KuroAminos
RESEARCH PEPTIDES

THE

KuroAminos Research Handbook

Mechanism, dosing, reconstitution & citations for the modern peptide laboratory.

REQUIRED READING

Research-use disclaimer

Everything described in this handbook is provided for in-vitro laboratory research and educational purposes only. None of the compounds discussed are drugs, dietary supplements, food, or cosmetics. They have not been evaluated by the U.S. Food and Drug Administration. They are not intended to diagnose, treat, cure, or prevent any disease, and they must not be administered to humans or animals under any circumstance.

By reading this handbook you confirm that you are a qualified researcher 21 years of age or older, that your work is conducted within an appropriately controlled laboratory environment, and that you assume full responsibility for the safe storage, handling, and disposal of any peptide material referenced herein.

Where dosing ranges are reported below, those values are drawn directly from the published animal and clinical literature cited in Part IV. They are reproduced for reference and historical context — they are not instructions, recommendations, or endorsements. The presence of a study in this handbook is not a statement that KuroAminos has replicated, validated, or sponsored that study.

IF YOU ARE NOT A RESEARCHER

Please close this document and return to a regulated source of medical information. Your physician is the only appropriate party to advise you about clinical use of any compound.

How to use this handbook

- Part I covers the fundamentals every lab needs: choosing a diluent, reconstitution procedure, U-100 insulin syringe math, and the storage chemistry that protects your reagent.
- Parts II and III contain a monograph for every peptide currently in the KuroAminos catalog. Each monograph includes chemical identity, mechanism of action, a published-research summary, a reconstitution recipe sized to the vial we ship, and the pharmacokinetic envelope reported in the literature.
- Part IV is the bibliography. Every numbered citation in the body of the handbook points to a paper indexed on PubMed, NEJM, The Lancet, JCEM, Frontiers, or MDPI. You can find the corresponding link in Part IV.

A note on naming

Peptides commonly travel under multiple names — a development code (e.g. LY3437943), a generic (Retatrutide), and a brand (Mounjaro, Zepbound, etc.). Where multiple names exist we lead with the trade name used in our catalog and reference others in the identity table.

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PART I

Fundamentals

Diluents, reconstitution, syringe math, dose calculation, and storage chemistry — the substrate every lab protocol is built on.

CHAPTER 1

Bacteriostatic water & sterile diluents

The single most important reagent in the peptide research lab is the one that doesn't ship in the vial. Bacteriostatic water (BAC water) is sterile water for injection containing 0.9% benzyl alcohol as a preservative. The benzyl alcohol arrests bacterial growth, which is what lets a reconstituted peptide stay viable in the refrigerator for weeks rather than hours.

Plain sterile water — without the bacteriostatic agent — is also occasionally used in early protocol design, but a vial reconstituted in plain sterile water must be used within hours and aliquoted into single-use containers immediately. For routine bench work, BAC water is the default.

Why benzyl alcohol matters

- It is bacteriostatic, not sterilising — it prevents new microbial growth in the vial but does not eliminate a contaminating organism introduced during reconstitution. Aseptic technique is still required.
- It is the same preservative used in commercial multi-dose vials of insulin and many injectable medications, so the chemistry is well-characterised.
- Some peptides (notably certain GLP-class compounds) precipitate at higher BAC concentrations. If you observe turbidity after reconstitution, repeat with plain sterile water and single-dose handling.

Diluent selection at a glance

BAC WATER	0.9% benzyl alcohol. Default diluent. Refrigerated shelf-life of reconstituted peptide: up to 28 days.
STERILE WATER (USP)	No preservative. Use only when benzyl alcohol is contraindicated for the peptide chemistry. Aliquot immediately.
ACETIC ACID 0.6%	Used for peptides that are insoluble in water (some hydrophobic sequences). Verify peptide compatibility against the supplier's data sheet.
0.9% SALINE	Used for some research peptides in dilution studies. Verify isotonic compatibility per literature.

PROCUREMENT NOTE

Bacteriostatic water is sold in 3 mL and 10 mL multi-dose vials. The 3 mL vial is ideal for reconstituting a single 5 mg peptide vial at 2.5 mg/mL. The 10 mL vial is the value option for labs running multiple reconstitutions per week — once opened, the 10 mL vial itself is good for 28 days refrigerated.

CHAPTER 2

Reconstitution, step by step

Reconstitution is the single most common point of failure in a peptide protocol. The compound itself may be 99.4% pure on arrival, but if it shears under agitation or precipitates against an incompatible diluent, the assay result you obtain next month will not match the COA.

Materials

- One lyophilized peptide vial (sealed, room temperature)
- One vial of bacteriostatic water at room temperature
- One sterile U-100 insulin syringe (31G × 6 mm)
- Two alcohol prep pads (70% isopropyl)
- Clean work surface; wash hands; bench-disinfected with the same alcohol pads

Procedure

1. **Bring vials to room temperature.**
   Cold liquid entering a cold peptide can shock-precipitate the powder. Let both sit out for 5–10 minutes.

2. **Swab both vial septa.**
   Use a fresh alcohol pad per septum. Let the alcohol dry for 30 seconds before piercing.

3. **Draw the diluent.**
   Pull the calculated volume of BAC water into the insulin syringe. Tap to clear any visible bubble at the plunger.

4. **Inject down the inner glass wall.**
   Hold the peptide vial at a 45° angle and let the diluent run down the side rather than landing directly on the lyophilized cake. This minimises shear.

5. **Do not shake.**
   Gently swirl the vial in a circular motion until the powder dissolves — typically 30–90 seconds. Shaking shears peptide bonds and produces foam that traps air.

6. **Inspect.**
   Solution should be clear and colourless. GHK-Cu is the documented exception — its solution is deep blue. Cloudiness or visible particulates indicate a failed reconstitution; do not use.

7. **Label.**
   Write the reconstitution date and the resulting concentration (mg/mL) directly on the vial label. Future-you will thank present-you.

8 **Refrigerate.**
Store at 2–8 °C. Do not freeze a reconstituted vial.

COMMON RECONSTITUTION MISTAKES

(1) Shaking the vial — shear damage. (2) Using cold diluent — precipitation. (3) Mis-calculating concentration before drawing the BAC water — leads to overdose or underdose every time. (4) Forgetting to label the date on the vial. (5) Storing the reconstituted vial in the freezer.

CHAPTER 3

U-100 insulin syringe math

The U-100 insulin syringe is the standard volumetric instrument for research-peptide work. The "U-100" notation means 100 units per millilitre — a holdover from insulin therapy where each unit corresponds to a specific quantity of hormone. For peptide research the units are pure volume markings:

100 UNITS	1.00 mL
50 UNITS	0.50 mL
25 UNITS	0.25 mL
10 UNITS	0.10 mL
1 UNIT	0.01 mL

The two-equation framework

Every peptide dose involves two simple equations: one for the concentration produced at reconstitution, and one for the syringe volume that delivers a given dose.

EQUATION 1 — CONCENTRATION

concentration (mg/mL) = vial mass (mg) ÷ BAC water added (mL)

EQUATION 2 — DOSE VOLUME

dose volume (mL) = dose (mg) ÷ concentration (mg/mL)

EQUATION 3 — SYRINGE UNITS

syringe units = dose volume (mL) × 100

Worked example

A KuroAminos 5 mg BPC-157 vial reconstituted with 2 mL of BAC water yields a concentration of 2.5 mg/mL. To draw a 250 µg (0.25 mg) study dose:

- Dose volume = 0.25 mg ÷ 2.5 mg/mL = 0.10 mL
- Syringe units = 0.10 mL × 100 = 10 units on a U-100 insulin syringe

SANITY CHECK

Whenever a calculation lands on an awkward number of syringe units (e.g. 7.5), re-derive the concentration with a different BAC water volume so the dose falls on a round mark. Drawing 7.5 units accurately on a U-100 syringe is nearly impossible.

CHAPTER 4

Concentration & dose reference tables

These tables are pre-computed for the vial sizes KuroAminos currently ships. Find your vial, your preferred concentration, and read across to the unit count for your target dose.

5 MG VIAL — COMMON RESEARCH DOSES (9Är•

BAC water	100 µg	200 µg	250 µg	500 µg
1.0 mL 5.00 mg/mL	2 u	4 u	5 u	10 u
2.0 mL 2.50 mg/mL	4 u	8 u	10 u	20 u
2.5 mL 2.00 mg/mL	5 u	10 u	12.5 u	25 u
3.0 mL 1.67 mg/mL	6 u	12 u	15 u	30 u

10 MG VIAL — COMMON RESEARCH DOSES (MG)

BAC water	1 mg	2 mg	2.5 mg	5 mg
1.0 mL 10.00 mg/mL	10 u	20 u	25 u	50 u
2.0 mL 5.00 mg/mL	20 u	40 u	50 u	100 u
3.0 mL 3.33 mg/mL	30 u	60 u	75 u	150 u

50 MG VIAL — COMMON RESEARCH DOSES (MG)

BAC water	1 mg	2 mg	5 mg	10 mg
5.0 mL 10.00 mg/mL	10 u	20 u	50 u	100 u

CHAPTER 5

Storage, aliquoting & stability

A peptide spends more of its life in storage than in active use. Storage discipline is therefore the single biggest determinant of reagent integrity at the point of assay.

Storage window summary

LYOPHILIZED, SEALED	" 20 °C, dark — up to 24 months from manufacture date.
LYOPHILIZED, OPENED	Reconstitute the same day. Do not store an opened vial dry.
RECONSTITUTED IN BAC WATER	2 – 8 °C, dark — up to 28 days. Discard any earlier turbidity.
RECONSTITUTED IN STERILE WATER	2 – 8 °C, dark — up to 24 hours. Aliquot and freeze the remainder.
FROZEN ALIQUOTS	" 20 °C or " 80 °C, dark — up to 6 months. One thaw cycle per aliquot.

Aliquoting protocol

- Aliquoting is recommended when reconstitution volume exceeds expected 28-day use. Divide the parent solution into single-use volumes immediately after reconstitution.
- Use sterile cryogenic vials (1.5 mL or 2 mL) with a recorded volume on each tube.
- Label each aliquot with date, concentration, and lot ID before freezing — frost obscures handwriting later.
- Thaw on the bench at room temperature, not in warm water. Use within four hours of thawing.
- Do not refreeze a thawed aliquot. Peptide chains shear with every freeze-thaw cycle.

Light, oxygen, and shear

- Light: chromophore-bearing peptides (GHK-Cu, PT-141 family) photodegrade under direct UV. Store in the original amber-protective box or wrap the vial in foil.
- Oxygen: cysteine-containing peptides (GHK has none, but many others do) oxidise at the disulfide bond. Minimise air contact by drawing diluent through the septum rather than removing the cap.
- Shear: never vortex a reconstituted peptide. Swirl, or use a low-rpm magnetic stir bar if dispersing into a buffer.

COLD-CHAIN REMINDER

Reagents shipped without cold-chain handling may arrive intact-looking but already degraded. Independent reverification on arrival (HPLC reassay) is best practice for any peptide that entered the supply chain outside a 2 – 8 °C window.

PART II

Regenerative & somatotropic peptides

Four peptides at the centre of soft-tissue, vascular, dermal, and somatotropic-axis research — BPC-157, TB-500, GHK-Cu, and CJC-1295 with DAC.

REGENERATIVE

BPC-157

Body Protection Compound 157 · Gastric pentadecapeptide

A 15-amino-acid peptide derived from a cytoprotective protein in human gastric juice. The most extensively studied peptide for tendon and soft-tissue research models.

CHEMICAL IDENTITY

SEQUENCE	Gly-Glu-Pro-Pro-Pro-Gly-Lys-Pro-Ala-Asp-Asp-Ala-Gly-Leu-Val
CAS NUMBER	137525-51-0
MOLECULAR FORMULA	C † ,H ‰ ˆN • †O , , (no Unicode subscripts in rendered PDF — see note)
MOLECULAR WEIGHT	1419.55 g/mol
FORM	Lyophilized white powder

Mechanism of action

BPC-157 is the 15-amino-acid sequence at the active region of the BPC protein, isolated from human gastric juice. The peptide is stable in gastric acid — a rarity that explains its survival and absorption from oral dosing in animal studies — and exerts multi-pathway cytoprotective effects.

In published models the principal mechanisms are: (1) activation of the VEGFR2 receptor with downstream upregulation of the Akt-eNOS pathway, producing angiogenesis [1]; (2) upregulation of the growth hormone receptor in tendon fibroblasts, increasing local responsiveness to circulating GH [2]; (3) modulation of nitric oxide synthesis in gastrointestinal mucosa; and (4) anti-inflammatory action via reduced pro-inflammatory cytokine release.

Published research

Krivic et al. (2008) demonstrated accelerated healing of transected rat Achilles tendons treated with BPC-157, with both faster tensile-strength recovery and stimulated tendocyte growth in vitro [3]. Subsequent imaging studies (Sikiric 2010) used VEGF, CD34, and FVIII antibodies to confirm modulated angiogenesis in BPC-157-treated muscle and tendon healing compared with controls [1].

More recent narrative and systematic reviews (2025–2026) survey the broader literature across rotator-cuff, ligament, and gastrointestinal mucosa models and conclude that BPC-157's effect is consistent across tissue types and species, with the angiogenic and GH-receptor pathways recurring as the most-cited mechanisms [4][5].

KEY REPORTED OUTCOMES

- Improved tendon-to-bone healing markers in rodent rotator-cuff models
- Angiogenesis and VEGFR2 expression upregulation in vitro
- Faster transected-tendon recovery vs. saline-treated controls
-

Modulation of nitric-oxide system in gastrointestinal mucosa

Pharmacokinetics

REPORTED ANIMAL-STUDY DOSES	10 µg/kg subcutaneous (most studies); some at 250 µg total dose
REPORTED HALF-LIFE (ANIMAL)	Approximately 4 hours after subcutaneous dosing
ONSET OF EFFECT (ANIMAL)	Hours to days, depending on tissue type

Reconstitution recipe

The KuroAminos vial ships 5 mg of lyophilized BPC-157. The two most common reconstitution choices, with corresponding U-100 syringe units for a 250 µg study dose, are:

2 ML BAC WATER	2.5 mg/mL · 10 units = 250 µg
1 ML BAC WATER	5.0 mg/mL · 5 units = 250 µg

NOTE

Higher concentrations (1 mL BAC) yield finer dose resolution but increase the risk of syringe-volume rounding error on small doses. Most published animal protocols use 2 mL BAC.

Storage

- Lyophilized vial: " 20 °C, dark — up to 24 months from manufacture date.
- Reconstituted vial: 2 – 8 °C — up to 28 days. Do not freeze the reconstituted solution.
- Do not vortex or shake. Swirl gently to dissolve.

References

[1] Sikiric et al. (2010) — Modulatory effect of gastric pentadecapeptide BPC 157 on angiogenesis in muscle and tendon healing.

[2] Chang et al. (2014) — Pentadecapeptide BPC 157 enhances the growth hormone receptor expression in tendon fibroblasts.

[3] Krivic et al. (2008) — Gastric pentadecapeptide BPC 157 accelerates healing of transected rat Achilles tendon.

[4] Various (2025) — Regeneration or Risk? A Narrative Review of BPC-157 for Musculoskeletal Healing. PMC12446177.

[5] Various (2026) — From Regeneration to Analgesia: The Role of BPC-157 in Tissue Repair and Pain Management. MDPI IJMS.

REGENERATIVE

TB-500

Synthetic fragment of Thymosin ;"ÓB † 7F—`e site)

A synthetic peptide built around the actin-binding active region of Thymosin ;"ÓBÂ F†R incipal monomeric actin-sequestering peptide in mammalian cells.

CHEMICAL IDENTITY

PARENT PROTEIN	Thymosin ;"ÓB ƒC2 Ö–æò 6–G0, naturally occurring)
ACTIVE REGION	LKKTETQ (residues 17–23) — the actin-binding sequence
CAS NUMBER (FULL T9#B•	77591-33-4
MOLECULAR WEIGHT (FULL T9#B•	4963.4 g/mol
FORM	Lyophilized white powder

Mechanism of action

Thymosin ;"Ó@ is the major monomeric actin-sequestering peptide in cells, capable of depolymerising F-actin and modulating the cytoskeletal dynamics of cell migration [1]. The seven-residue LKKTETQ segment is the molecular site responsible for actin binding, cell migration, and wound healing — and is the basis for the truncated synthetic peptide research labs reference as TB-500.

By binding G-actin and promoting cell migration, T;#@ mobilises stem and progenitor cells that go on to form new blood vessels (angiogenesis) and regenerate tissue [2]. After injury, T;#@ is released by platelets, macrophages, and other cell types to protect adjacent cells from secondary damage, suppress apoptosis, reduce local inflammation, and inhibit microbial growth.

Published research

Malinda et al. (1999) demonstrated that T;#@ accelerates dermal-wound healing in rodent models, with subsequent work extending the effect to diabetic and aged animals as well as thermal burns [2][3]. In Phase 2 human work, T;#@ accelerated repair in patients with pressure ulcers, stasis ulcers, and epidermolysis bullosa lesions [4].

Beyond skin, T;#@ has been evaluated in animal models of myocardial infarction, ischemia-reperfusion injury, xerophthalmia, liver and renal fibrosis, and ulcerative colitis [5]. A consistent finding is the reduction in scar-forming myofibroblasts and overall fibrosis — distinguishing T;#BÖÖVF– FV@ repair from default scar-tissue replacement.

KEY REPORTED OUTCOMES

- G-actin sequestration and cytoskeletal modulation in vitro
- Stem-/progenitor-cell migration and recruitment to wound sites
- Endothelial cell proliferation and tube formation
- Reduced fibrosis and scar formation in dermal and cardiac repair models

Pharmacokinetics

REPORTED RESEARCH-PROTOCOL DOSES	2 – 2.5 mg per dose, twice weekly (animal protocols)
REPORTED HALF-LIFE	Hours (the active fragment is rapidly cleared)
ONSET OF EFFECT	Days; cumulative across weekly dosing

Reconstitution recipe

The KuroAminos vial ships 5 mg of lyophilized TB-500. Most rodent and large-animal protocols use a 2 mg dose, with reconstitution chosen for round-unit dosing:

2 ML BAC WATER	2.5 mg/mL · 80 units = 2 mg
2.5 ML BAC WATER	2.0 mg/mL · 100 units = 2 mg (one full syringe)

NOTE

The 2.5 mL reconstitution lands the 2 mg dose at exactly one full U-100 syringe, eliminating rounding error. This is the most common protocol choice for TB-500 research.

Storage

- Lyophilized vial: " 20 °C, dark — up to 24 months.
- Reconstituted vial: 2 – 8 °C, dark — up to 28 days.
- Do not freeze reconstituted material; aliquot before freezing if longer storage is required.

References

[1] Goldstein, Hannappel, Kleinman (2005) — Thymosin ;"ÓC actin-sequestering protein moonlights to repair injured tissues.

[2] Malinda et al. (1999) — Thymosin ;"ÓB 66VÆW ates wound healing.

[3] Sosne et al. (2009) — Thymosin ;"ÓC a novel corneal wound healing and anti-inflammatory agent.

[4] Crockford et al. (2011) — Thymosin ;"ÓC a multi-functional regenerative peptide.

[5] Frontiers in Endocrinology (2021) — Progress on the Function and Application of Thymosin ;"ÓBà

REGENERATIVE · SKIN & CONNECTIVE TISSUE

GHK-Cu

Glycyl-L-Histidyl-L-Lysine : Copper(II) complex

A naturally occurring copper-binding tripeptide first isolated from human plasma by Loren Pickart. The most-cited research peptide in dermal fibroblast and collagen-synthesis studies.

CHEMICAL IDENTITY

SEQUENCE	Gly-His-Lys, complexed with Cu(II)
CAS NUMBER	89030-95-5
MOLECULAR FORMULA	C • „H , „CuN †O „
MOLECULAR WEIGHT	404.0 g/mol
FORM	Deep blue lyophilized powder

Mechanism of action

GHK is a tripeptide with affinity for copper(II) ions. As a copper-bound complex, GHK-Cu modulates multiple regenerative and remodelling pathways in dermal fibroblasts and connective tissue [1]. It is one of the few peptides for which the copper coordination is intrinsic to function — apo-GHK without copper has substantially reduced activity.

The pathway breadth is unusual: GHK-Cu stimulates collagen and glycosaminoglycan synthesis [1][2], modulates matrix metalloproteinase-2 (MMP-2) expression to balance synthesis with remodelling [3], promotes angiogenesis to restore tissue perfusion, and acts as an antioxidant through its copper-mediated redox chemistry [4].

Published research

Foundational work by Pickart and colleagues (1988) demonstrated stimulated collagen synthesis in human fibroblast cultures exposed to GHK-Cu [1]. Subsequent gene-expression studies (Pickart & Margolina 2018) using Affymetrix microarray data showed GHK-Cu modifies the expression of ~4,000 genes, including normalization of expression patterns in damaged or aged tissues toward a more youthful baseline [2].

In wound-healing models GHK-Cu accelerated closure in superficial dermal wounds and restored replicative vitality to fibroblasts after radiation injury [3]. The peptide has also been examined in lung connective tissue, bone, liver, and stomach lining — with consistent direction of effect across tissue type.

KEY REPORTED OUTCOMES

- Stimulated collagen and elastin synthesis in fibroblast cultures
- MMP-2 modulation supporting balanced remodelling
- Angiogenesis and improved tissue perfusion
- Antioxidant gene expression with copper-mediated redox activity
-

Reduced scar formation in animal dermal-repair models

Pharmacokinetics

REPORTED RESEARCH APPLICATIONS	Topical formulations (0.05% – 5%) and subcutaneous studies
REPORTED HALF-LIFE (SYSTEMIC)	Minutes (cleared rapidly; topical use bypasses systemic exposure)
LIGHT SENSITIVITY	Photodegrades under UV; store in original protective box

Reconstitution recipe

The KuroAminos GHK-Cu vial ships 50 mg. Standard research dilutions:

5 ML BAC WATER	10 mg/mL · 5 units = 0.5 mg; 10 units = 1 mg
10 ML BAC WATER	5 mg/mL · 10 units = 0.5 mg; 20 units = 1 mg
TOPICAL STUDY FORMULATION	100 mg / 100 mL = 0.1% w/v (light-protected)

NOTE

GHK-Cu solution is the documented exception to the "clear and colourless" rule — a properly reconstituted vial is deep blue from the copper coordination. Cloudiness or precipitation is still a failed reconstitution.

Storage

- Lyophilized vial: store cool and dark; the dry powder is shelf-stable for 18 – 24 months.
- Reconstituted vial: refrigerate at 2 – 8 °C, wrap in foil to protect from light, use within 28 days.
- Do not freeze reconstituted material — repeated thaw cycles destabilise the copper coordination.

References

[1] Maquart et al. (1988) — Stimulation of collagen synthesis in fibroblast cultures by the tripeptide-copper complex GHK-Cu² z.

[2] Pickart & Margolina (2018) — Regenerative and Protective Actions of the GHK-Cu Peptide in the Light of the New Gene Data.

[3] Pickart (2008) — The human tri-peptide GHK and tissue remodeling.

[4] Pickart et al. (2012) — The Human Tripeptide GHK-Cu in Prevention of Oxidative Stress and Degenerative Conditions of Aging.

[5] Siméon et al. (2000) — The tripeptide-copper complex GHK-Cu² z stimulates MMP-2 expression by fibroblast cultures.

SOMATOTROPIC AXIS

CJC-1295 with DAC

Long-acting GHRH(1-29) analog with Drug Affinity Complex

A tetrasubstituted analog of human GHRH(1-29) covalently linked to a maleimidopropionic acid moiety that binds endogenous serum albumin — extending the in-vivo half-life from minutes to roughly 6–8 days.

CHEMICAL IDENTITY

PARENT SEQUENCE	hGRF(1-29) modified at positions 2, 8, 15, 27
DAC MODIFICATION	Maleimidopropionic acid (Mpa) — covalent thiol bond to albumin Cys-34
CAS NUMBER	863288-34-0
MOLECULAR FORMULA	C • † …H , † ‰N „ ‡O „ †
MOLECULAR WEIGHT	3647.16 g/mol
FORM	Lyophilized white powder

Mechanism of action

CJC-1295 is a synthetic analog of growth-hormone-releasing hormone (GHRH) bearing four amino-acid substitutions that confer resistance to enzymatic degradation, plus the proprietary DAC modification — a small maleimidopropionic acid group that covalently bonds to a free thiol on circulating serum albumin (Cys-34) [1]. The albumin conjugation is the key innovation: native GHRH has a plasma half-life of ~7 minutes; CJC-1295 with DAC has a half-life of 5.8 – 8.1 days [2][3].

Despite the continuous receptor occupancy, GH secretion remains pulsatile — Ionescu and Frohman (2006) demonstrated that pituitary somatotrophs maintain their natural pulsatile output even under sustained CJC-1295 stimulation, with both basal and peak GH levels elevated [3]. Mean IGF-1 levels remain above baseline for up to 28 days after a single multi-dose course.

Published research

Jetté et al. (2005) first identified CJC-1295 as a long-lasting GHRH analog and demonstrated activation of the GRF receptor on the anterior pituitary in rats [1]. Teichman et al. (2006) extended this to healthy human adults, with prolonged stimulation of GH and IGF-I secretion confirmed over multiple weeks [2]. Alba et al. (2006) showed once-daily CJC-1295 normalized growth in the GHRH-knockout mouse, validating the mechanism in a controlled deficiency model [4].

The same studies report increased total pituitary RNA and GH mRNA after CJC-1295 administration, suggesting somatotroph proliferation in addition to acute secretory effects. This is the basis for protocols that pulse CJC-1295 in courses with rest periods rather than continuous administration.

KEY REPORTED OUTCOMES

Half-life extension from minutes to 5.8 – 8.1 days via albumin binding

- Preserved pulsatile GH secretion under sustained receptor stimulation
- Sustained IGF-1 elevation up to 28 days post-dose
- Somatotroph proliferation evidence in pituitary RNA assays

Pharmacokinetics

REPORTED HALF-LIFE	5.8 – 8.1 days (humans, after subcutaneous dosing)
IGF-1 ELEVATION DURATION	Up to 28 days after multi-dose course
REPORTED RESEARCH-PROTOCOL DOSING	1 – 2 mg per dose, weekly or every other week
ROUTE	Subcutaneous in published research

Reconstitution recipe

The KuroAminos CJC-1295 DAC vial ships 5 mg. Standard reconstitution choices:

2 ML BAC WATER	2.5 mg/mL · 40 units = 1 mg; 80 units = 2 mg
2.5 ML BAC WATER	2.0 mg/mL · 50 units = 1 mg; 100 units = 2 mg (full syringe)

NOTE

Because the published research dose is typically 1 – 2 mg, the 2.5 mL reconstitution lands both standard doses on round, easily measured syringe volumes.

Storage

- Lyophilized vial: " 20 °C, dark — up to 24 months.
- Reconstituted vial: 2 – 8 °C, dark — up to 28 days. Refrigerator door storage is acceptable; avoid the back wall (risk of accidental freezing).
- Do not vortex. Swirl gently.

References

[1] Jetté et al. (2005) — hGRF(1-29)-albumin bioconjugates activate the GRF receptor on the anterior pituitary in rats.

[2] Teichman et al. (2006) — Prolonged Stimulation of GH and IGF-I Secretion by CJC-1295 in Healthy Adults. JCEM 91(3):799.

[3] Ionescu & Frohman (2006) — Pulsatile Secretion of GH Persists during Continuous Stimulation by CJC-1295. JCEM 91(12):4792.

[4] Alba et al. (2006) — Once-daily CJC-1295 normalizes growth in the GHRH knockout mouse.

PART III

Metabolic & GLP-axis peptides

Three of the most clinically validated metabolic peptides — semaglutide (GLP-1), tirzepatide (GIP/GLP-1 dual), and the investigational triple agonist GLP-3RT (retatrutide).

METABOLIC · GLP-1

Semaglutide

GLP-1 receptor agonist · Brand: Ozempic, Wegovy, Rybelsus

A long-acting glucagon-like peptide-1 receptor agonist. The first GLP-1 molecule with a ~160-hour half-life supporting once-weekly subcutaneous dosing.

CHEMICAL IDENTITY

PARENT HORMONE	Human GLP-1(7-37)
MODIFICATIONS	Amino-acid substitution + C18 fatty-diacid side chain for albumin binding
CAS NUMBER	910463-68-2
MOLECULAR FORMULA	C • ˆ ‡H , ‰ •N „ …O … ‰
MOLECULAR WEIGHT	4113.58 g/mol
FORM	Lyophilized white powder

Mechanism of action

Semaglutide is a glucagon-like peptide-1 receptor (GLP-1R) agonist [1]. GLP-1 stimulates insulin secretion in a glucose-dependent manner, inhibits glucagon secretion, slows gastric emptying, and acts centrally on GLP-1 receptors in the hypothalamus and hindbrain to increase satiety and reduce appetite [2].

The molecular engineering that distinguishes semaglutide from earlier GLP-1 agonists is two-fold: specific amino-acid substitutions confer resistance to dipeptidyl peptidase-4 (DPP-4) enzymatic degradation, and the addition of a C18 fatty-diacid side chain enables non-covalent binding to serum albumin. Together these modifications extend the in-vivo half-life to approximately 160 hours, supporting once-weekly subcutaneous dosing [2].

Published research

The STEP 1 trial (Wilding et al. 2021) was a 68-week Phase 3a study in adults with overweight or obesity. Subjects receiving once-weekly semaglutide 2.4 mg achieved a mean weight loss of 14.85% compared with 2.41% in the placebo group [1]. Across the broader STEP programme nearly two-thirds of patients achieved a body-weight reduction of "e 15%.

The SUSTAIN programme, conducted in type-2 diabetes, validated significant reductions in HbA1c and weight, and a 26% reduction in relative risk of major adverse cardiovascular events versus placebo [3]. Mechanistic and translational reviews (2024–2025) provide comprehensive coverage of the molecule's bench-to-bedside development arc [4][5].

KEY REPORTED OUTCOMES

- Mean weight loss of 14.85% at 68 weeks (STEP 1, 2.4 mg dose) vs. 2.41% placebo
- 26% relative risk reduction in major adverse cardiovascular events (SUSTAIN-6)
- Robust HbA1c reductions in type-2 diabetes populations
-

Once-weekly subcutaneous dosing supported by ~160-hour half-life

Pharmacokinetics

REPORTED HALF-LIFE	~160 hours (approximately 7 days)
TRIAL DOSING SCHEDULE	Weekly titration: 0.25 !’ 0.5 !’ 1.0 !’ 1.7 !’ 2.4 mg over 16 weeks
ROUTE	Subcutaneous (clinical), oral (Rybelsus formulation)
TMAX	1 – 3 days after subcutaneous administration

Reconstitution recipe

The KuroAminos semaglutide vial ships 5 mg. The standard STEP-1 titration protocol — 0.25 mg, 0.5 mg, 1.0 mg, 1.7 mg, 2.4 mg — pairs cleanly with a 2 mL reconstitution:

2 ML BAC WATER	2.5 mg/mL · 10u = 0.25 mg · 20u = 0.5 mg · 40u = 1 mg · 68u = 1.7 mg · 96u = 2.4 mg
1 ML BAC WATER	5.0 mg/mL · 5u = 0.25 mg · 10u = 0.5 mg · 20u = 1 mg · 34u = 1.7 mg · 48u = 2.4 mg

NOTE

The 2 mL reconstitution gives a 2.5 mg/mL working solution and lets every STEP-protocol dose land on a clean syringe-unit mark. Most research labs adopt this dilution.

Storage

- Lyophilized vial: refrigerate at 2 – 8 °C or freeze at " 20 °C, dark — up to 24 months.
- Reconstituted vial: 2 – 8 °C, dark — up to 28 days. Do not freeze the reconstituted material.
- Inspect before each use; discard if turbid.

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[1] Wilding et al. (2021) — Once-Weekly Semaglutide in Adults with Overweight or Obesity (STEP 1). NEJM 384:989-1002.

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METABOLIC · GIP+GLP-1

Tirzepatide

Dual GIP / GLP-1 receptor co-agonist · Brand: Mounjaro, Zepbound

A 39-amino-acid synthetic peptide that simultaneously activates the GIP and GLP-1 receptors, producing larger reductions in HbA1c and body weight than GLP-1 monoagonists.

CHEMICAL IDENTITY

DEVELOPMENT CODE	LY3298176
CAS NUMBER	2023788-19-2
MOLECULAR FORMULA	C , , …H *ƒ* „ ˆN „ ˆO † ˆ
MOLECULAR WEIGHT	4813.45 g/mol
FORM	Lyophilized white powder

Mechanism of action

Tirzepatide is a single peptide engineered to bind and activate both the GIP receptor and the GLP-1 receptor simultaneously — a so-called dual-incretin or co-agonist mechanism [1]. GIP (glucose-dependent insulinotropic polypeptide) and GLP-1 are the two principal intestinal incretin hormones; they are released after nutrient ingestion and stimulate insulin secretion from pancreatic ;"Ö6VÆÇ0. Co-activation of both receptors produces additive and in some cases synergistic effects on glycaemic control and body weight beyond what either single agonist achieves [2].

Mechanistically the dual activation also engages central appetite circuits and gastric-emptying control, with the combined effect mediated through both peripheral organs and the central nervous system [3]. The peptide has a fatty-acid moiety enabling albumin binding similar to semaglutide, giving a ~5-day half-life that supports once-weekly dosing.

Published research

The SURPASS Phase III programme comprises ten clinical trials, including five global trials and the global SURPASS-CVOT cardiovascular outcomes trial, with more than 13,000 patients with type-2 diabetes [4]. The primary endpoint across the programme was change in HbA1c relative to baseline.

Across SURPASS, tirzepatide showed robust improvements in glycaemic control and body weight without an increased risk of hypoglycaemia, and its safety profile was consistent with the broader GLP-1 receptor agonist class [3] [5]. SURPASS-2 specifically compared tirzepatide to semaglutide 1 mg head-to-head and demonstrated superiority across HbA1c and weight endpoints. Tirzepatide became the first dual GIP/GLP-1R agonist approved for type-2 diabetes in the United States.

KEY REPORTED OUTCOMES

- Superior HbA1c reduction vs. semaglutide 1 mg (SURPASS-2)
-

Body-weight reductions exceeding GLP-1 monoagonists

- No increased hypoglycaemia risk vs. comparators
- Safety profile consistent with GLP-1 receptor agonist class

Pharmacokinetics

REPORTED HALF-LIFE	~5 days
TRIAL DOSING SCHEDULE	Weekly titration starting at 2.5 mg, escalating monthly: 2.5 !’ 5 !’ 7.5 !’ 10 !’ 12.5 !’ 15 mg
ROUTE	Subcutaneous
TMAX	1 – 3 days after subcutaneous administration

Reconstitution recipe

The KuroAminos tirzepatide vial ships 10 mg. The published SURPASS titration steps land cleanly on a 2 mL reconstitution:

2 ML BAC WATER	5 mg/mL · 5u = 2.5 mg · 10u = 5 mg · 15u = 7.5 mg · 20u = 10 mg · 25u = 12.5 mg · 30u = 15 mg
1 ML BAC WATER	10 mg/mL · 2.5u = 2.5 mg · 5u = 5 mg · 7.5u = 7.5 mg · 10u = 10 mg · 12.5u = 12.5 mg · 15u = 15 mg

NOTE

The 2 mL reconstitution puts every SURPASS dose on a 5-unit increment of the U-100 syringe, eliminating fractional-unit rounding.

Storage

- Lyophilized vial: refrigerate at 2 – 8 °C or freeze at " 20 °C — up to 24 months.
- Reconstituted vial: 2 – 8 °C — up to 28 days. Do not freeze the reconstituted material.

References

[1] Frías et al. (2021) — Tirzepatide versus Semaglutide Once Weekly in Patients with Type 2 Diabetes (SURPASS-2). NEJM 385:503-515.

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[4] Various (2023) — Research Progress on the GIP/GLP-1 Receptor Coagonist Tirzepatide. PMC10122586.

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METABOLIC · TRIPLE AGONIST (FRONTIER)

GLP-3RT (Retatrutide)

LY3437943 · Triple GIP / GLP-1 / Glucagon receptor agonist

An investigational single-molecule agonist of the GIP, GLP-1, and glucagon receptors. Phase 2 trial results published in NEJM (August 2023) showed dose-dependent weight loss exceeding any prior pharmacotherapy.

CHEMICAL IDENTITY

DEVELOPMENT CODE	LY3437943
CAS NUMBER	2381089-83-2
STRUCTURE	Single peptide conjugated to a fatty-diacid moiety
RECEPTOR AGONISM	GIP, GLP-1, and glucagon receptors (triple)
FORM	Lyophilized white powder

Mechanism of action

Retatrutide is engineered as a single peptide that activates three receptors simultaneously: GIP (glucose-dependent insulinotropic polypeptide), GLP-1 (glucagon-like peptide-1), and the glucagon receptor (GCG) [1]. The molecule is conjugated to a fatty-diacid moiety similar to semaglutide and tirzepatide, conferring albumin binding and a once-weekly dosing schedule.

Structural cryo-EM and binding studies have characterised how the single peptide accommodates the geometric and electrostatic requirements of all three receptors [2]. The glucagon component is mechanistically distinct from semaglutide and tirzepatide — glucagon receptor activation increases energy expenditure via hepatic and adipose metabolism in addition to the satiety and insulinotropic effects of the GIP/GLP-1 components.

Published research

The Jastreboff et al. (2023) Phase 2 trial published in NEJM was a randomised, placebo-controlled study of adults with BMI "e 30 (or 27 with at least one weight-related condition). Participants received once-weekly retatrutide at 1, 4, 8, or 12 mg or placebo for 48 weeks [1].

At 48 weeks the 12 mg group achieved a mean weight loss of 24.2% — substantially greater than any prior single pharmacological agent in obesity research. Weight loss at 24 weeks was already 17.5% in the same group [1][3]. Subsequent translational work has examined retatrutide's effects on obesity-associated cancer progression [4] and broader metabolic outcomes [5].

KEY REPORTED OUTCOMES

- 24.2% mean weight loss at 48 weeks (12 mg group) — Phase 2 trial
- 17.5% mean weight loss at 24 weeks (12 mg group)
- Dose-dependent efficacy across 1, 4, 8, 12 mg arms
-

Pharmacokinetics

REPORTED HALF-LIFE	Approximately 6 days
TRIAL DOSING SCHEDULE	Weekly titration: 2 mg !’ 4 mg !’ 8 mg !’ 12 mg over multiple months
ROUTE	Subcutaneous
TMAX	Days after subcutaneous administration

Reconstitution recipe

The KuroAminos GLP-3RT vial ships 10 mg. The NEJM Phase 2 dose ladder (1, 2, 4, 8, 12 mg) pairs cleanly with a 2 mL reconstitution:

2 ML BAC WATER	5 mg/mL · 2u = 1 mg · 4u = 2 mg · 8u = 4 mg · 16u = 8 mg · 24u = 12 mg
1 ML BAC WATER	10 mg/mL · 1u = 1 mg · 2u = 2 mg · 4u = 4 mg · 8u = 8 mg · 12u = 12 mg

NOTE

The 1 mL reconstitution puts each NEJM trial dose on a clean integer unit — useful for early titration steps where 1 unit equals 1 mg. The 2 mL gives finer resolution for the smaller titration steps.

Storage

- Lyophilized vial: refrigerate at 2 – 8 °C or freeze at " 20 °C — up to 24 months.
- Reconstituted vial: 2 – 8 °C — up to 28 days.
- Discard any vial that shows turbidity or visible particulates after reconstitution.

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PART IV

References & resources

Bibliography, glossary, and contact information for ongoing technical support and lot-level certificate requests.

PART IV

Bibliography & primary literature

All citations below are indexed on PubMed, NEJM, The Lancet, JCEM (Oxford Academic), or MDPI / Frontiers. Where available, the canonical URL is included. Numbers correspond to in-monograph citation markers; some references support more than one peptide and are therefore listed once.

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RETATRUTIDE (GLP-3RT)

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PART IV

Glossary

Agonist — A molecule that binds a receptor and activates it, mimicking the natural ligand.

Albumin binding — Reversible association of a drug molecule with serum albumin, the most abundant blood protein. Used to extend plasma half-life by reducing renal clearance.

Bacteriostatic water (BAC water) — Sterile water for injection preserved with 0.9% benzyl alcohol. Standard diluent for lyophilized peptides.

BMI — Body-mass index; mass (kg) divided by height (m) squared.

CAS number — Chemical Abstracts Service registry number; a unique numerical identifier for a chemical substance.

COA — Certificate of Analysis; the lot-specific report from a third-party analytical lab quantifying purity, identity, and contamination of a peptide batch.

Co-agonist / dual agonist — A single molecule that activates two distinct receptors simultaneously (e.g. tirzepatide on GIP and GLP-1 receptors).

DAC — Drug Affinity Complex; a maleimidopropionic acid moiety appended to a peptide to drive covalent binding to serum albumin.

GHRH — Growth Hormone Releasing Hormone; hypothalamic peptide that stimulates pulsatile GH release from the anterior pituitary.

GIP — Glucose-dependent insulinotropic polypeptide; intestinal incretin hormone.

GLP-1 — Glucagon-Like Peptide-1; intestinal incretin hormone with insulinotropic, satiety-promoting, and gastric-emptying effects.

GLP-3RT — Catalog identifier for retatrutide, a triple agonist of GIP, GLP-1, and glucagon receptors.

HPLC — High-Performance Liquid Chromatography; the gold-standard analytical technique for peptide purity assay.

Lyophilized — Freeze-dried; the form in which most research peptides ship to preserve stability.

Pulsatility (GH) — The natural pattern of bolus growth-hormone release from the pituitary in distinct waves rather than continuous secretion.

SPPS — Solid-Phase Peptide Synthesis; the standard chemistry for producing research peptides.

Triple agonist — A single molecule that activates three distinct receptors simultaneously (retatrutide on GIP, GLP-1, and glucagon receptors).

U-100 syringe — Insulin syringe calibrated so that 100 units = 1 mL. The standard volumetric instrument for peptide research dosing.

VEGF / VEGFR2 — Vascular Endothelial Growth Factor and its type-2 receptor; the signalling pair that orchestrates new blood-vessel formation.

PART IV

About KuroAminos

KuroAminos is a United States research-peptide supplier built around a single thesis: lab-grade reproducibility starts with reagent integrity. We synthesize, assay, and dispatch every batch with the discipline a published-paper laboratory expects.

Quality protocol

- HPLC and ESI-MS verification on every lot at independent third-party labs.
- Lot-locked Certificates of Analysis — the COA you download corresponds to the exact vial in your freezer, not a generic product spec.
- Cold-chain shipping with insulated thermal liners and refrigerant from our Princeton, NJ facility.
- 24-hour fulfilment Monday – Friday on every in-stock order.

Stay in touch

For lot-COA requests, bulk pricing, or technical questions: research@kuroaminos.com. Our research customers also receive monthly updates with new monographs, fresh literature roundups, and access to the KuroAminos research library.

EDITION NOTE

This handbook is a living document. As new literature is published — particularly for the GLP-axis molecules — we revise the relevant monographs and re-issue the PDF. Subscribers to research@kuroaminos.com receive each revision automatically.

KuroAminos

Precision peptides for serious research.

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