6815209](#)
- [3] Brazeau P, Ling N, Esch F, Böhlen P, Mougin C, Guillemin R. Growth hormone releasing factor, somatocrinin, releases pituitary growth hormone in vitro. *Proc Natl Acad Sci USA*. 1982;79(24):7909-7913. [PMID 6817210](#)

STORAGE

Lyophilized -20°C, dry, dark, 24+ months

Shelf life 24+ months lyophilized

FULL RESEARCH

peerlesspeptides.com/peptides/sermorelin

12 / 28

Tesamorelin

Synthetic 44-amino-acid GHRH 1-44 analog with N-terminal trans-3-hexenoyl modification



EVIDENCE

In vitro

Human study

CAS NUMBER

218949-48-5

FORMULA

C221H366N72O67S

MOLECULAR WEIGHT

5135.86 g/mol

WHAT IT IS

Tesamorelin is full-length GHRH (residues 1 to 44) carrying a trans-3-hexenoyl group on the N-terminal tyrosine. It is the active substance of an FDA-approved finished drug product; that approval does not extend to research-grade material.

WHAT IS BEING STUDIED

The hexenoyl cap blocks cleavage by dipeptidyl peptidase IV, the enzyme that inactivates native GHRH within minutes, while leaving binding to the GHRH receptor intact. The result is a modestly longer plasma half-life that keeps the pulsatile signaling pattern of the native hormone. Research on the molecule sits within GHRH-receptor pharmacology, where it occupies a design position between the native hormone and albumin-bound analogs.

KEY PAPERS

- [1] Frohman LA, Downs TR, Williams TC, Heimer EP, Pan YC, Felix AM. Rapid enzymatic degradation of growth hormone-releasing hormone by plasma in vitro and in vivo to a biologically inactive product cleaved at the NH2 terminus. J Clin Invest. 1986;78(4):906-913. PMID 3093534
- [2] Frohman LA, Jansson JO. Growth hormone-releasing hormone. Endocr Rev. 1986;7(3):223-253. PMID 3530585

STORAGE

Lyophilized -20°C, dry, dark, sealed amber vial with desiccant
Shelf life 24-36 months lyophilized

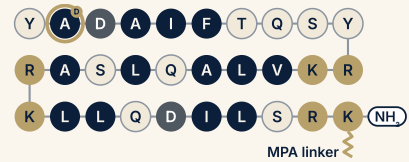
FULL RESEARCH

peerlesspeptides.com/peptides/tesamorelin

13 / 28

CJC-1295

30-amino-acid GHRH analog with Drug Affinity Complex (DAC)
albumin-binding modification



EVIDENCE

Animal model

Human study

CAS NUMBER

863288-34-0

FORMULA

C165H269N47O46

MOLECULAR WEIGHT

3647.25 g/mol

WHAT IT IS

CJC-1295 with DAC is a 30-residue GHRH analog carrying four protease-resistance substitutions and a maleimidopropionyl linker that bonds covalently to circulating albumin. The unmodified sequence often sold as Mod GRF 1-29 is a chemically distinct molecule, and the two are frequently conflated.

WHAT IS BEING STUDIED

The albumin tether, first characterized in rat pituitary work, extends plasma half-life to several days and turns the pulsatile signaling of native GHRH into sustained occupancy of the GHRH receptor. The published human pharmacology consists of two 2006 papers, both conducted with the original developer's material and neither independently replicated. The developer's GHRH program has not been continued by any sponsor.

KEY PAPERS

- [1] Jetté L, Léger R, Thibadeau K, et al. Human growth hormone-releasing factor (hGRF)1-29-albumin bioconjugates activate the GRF receptor on the anterior pituitary in rats. *Endocrinology*. 2005;146(7):3052-3058. [PMID 15817669](#)
- [2] Teichman SL, Neale A, Lawrence B, Gagnon C, Castaigne JP, Frohman LA. Prolonged stimulation of growth hormone (GH) and insulin-like growth factor I secretion by CJC-1295, a long-acting analog of GH-releasing hormone, in healthy adults. *J Clin Endocrinol Metab*. 2006;91(3):799-805. [PMID 16352683](#)
- [3] Ionescu M, Frohman LA. Pulsatile secretion of growth hormone (GH) persists during continuous stimulation by CJC-1295, a long-acting GH-releasing hormone analog. *J Clin Endocrinol Metab*. 2006;91(12):4792-4797. [PMID 17018654](#)

STORAGE

Lyophilized -20°C, dry, dark, 18-24 months

Shelf life 18-24 months lyophilized

FULL RESEARCH

peerlesspeptides.com/peptides/cjc-1295

14 / 28



Ipamorelin

Synthetic pentapeptide Aib-His-D-2Nal-D-Phe-Lys-NH₂, growth hormone secretagogue receptor (GHS-R1a) agonist

EVIDENCE

Animal model

Human study

CAS NUMBER
170851-70-4

FORMULA
C₃₈H₄₉N₉O₅

MOLECULAR WEIGHT
711.86 g/mol

WHAT IT IS

Ipamorelin is a synthetic pentapeptide (Aib-His-D-2Nal-D-Phe-Lys-NH₂) designed at Novo Nordisk in the 1990s as a selective agonist of the ghrelin receptor, GHS-R1a.

WHAT IS BEING STUDIED

The foundational 1998 study reported growth hormone release in rat and swine preparations with no detectable change in ACTH, cortisol or prolactin, even at exposures more than 200 times the level needed for growth hormone release. That selectivity has so far been measured only in animals. The one Phase 2 efficacy trial missed its primary endpoint in 2014, and the sponsor ended development.

KEY PAPERS

- [1] Raun K, Hansen BS, Johansen NL, et al. Ipamorelin, the first selective growth hormone secretagogue. Eur J Endocrinol. 1998;139(5):552-561. doi:10.1530/eje.0.1390552 PMID 9849822
- [2] Ankersen M, Johansen NL, Madsen K, et al. A new series of highly potent growth hormone-releasing peptides derived from ipamorelin. J Med Chem. 1998;41(20):3699-3704. PMID 9733495
- [3] Bowers CY. Growth hormone-releasing peptide (GHRP). Cell Mol Life Sci. 1998;54(12):1316-1329. PMID 9893707

STORAGE

Lyophilized -20°C, dry, dark, 24+ months
Shelf life 24 months lyophilized

FULL RESEARCH

peerlesspeptides.com/peptides/ipamorelin

15 / 28



GHRP-2

Synthetic hexapeptide ghrelin-receptor agonist with non-natural D-amino-acid and 2-naphthylalanine residues

EVIDENCE

Animal model

Human study

CAS NUMBER

158861-67-7

FORMULA

C45H55N9O6

MOLECULAR WEIGHT

817.99 g/mol

WHAT IT IS

GHRP-2 (pralmorelin) is a synthetic hexapeptide ghrelin-receptor agonist built with D-amino acids and 2-naphthylalanine. It was designed at Tulane University in the late 1980s, before the receptor itself was cloned.

WHAT IS BEING STUDIED

GHRP-2 binds GHS-R1a on pituitary somatotrophs and signals through the Gαq, phospholipase C and calcium cascade. It also acts on the corticotroph axis: rat work traced its ACTH-releasing activity to hypothalamic CRF release, and human pharmacology studies measured cortisol and prolactin changes alongside growth hormone. It has served as a reference ligand in ghrelin-receptor pharmacology for more than three decades.

KEY PAPERS

- [1] Bowers CY, Sartor AO, Reynolds GA, Badger TM. On the actions of the growth hormone-releasing hexapeptide, GHRP. *Endocrinology*. 1991;128(4):2027-2035. [PMID 2004615](#)
- [2] Doi N, Hirotani C, Ukai K, Shimada O, Okuno T, Kurasaki S, et al. Pharmacological characteristics of KP-102 (GHRP-2), a potent growth hormone-releasing peptide. *Arzneimittelforschung*. 2004;54(12):857-867. [PMID 15646370](#)
- [3] Hirotani C, Doi N, Ukai K, et al. ACTH releasing activity of KP-102 (GHRP-2) in rats is mediated mainly by release of CRF. *Naunyn Schmiedeberg's Arch Pharmacol*. 2005;371(2):109-118. [PMID 15645295](#)

STORAGE

Lyophilized -20°C, dry, dark, 24+ months
Shelf life 24+ months lyophilized

[FULL RESEARCH](#)
peerlesspeptides.com/peptides/ghrp-2

GH-fragment and IGF-I analogs

Engineered fragments and analogs of growth hormone axis proteins that work outside the secretagogue receptors.

16	AOD-9604	28
17	IGF-I LR ₃	29

SEQUENCE GRAPHIC KEY

○ Nonpolar ● Polar ● Basic ● Acidic ○ Non-coded or D residue ⤵ S-S or lactam bridge
⤵ Lipid or linker ▬ End cap: Ac or NH₂

16 / 28

AOD-9604

Tyr-extended hGH 177-191 hexadecapeptide, 16 amino acids



EVIDENCE

Animal model

Human study

CAS NUMBER

221231-10-3

FORMULA

C78H123N23O23S2

MOLECULAR WEIGHT

1815.10 g/mol

WHAT IT IS

AOD-9604 is a 16-residue peptide corresponding to residues 177 to 191 of human growth hormone, with an added N-terminal tyrosine and an internal disulfide bond. At about 1.8 kDa it is a small fragment of the 22 kDa hormone, and it was reported to lack measurable affinity for the growth hormone receptor.

WHAT IS BEING STUDIED

Nearly all mechanism work comes from the originating Monash University laboratory, which reported changes in beta-3 adrenergic receptor expression in rodent adipose tissue; those findings have not been replicated by an unaffiliated group. The sponsor's clinical program reported no effect on serum IGF-1, and development ended in 2007 after a Phase 2b trial missed its primary endpoint. Anti-doping laboratories have published detection methods for the peptide.

KEY PAPERS

- [1] Ng FM, Sun J, Sharma L, Libinaka R, Jiang WJ, Gianello R. Metabolic studies of a synthetic lipolytic domain (AOD9604) of human growth hormone. *Horm Res.* 2000;53(6):274-278. [PMID 11146367](#)
- [2] Cox HD, Smeal SJ, Hughes CM, Cox JE, Eichner D. Detection and in vitro metabolism of AOD9604. *Drug Test Anal.* 2015;7(1):31-38. [PMID 25208511](#)
- [3] Orlovius AK, Thomas A, Schänzer W, Thevis M. AOD-9604 does not influence the WADA hGH isoform immunoassay. *Drug Test Anal.* 2013;5(11-12):850-852. [PMID 24124033](#)

STORAGE

Lyophilized -20°C, dry, dark, sealed amber vials with desiccant, 18-24 months
Shelf life 18-24 months lyophilized

FULL RESEARCH

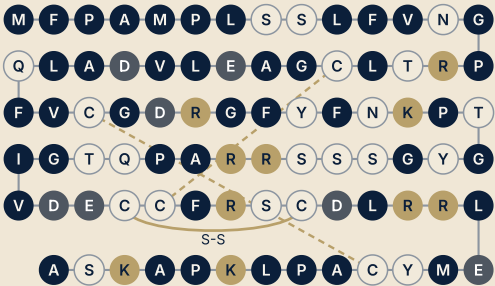
peerlesspeptides.com/peptides/aod-9604

17 / 28

IGF-I LR3

Engineered 83-amino-acid IGF-1 analog with Arg3 substitution and N-terminal MFPAMPLSSLFVN extension

EVIDENCE In vitro



CAS NUMBER	FORMULA	MOLECULAR WEIGHT
946870-92-4	C400H625N1110115S9	~9117.6 g/mol

WHAT IT IS IGF-1 LR3 is an 83-residue engineered analog of insulin-like growth factor 1, with a 13-residue N-terminal extension and an arginine at position 3. It was designed at CSIRO in Adelaide in 1992 as a cell-culture reagent for serum-free bioreactor media.

WHAT IS BEING STUDIED The two modifications cut binding to the six IGF-binding proteins more than a thousandfold while sparing the IGF-1 receptor contact surface, so the analog stays available to cells in media where native IGF-1 would be sequestered. Cell-culture supplementation is its deepest and most reproducible evidence base, with canonical IGF-1 receptor signaling through PI3K-Akt and MAPK.

KEY PAPERS

- [1] Francis GL, Ross M, Ballard FJ, Milner SJ, Senn C, McNeil KA, Wallace JC, King R, Wells JR. Novel recombinant fusion protein analogues of insulin-like growth factor (IGF)-I indicate the relative importance of IGF-binding protein and receptor binding for enhanced biological potency. J Mol Endocrinol. 1992;8(3):213-223. [PMID 1378742](#)
- [2] Laajoki LG, Le Breton GC, Edmondson SF, et al. Secondary structure determination of 15N-labelled human Long-[Arg-3]-insulin-like growth factor 1 by multidimensional NMR spectroscopy. FEBS Lett. 1997;420(2-3):169-174. [doi:10.1016/S0014-5793\(97\)01510-8](#)
- [3] Morris AE, Schmid J. Long-R3-IGF-I as a more potent alternative to insulin in serum-free culture of HEK293 cells. Mol Biotechnol. 2007;35(1):17-22. [PMID 17172665](#)

STORAGE	Lyophilized	-20°C, sealed, desiccant, 12-24 months
	Shelf life	12-24 months lyophilized at -20°C; 6-12 months at 4°C

[FULL RESEARCH](#)

peerlesspeptides.com/peptides/igf-1-lr3

Khavinson bioregulators

Short synthetic peptides from the Saint Petersburg Institute of Bioregulation and Gerontology, proposed to act directly on gene expression.

18	Epitalon	31
19	Pinealon	32

SEQUENCE GRAPHIC KEY

○ Nonpolar ● Polar ● Basic ● Acidic ● Non-coded or D residue ⤵ S-S or lactam bridge
 ⤵ Lipid or linker — End cap: Ac or NH₂

18 / 28



Epitalon

Synthetic Ala-Glu-Asp-Gly (AEDG) tetrapeptide, also written Epithalon. Khavinson short-peptide bioregulator family

EVIDENCE

In vitro

Animal model

CAS NUMBER
307297-39-8

FORMULA
C14H22N4O9

MOLECULAR WEIGHT
390.35 g/mol

WHAT IT IS

Epitalon (also written Epithalon) is the synthetic tetrapeptide Ala-Glu-Asp-Gly (AEDG) from the Khavinson program at the Saint Petersburg Institute of Bioregulation and Gerontology. Its sequence was derived from the amino-acid composition of a bovine pineal extract rather than isolated by its activity.

WHAT IS BEING STUDIED

The program proposes that short peptides bind gene promoters directly. For epitalon the reported targets are the telomerase (hTERT) promoter and histone proteins, supported mainly by cell-culture work and molecular docking. No co-crystal structure or independent biophysical confirmation has been published, and roughly 75 to 90 percent of the indexed literature comes from the originating institute. Rodent lifespan studies from the same network have not been independently replicated.

KEY PAPERS

- [1] Khavinson VKh, Bondarev IE, Butyugov AA. Epithalon peptide induces telomerase activity and telomere elongation in human somatic cells. Bull Exp Biol Med. 2003;135(6):590-592. doi:10.1023/A:1025493705728 PMID 12937682
- [2] Diomede F, Marconi GD, Cavalcanti MFXB, et al. In silico interaction of Epitalon with histone proteins of telomere repeats and effects on osteogenic differentiation. Molecules. 2020;25(22):5404. doi:10.3390/molecules25225404 PMID 33233675
- [3] Kozina LS, Arutjunyan AV, Stvolinskii SL, Krasnov GS, Khavinson VKh. Direct mass-spectrometric detection of the tetrapeptide Ala-Glu-Asp-Gly in pineal gland tissue. Bull Exp Biol Med. 2017;164(2):143-145. doi:10.1007/s10517-017-3946-0 PMID 29124531

STORAGE

Lyophilized -20°C, dry, dark, 24-36 months
Shelf life 24-36 months lyophilized

FULL RESEARCH

peerlesspeptides.com/peptides/epitalon

19 / 28



Pinealon

Synthetic tripeptide Glu-Asp-Arg (EDR), Khavinson short-peptide-bioregulator class

EVIDENCE

In vitro

Animal model

CAS NUMBER
175175-23-2

FORMULA
C15H26N6O8

MOLECULAR WEIGHT
418.41 g/mol

WHAT IT IS

Pinealon is the synthetic tripeptide Glu-Asp-Arg (EDR), a sister molecule to epitalon from the same Saint Petersburg short-peptide program. It is a different molecule from the AEDG tetrapeptide it is sometimes confused with.

WHAT IS BEING STUDIED

Research has examined EDR in cultured cerebellar granule cells, neutrophils and PC12 cells under oxidative challenge, and in a rat prenatal hyperhomocysteinemia model. The proposed mechanism, direct binding to DNA and histones, rests on fluorescence-quenching assays and docking studies; one St. Petersburg State University biophysics paper confirmed a physical interaction but not sequence-specific recognition. About 80 to 90 percent of the small corpus originates within the Khavinson network.

KEY PAPERS

- [1] Fedoreyeva LI, Kireev II, Khavinson VKh, Vanyushin BF. Penetration of short fluorescence-labeled peptides into the nucleus in HeLa cells and in vitro specific interaction of the peptides with deoxyribonucleotides and DNA. Biochemistry (Mosc). 2011;76(11):1210-1219. doi:10.1134/S0006297911110022 PMID 22117547
- [2] Khavinson VKh, Lin'kova NS, Tarnovskaya SI, Umnov RS, Elashkina EV, Durnova AO. Short peptides stimulate serotonin expression in cells of brain cortex. Bull Exp Biol Med. 2014;157(1):77-80. doi:10.1007/s10517-014-2497-x PMID 24909721
- [3] Silanteva IA, Komolkin AV, Morozova EA, Vorontsov-Velyaminov PN, Kasyanenko NA. Role of Mono- and Divalent Ions in Peptide Glu-Asp-Arg-DNA Interaction. J Phys Chem B. 2019;123(8):1786-1795. doi:10.1021/acs.jpcc.8b11783 PMID 30762356

STORAGE

Lyophilized -20°C, dry, dark, 24+ months
Shelf life 24+ months lyophilized

FULL RESEARCH

peerlesspeptides.com/peptides/pinealon

Russian neuropeptides

Heptapeptide analogs of endogenous regulatory peptides, designed at the Institute of Molecular Genetics in Moscow with a Pro-Gly-Pro stabilizing extension.

20	Selank	34
21	Semax	35

SEQUENCE GRAPHIC KEY

○ Nonpolar ● Polar ● Basic ● Acidic ● Non-coded or D residue ⤵ S-S or lactam bridge
➤ Lipid or linker ▬ End cap: Ac or NH₂

20 / 28

Selank



Synthetic heptapeptide Thr-Lys-Pro-Arg-Pro-Gly-Pro, tuftsin analog

EVIDENCE

In vitro

Animal model

CAS NUMBER
129954-34-3

FORMULA
C33H57N11O9

MOLECULAR WEIGHT
751.88 g/mol

WHAT IT IS

Selank is a synthetic heptapeptide (Thr-Lys-Pro-Arg-Pro-Gly-Pro) built on tuftsin, a four-residue fragment of the IgG heavy chain, with a Pro-Gly-Pro extension added for protease resistance. It was designed at the Institute of Molecular Genetics in Moscow.

WHAT IS BEING STUDIED

Four mechanism lines appear in the literature: inhibition of enkephalin-degrading enzymes in serum assays, changes in expression of GABAergic genes in cell lines and mouse hippocampus, hippocampal BDNF expression in rats, and monoamine turnover. None has been established by receptor knockout or antagonist studies, and no specific receptor has been identified. Most of the corpus originates in Moscow research institutes.

KEY PAPERS

- [1] Najjar VA, Nishioka K. 'Tuftsin': a natural phagocytosis stimulating peptide. Nature. 1970;228(5272):672-673. [PMID 5474939](#)
- [2] Zolotarev YA, Dadayan AK, Borisov YA, et al. Stability of synthetic peptide drug Semax and Selank in human serum and in serum enkephalinase assays. Bull Exp Biol Med. 2001;132(2):756-760. [PMID 11550013](#)
- [3] Volkova A, Shadrina M, Kolomin T, et al. Selank administration affects the expression of some genes involved in GABAergic neurotransmission. Front Pharmacol. 2016;7:31. [doi:10.3389/fphar.2016.00031](#) [PMID 26924987](#)

STORAGE

Lyophilized -20°C, dry, dark
Shelf life 24-36 months lyophilized

FULL RESEARCH

peerlesspeptides.com/peptides/selank

21 / 28



Semax

Synthetic heptapeptide Met-Glu-His-Phe-Pro-Gly-Pro, ACTH(4-7) analog with C-terminal Pro-Gly-Pro extension

EVIDENCE

Animal model

CAS NUMBER

80714-61-0

FORMULA

C37H51N9O10S

MOLECULAR WEIGHT

813.92 g/mol

WHAT IT IS

Semax is a synthetic heptapeptide (Met-Glu-His-Phe-Pro-Gly-Pro) that joins the ACTH(4-7) fragment to a C-terminal Pro-Gly-Pro stabilizer. It was developed at the Institute of Molecular Genetics in Moscow in the 1980s and lacks the ACTH residues needed for adrenal receptor activity.

WHAT IS BEING STUDIED

The best-characterized axis is BDNF and its receptor TrkB: rat studies reported increased hippocampal BDNF and TrkB expression, and the same group described a specific binding site in rat basal forebrain. Part of the BDNF response has been attributed to the Pro-Gly-Pro metabolite, which complicates attributing it to the parent peptide. Most of the corpus originates in Moscow.

KEY PAPERS

- [1] Dolotov OV, Karpenko EA, Inozemtseva LS, et al. Semax, an analog of ACTH(4-7), regulates expression of brain-derived neurotrophic factor and trkB in the hippocampus of rats. Brain Res. 2006;1117(1):54-60. doi:10.1016/j.brainres.2006.07.108 PMID 16996037
- [2] Dolotov OV, Karpenko EA, Inozemtseva LS, et al. Semax binding to the receptor for the ACTH(4-10) fragment in the rat basal forebrain. J Neurochem. 2006;97 Suppl 1:82-86. doi:10.1111/j.1471-4159.2006.03658.x PMID 16635254
- [3] Shadrina MI, Dolotov OV, Grivennikov IA, et al. Rapid induction of neurotrophin mRNAs in rat glial cell cultures by Semax, an adrenocorticotrophic hormone analog. Neurosci Lett. 2001;308(2):115-118. doi:10.1016/s0304-3940(01)01994-2 PMID 11457573

STORAGE

Lyophilized -20°C, dry, dark, argon-flushed amber vials, 18-24 months
Shelf life 18-24 months lyophilized

FULL RESEARCH

peerlesspeptides.com/peptides/semax

Neuroendocrine peptides

Endogenous neuropeptides and their synthetic forms, studied in hypothalamic, pituitary and central signaling research.

22	DSIP	37
23	Kisspeptin-10	38
24	Oxytocin	39

SEQUENCE GRAPHIC KEY

○ Nonpolar ● Polar ● Basic ● Acidic ○ Non-coded or D residue ⤵ S-S or lactam bridge
⤵ Lipid or linker — End cap: Ac or NH₂

22 / 28



DSIP

Delta Sleep-Inducing Peptide, synthetic Trp-Ala-Gly-Gly-Asp-Ala-Ser-Gly-Glu nonapeptide

EVIDENCE

In vitro

Animal model

CAS NUMBER
62568-57-4

FORMULA
C35H48N10O15

MOLECULAR WEIGHT
848.81 g/mol

WHAT IT IS

DSIP (delta sleep-inducing peptide) is the nine-residue peptide Trp-Ala-Gly-Gly-Asp-Ala-Ser-Gly-Glu, isolated in 1977 at the University of Basel from the cerebral venous blood of rabbits during electrically induced slow-wave sleep. The name reflects the conditions of that original experiment.

WHAT IS BEING STUDIED

Nearly five decades on, no specific receptor and no mammalian gene encoding DSIP have been identified; a 2006 review called it “a still unresolved riddle.” Rabbit and rodent studies using direct brain delivery reported changes in slow-wave EEG activity, and rat brainstem slices released Met-enkephalin in its presence. The original isolation has never been independently reproduced.

KEY PAPERS

- [1] Schoenenberger GA, Monnier M. Characterization of a delta-electroencephalogram (-sleep)-inducing peptide. Proc Natl Acad Sci USA. 1977;74(3):1282-1286. PMID 265572
- [2] Kovalzon VM, Strekalova TV. Delta sleep-inducing peptide (DSIP): a still unresolved riddle. J Neurochem. 2006;97(2):303-309. doi:10.1111/j.1471-4159.2006.03726.x
- [3] Iwata N, Kobayashi M, Sasaki T, Tanaka T, Hizukuri K, Honda K. Delta-sleep-inducing peptide (DSIP) stimulates the release of immunoreactive Met-enkephalin from rat lower brainstem slices in vitro. Brain Res. 1989;481(2):187-191. PMID 2706459

STORAGE

Lyophilized -20°C, dry, dark, sealed amber vials with desiccant; 18-24 months
Shelf life 18-24 months lyophilized

FULL RESEARCH

peerlesspeptides.com/peptides/dsip

23 / 28

Kisspeptin-10

C-terminal decapeptide YNWNSFGLRF-NH₂ of the KISS1 gene product;
GPR54 / KISS1R ligand



EVIDENCE

Animal model

Human study

CAS NUMBER

374675-21-5

FORMULA

C₆₃H₈₃N₁₇O₁₄

MOLECULAR WEIGHT

1302.45 g/mol

WHAT IT IS

Kisspeptin-10 is the C-terminal decapeptide (YNWNSFGLRF-NH₂) shared by all processed products of the KISS1 gene, and the minimal fragment that activates the kisspeptin receptor, KISS1R (GPR54). The KISS1 gene was first identified in 1996 in melanoma metastasis research.

WHAT IS BEING STUDIED

KISS1R couples to Gαq/11 and intracellular calcium signaling. In 2003, two groups reported that loss-of-function mutations in the receptor cause hypogonadotropic hypogonadism in humans and mice, which placed kisspeptin neurons upstream of GnRH release. Research uses the peptide to probe hypothalamic-pituitary-gonadal signaling; its plasma half-life of a few minutes and receptor desensitization under continuous exposure shape study design.

KEY PAPERS

- [1] Kotani M, Detheux M, Vandenbogaerde A, et al. The metastasis suppressor gene KiSS-1 encodes kisspeptins, the natural ligands of the orphan G protein-coupled receptor GPR54. J Biol Chem. 2001;276(37):34631-34636. doi:10.1074/jbc.M104847200 PMID 11457843
- [2] de Roux N, Genin E, Carel J-C, Matsuda F, Chaussain J-L, Milgrom E. Hypogonadotropic hypogonadism due to loss of function of the KiSS1-derived peptide receptor GPR54. Proc Natl Acad Sci USA. 2003;100(19):10972-10976. doi:10.1073/pnas.1834399100 PMID 12944565
- [3] Seminara SB, Messager S, Chatzidaki EE, et al. The GPR54 gene as a regulator of puberty. N Engl J Med. 2003;349(17):1614-1627. doi:10.1056/NEJMoa035322 PMID 14573733

STORAGE

Lyophilized -20°C, dry, dark, in sealed amber vials with desiccant
Shelf life 24+ months lyophilized at -20°C

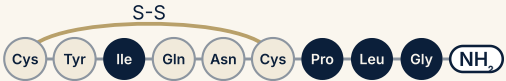
FULL RESEARCH

peerlesspeptides.com/peptides/kisspeptin

24 / 28

Oxytocin

Endogenous cyclic nonapeptide hormone with Cys-1/Cys-6 disulfide bridge



EVIDENCE

Animal model

Human study

CAS NUMBER

50-56-6

FORMULA

C43H66N12O12S2

MOLECULAR WEIGHT

1007.19 g/mol

WHAT IT IS

Oxytocin is the endogenous nine-residue hormone of the posterior pituitary, cyclized by a disulfide bridge between cysteines 1 and 6. It was the first peptide hormone to be sequenced and synthesized, work recognized by the 1955 Nobel Prize in Chemistry. The research material is not a finished drug product.

WHAT IS BEING STUDIED

Its receptor, OXTR, is a Gαq-coupled receptor mapped across uterine and mammary tissue and brain regions including the amygdala and hippocampus. Oxytocin and vasopressin differ at only two positions, so cross-reactivity with vasopressin receptors is a recurring methodological issue. Comparative vole studies anchor much of the social-neurobiology literature, while the central pharmacokinetics behind many human behavioral studies remain contested.

KEY PAPERS

- [1] Gimpl G, Fahrenholz F. The oxytocin receptor system: structure, function, and regulation. *Physiol Rev.* 2001;81(2):629-683. [PMID 11274341](#)
- [2] Young LJ, Wang Z. The neurobiology of pair bonding. *Nat Neurosci.* 2004;7(10):1048-1054. [PMID 15452576](#)
- [3] du Vigneaud V, Ressler C, Trippett S. The sequence of oxytocin. *J Biol Chem.* 1953;205(2):949-957. [PMID 13129278](#)

STORAGE

Lyophilized -20°C, dry, dark, 24-36 months
Shelf life 24-36 months lyophilized

[FULL RESEARCH](#)
peerlesspeptides.com/peptides/oxytocin

Melanocortin-receptor peptides

Cyclic analogs of alpha-melanocyte-stimulating hormone from the University of Arizona program, studied as agonists across the melanocortin receptor family.

25	Melanotan-2	41
26	PT-I4I	42

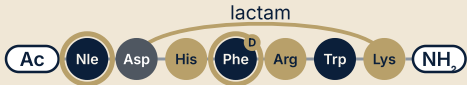
SEQUENCE GRAPHIC KEY

○ Nonpolar ● Polar ● Basic ● Acidic ● Non-coded or D residue ⤵ S-S or lactam bridge
➤ Lipid or linker — End cap: Ac or NH₂

25 / 28

Melanotan-2

Synthetic cyclic heptapeptide α -MSH analog; non-selective MC1R/MC3R/MC4R/MC5R agonist



EVIDENCE In vitro

CAS NUMBER	FORMULA	MOLECULAR WEIGHT
121062-08-6	C50H69N15O9	1024.18 g/mol
WHAT IT IS	Melanotan-2 (MT-II) is the synthetic cyclic heptapeptide Ac-Nle-cyclo[Asp-His-D-Phe-Arg-Trp-Lys]-NH ₂ , designed at the University of Arizona in the late 1980s as a conformationally constrained analog of alpha-melanocyte-stimulating hormone. It has never been approved by any regulator.	
WHAT IS BEING STUDIED	MT-II is a non-selective agonist at the melanocortin receptors MC1R, MC3R, MC4R and MC5R, with negligible activity at the adrenal receptor MC2R. Its lactam bridge holds the His-Phe-Arg-Trp sequence in its receptor-bound shape, and the Arizona group reported potency roughly 100-fold above the native hormone in melanocyte bioassays. It remains a standard non-selective reference agonist in melanocortin receptor pharmacology.	
KEY PAPERS	[1] Sawyer TK, Sanfilippo PJ, Hruby VJ, Engel MH, Heward CB, Burnett JB, Hadley ME. 4-Norleucine, 7-D-phenylalanine-alpha-melanocyte-stimulating hormone: a highly potent alpha-melanotropin with ultralong biological activity. <i>Proc Natl Acad Sci U S A</i>. 1980;77(10):5754-5758. PMID 6777774 [2] Al-Obeidi F, Castrucci AM, Hadley ME, Hruby VJ. Potent and prolonged-acting cyclic lactam analogues of alpha-melanotropin: design based on molecular dynamics. <i>J Med Chem</i>. 1989;32(12):2555-2561. doi:10.1021/jm00132a010 [3] Sugg EE, Castrucci AM, Hadley ME, van Binst G, Hruby VJ. Cyclic lactam analogues of Ac-[Nle4]alpha-MSH4-11-NH₂. <i>Biochemistry</i>. 1988;27(22):8181-8188. PMID 2852955	
STORAGE	Lyophilized	-20°C, dry, dark, sealed amber vial with desiccant
	Shelf life	24+ months lyophilized at -20°C

FULL RESEARCH

peerlesspeptides.com/peptides/melanotan-2

26 / 28

PT-141

Synthetic cyclic heptapeptide melanocortin receptor agonist with primary activity at MC4R



EVIDENCE

In vitro

Animal model

CAS NUMBER
189691-06-3

FORMULA
C50H68N14O10

MOLECULAR WEIGHT
1025.18 g/mol

WHAT IT IS

PT-141 (bremelanotide) is a cyclic heptapeptide identical to Melanotan-2 except at the C-terminus, where a free acid replaces the amide. Bremelanotide is also the active ingredient of an FDA-approved finished drug product; that approval does not extend to research-grade material.

WHAT IS BEING STUDIED

It is an agonist across the melanocortin receptors MC1R, MC3R, MC4R and MC5R, with central activity attributed mainly to MC4R. Preclinical work has examined MC4R signaling in hypothalamic regions including the medial preoptic area, and rat microdialysis studies associated MC4R activation with dopamine release in mesolimbic circuits. The single amide-to-acid change was enough for the molecule to be developed as a separate chemical entity.

KEY PAPERS

- [1] Al-Obeidi F, Castrucci AM, Hadley ME, Hruby VJ. Potent and prolonged acting cyclic lactam analogues of alpha-melanotropin: design based on molecular dynamics. J Med Chem. 1989;32(12):2555-2561. [PMID 2555512](#)
- [2] Hadley ME, Dorr RT. Melanocortin peptide therapeutics: historical milestones, clinical studies and commercialization. Peptides. 2006;27(4):921-930. [PMID 16412534](#)

STORAGE

Lyophilized -20°C, dry, dark, 24-36 months
Shelf life 24-36 months lyophilized

FULL RESEARCH

peerlesspeptides.com/peptides/pt-141

10

Incretin and amylin receptor agonists

Long-acting acylated peptide agonists at the GLP-1, amylin and calcitonin receptors.

27	Cagrilintide	44
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28	Semaglutide	45
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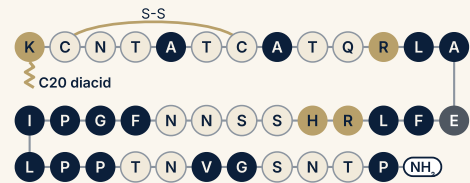
SEQUENCE GRAPHIC KEY

○ Nonpolar ● Polar ● Basic ● Acidic ○ Non-coded or D residue ⤵ S-S or lactam bridge
⤵ Lipid or linker — End cap: Ac or NH₂

27 / 28

Cagrilintide

37-amino-acid long-acting amylin analog (DACRA),
investigational



EVIDENCE In vitro

CAS NUMBER	FORMULA	MOLECULAR WEIGHT
1415456-99-3	C194H312N54O59S2	~4409 g/mol (average)

WHAT IT IS Cagrilintide is an investigational 37-residue analog of human amylin, acylated with a C20 fatty diacid through a gamma-glutamic acid spacer. It belongs to the calcitonin gene family of peptides and is classified as a dual amylin and calcitonin receptor agonist (DACRA). It is not approved by the FDA as a standalone product.

WHAT IS BEING STUDIED Its receptor targets are the three amylin receptors, each a calcitonin receptor paired with one of the receptor activity-modifying proteins RAMP1, RAMP2 or RAMP3, plus the calcitonin receptor alone. Cryo-electron microscopy structures published in 2025 resolved all four complexes. The discovery chemistry describes an engineered salt bridge that stabilizes the N-terminal helix and substitutions that reduce the aggregation typical of native amylin. Clinical development has run through Phase 3 programs.

KEY PAPERS

- [1] Kruse T, Hansen JL, Dahl K, et al. Development of cagrilintide, a long-acting amylin analogue. J Med Chem. 2021;64(15):11183-11194. [PMID 34288673](#)
- [2] Cao J, Belousoff MJ, Liang YL, et al. Structural insight into selectivity of amylin and calcitonin receptor agonists. Nat Commun. 2025;16(1):3275. [PMID 40204768](#)
- [3] McLatchie LM, Fraser NJ, Main MJ, et al. RAMPs regulate the transport and ligand specificity of the calcitonin-receptor-like receptor. Nature. 1998;393(6683):333-339. [PMID 9620797](#)

STORAGE

Lyophilized -20°C, dry, dark, >24 months

Shelf life >24 months lyophilized at -20°C

28 / 28

Semaglutide

31-amino-acid acylated GLP-1 receptor agonist with γGlu-AEEA-AEEA-C18 lipidation arm



EVIDENCE In vitro

CAS NUMBER	FORMULA	MOLECULAR WEIGHT
910463-68-2	C187H291N45O59	4113.58 g/mol (average); 4111.12 Da (monoisotopic)

WHAT IT IS	Semaglutide is a synthetic 31-residue analog of GLP-1(7-37) carrying an aminoisobutyric acid (Aib) at position 8, an arginine at position 34 and a C18 fatty-diacid chain on lysine 26. It is the active ingredient of FDA-approved finished drug products; that approval does not extend to research-grade material.
WHAT IS BEING STUDIED	It is an agonist at the GLP-1 receptor, a class B G-protein-coupled receptor that signals mainly through Gαs and cyclic AMP; the structure of the activated receptor in complex with its G protein was resolved by cryo-electron microscopy in 2017. The discovery chemistry describes how the Aib residue blocks cleavage by dipeptidyl peptidase IV and how the lipidation arm binds a fatty-acid site on serum albumin.
KEY PAPERS	[1] Lau J, Bloch P, Schäffer L, et al. Discovery of the once-weekly glucagon-like peptide-1 (GLP-1) analogue semaglutide. J Med Chem. 2015;58(18):7370-7380. doi:10.1021/acs.jmedchem.5b00726 PMID 26308095 [2] Zhang Y, Sun B, Feng D, et al. Cryo-EM structure of the activated GLP-1 receptor in complex with a G protein. Nature. 2017;546(7657):248-253. PMID 28492259
STORAGE	Lyophilized -20°C, dry, dark, inert headspace, >24 months Shelf life >24 months lyophilized at -20°C

FULL RESEARCH

peerlesspeptides.com/peptides/semaglutide

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[Back to contents](#)