EDUCATIONAL GUIDE · PART 1

A Practical Guide to Peptides

What peptides are, what the science actually shows, and what to understand before considering them.

A note before you begin

This guide is written to be genuinely useful and honest. Peptides are one of the most interesting areas in modern medicine, and a few peptide-based medicines have transformed treatment for conditions like obesity and type 2 diabetes. At the same time, many compounds marketed as "peptides" for wellness, recovery, and anti-aging are **not approved for human use** by Health Canada, the U.S. FDA, or comparable regulators. They are sold as "research chemicals," often with little oversight of purity or dosing, and the evidence behind them ranges from strong to almost entirely preliminary.

You'll see both realities reflected throughout. Where a peptide is a proven, approved medicine, this guide says so. Where the excitement is running ahead of the evidence, it says that too. The goal is to leave you better informed — not to sell you anything.

This document is educational and is **not medical advice**. Nothing here should be used to start, stop, or self-administer any substance. Decisions about any of these compounds should be made with a licensed physician who knows your health history.

1. Introduction to Peptides

What is a peptide?

A peptide is a short chain of amino acids — the same building blocks that make up proteins. Amino acids link together like beads on a string. When the chain is short (roughly 2 to 50 amino acids), we call it a peptide. When it gets longer and folds into a complex three-dimensional shape, we call it a protein.

So the line between "peptide" and "protein" is mostly about size and complexity:

- **Peptides** are small, relatively simple chains. Many act as signaling molecules — chemical messages that tell cells what to do.
- **Proteins** are large, folded structures that do the heavy lifting of biology: building tissue, speeding up chemical reactions (enzymes), forming antibodies, and carrying things around the body.

Your body makes thousands of its own peptides. Insulin (which regulates blood sugar), oxytocin (involved in bonding and labor), and glucagon-like peptide-1 or GLP-1 (which influences appetite and blood sugar) are all natural peptides. The peptide medicines and research compounds people talk about today are usually either copies of these natural messengers or modified versions designed to last longer or act more selectively.

How do peptides work in the body?

Most peptides work by binding to **receptors** — specialized docking sites on the surface of cells. Think of a receptor as a lock and the peptide as a key. When the right peptide fits its receptor, it triggers a change inside the cell: switching a process on or off, ramping production of a substance up or down, or telling the cell to grow, repair, or migrate.

Because this signaling is often very specific, peptides can produce targeted effects with — in principle — fewer off-target consequences than broader drugs. That selectivity is a big part of why pharmaceutical companies have invested heavily in peptide medicines.

A practical limitation: most peptides are fragile. The digestive system breaks them down like any other protein in food, which is why so many peptide drugs (insulin being the classic example) are injected rather than swallowed. Newer chemistry has produced some oral and nasal options, but injection remains common.

The short version

A peptide is a small chain of amino acids that usually acts as a biological message. Some are well-understood medicines; others are experimental. Understanding which is which is the single most important thing this guide can give you.

2. Key Benefits of Peptides

Peptides are studied across many areas of health. Below is what the research suggests in each category, along with the biological mechanism where it's understood. An important caveat applies throughout: **strong evidence in a lab dish or in mice is not the same as proven benefit in humans.** Categories are noted accordingly.

Skin & anti-aging

This is one of the better-supported areas, particularly for topical (applied-to-skin) copper peptides.

- **Mechanism:** Certain peptides signal skin cells (fibroblasts) to produce more collagen, elastin, and the gel-like molecules that keep skin plump and firm. The copper peptide GHK-Cu also appears to influence a remarkably broad set of genes involved in tissue repair and remodeling.
- **What it may mean:** Reduced appearance of fine lines, improved skin firmness and density, support for wound healing and recovery after procedures like microneedling.
- **Evidence quality:** Topical GHK-Cu has human clinical data behind it and a long safety record in cosmetics. Injectable versions are far less studied.

Muscle growth & recovery

- **Mechanism:** Growth-hormone-stimulating peptides (like the GHRH analog CJC-1295 and the secretagogue Ipamorelin) prompt the pituitary gland to release the body's own growth hormone in natural, pulse-like bursts. Growth hormone in turn raises IGF-1, a hormone central to building and repairing muscle. Repair-focused peptides like BPC-157 and TB-500 are studied for their effects on tendon, ligament, and muscle healing.
- **What it may mean:** Faster recovery, improved body composition, support for injured connective tissue.
- **Evidence quality:** The GH-stimulating peptides have human pharmacology data showing they do raise GH and IGF-1, but rigorous trials on muscle and performance outcomes are limited. The repair peptides (BPC-157, TB-500) are supported mostly by **animal studies**, with very little human trial data.

Fat loss

This is where peptides have made their biggest, most rigorously proven impact — but specifically through **approved prescription medicines**, not research chemicals.

- **Mechanism:** GLP-1 receptor agonists (semaglutide) and the dual GIP/GLP-1 agonist tirzepatide act on the gut-brain axis to reduce appetite, slow stomach emptying, and improve how the body handles blood sugar. The investigational triple agonist retatrutide adds a third target (the glucagon receptor) that also raises energy expenditure.

- **What it may mean:** Substantial, sustained weight loss and, for semaglutide, proven reduction in heart attacks and strokes in high-risk patients.
- **Evidence quality:** Excellent for semaglutide and tirzepatide (large randomized trials, regulatory approval). Promising but still investigational for retatrutide.

Hormone regulation

- **Mechanism:** Growth-hormone secretagogues nudge the body's own hormonal rhythms rather than replacing hormones directly, which in theory preserves natural feedback control. Epithalon is studied for its effect on the pineal gland and melatonin, which governs sleep and circadian rhythm.
- **Evidence quality:** Mechanistically plausible; human outcome data are thin, and much of the Epithalon work comes from a single research group.

Cognitive function

- **Mechanism:** Some peptides influence neurotransmitters, brain blood flow, or stress signaling. GHK-Cu has shown gene-expression effects relevant to nervous-system function in laboratory work; restored melatonin rhythms (the proposed Epithalon effect) can indirectly support cognition through better sleep.
- **Evidence quality:** Early and largely preclinical. Claims of direct cognitive enhancement in healthy people are not well established.

Immune support

- **Mechanism:** Thymus-derived peptides (the thymosin family, which includes the parent molecule of TB-500) are involved in immune cell regulation. Some peptides modulate inflammation rather than simply suppressing or boosting it.
- **Evidence quality:** Biologically grounded for the natural thymic peptides; the wellness versions are less studied in humans.

Gut health

- **Mechanism:** BPC-157 is derived from a protein found in human gastric juice, and its most consistent laboratory evidence is in healing the lining of the stomach and intestine and protecting against ulcer-type damage.
- **Evidence quality:** The gut-protective effect is the **strongest and most replicated** finding for BPC-157 — but, again, overwhelmingly in rodents, with minimal human trial data.

3. Research & Studies Summary

Below are notable, real studies, written for a general reader. Each entry names the peptide, what was tested, the key finding, and the source. Pay attention to the **study type** label — it tells you how much weight a finding can bear. A large human trial is far more convincing than a single experiment in cells or mice.

1. Semaglutide and heart health (the SELECT trial)

Peptide: Semaglutide (a GLP-1 medicine; brand names Ozempic/Wegovy). *Tested:* Whether it reduces heart attacks and strokes in over 17,600 adults with obesity and existing heart disease but no diabetes. *Finding:* It cut the risk of major cardiovascular events by about 20% over roughly three years, alongside meaningful weight loss. *Source:* Lincoff et al., *New England Journal of Medicine*, 2023. *Study type:* Large human randomized trial — very strong evidence.

2. Tirzepatide for weight loss (SURMOUNT-1)

Peptide: Tirzepatide (a dual GIP/GLP-1 medicine; Mounjaro/Zepbound). *Tested:* Weight change over 72 weeks in adults with obesity. *Finding:* Average weight loss of roughly 16% to 22.5% depending on dose, versus about 2% on placebo. *Source:* Jastreboff et al., *New England Journal of Medicine*, 2022. *Study type:* Large human randomized trial — very strong evidence.

3. Retatrutide, the "triple agonist" (Phase 2)

Peptide: Retatrutide (acts on three receptors: GIP, GLP-1, and glucagon). *Tested:* Weight change over 48 weeks in 338 adults with obesity. *Finding:* Up to about 24% average weight loss at the highest dose. *Source:* Jastreboff et al., *New England Journal of Medicine*, 2023. *Study type:* Mid-stage human trial — promising, but the drug is **investigational and not approved**.

4. BPC-157 and tendon-to-bone healing

Peptide: BPC-157. *Tested:* Healing of a surgically detached Achilles tendon in rats. *Finding:* Treated animals showed faster, stronger, better-organized healing than untreated ones. *Source:* Krivic et al., *Journal of Orthopaedic Research*, 2006. *Study type:* Animal study — encouraging, but not yet shown in humans.

5. How BPC-157 might work in tendons

Peptide: BPC-157. *Tested:* Its effect on rat tendon cells in a dish. *Finding:* It sped the outgrowth of tendon cells and increased growth-hormone receptor expression, suggesting one mechanism for its repair effects. *Source:* Chang et al., *Journal of Applied Physiology*, 2011. *Study type:* Laboratory (in vitro) — mechanistic, not clinical.

6. Thymosin β4 (the parent of TB-500) and the heart

Peptide: Thymosin β4. *Tested:* Whether it helps the heart recover after a simulated heart attack in mice. *Finding:* It improved heart-muscle cell survival and function by activating a key cell-survival pathway. *Source:* Bock-Marquette et al., *Nature*, 2004. *Study type:* Animal study — a landmark mechanistic paper, still preclinical.

7. GHK-Cu stimulates collagen

Peptide: GHK-Cu (copper peptide). *Tested:* Collagen production by human skin cells in culture. *Finding:* The copper-peptide complex increased collagen synthesis. *Source:* Maquart et al., *FEBS Letters*, 1988. *Study type:* Laboratory — a foundational finding for copper peptides in skincare.

8. GHK-Cu in an anti-aging cream (human trial)

Peptide: GHK-Cu, applied topically. *Tested:* A copper-peptide facial cream over 12 weeks in women. *Finding:* Improvements in skin appearance, firmness, and density compared with control. *Source:* Leyden et al., 2005 (dermatology literature). *Study type:* Human clinical trial — supports the **topical** use.

9. GHK-Cu's broad gene effects

Peptide: GHK-Cu. *Tested:* Which human genes it influences, using a large genomic database. *Finding:* It appears to shift the activity of thousands of genes, many tied to tissue repair and regeneration. *Source:* Pickart & Margolina, *International Journal of Molecular Sciences*, 2018. *Study type:* Genomic analysis — explains breadth of effect; not a clinical outcome.

10. Epithalon and telomerase

Peptide: Epithalon (a four-amino-acid pineal peptide). *Tested:* Whether it activates telomerase — an enzyme that maintains the protective caps on chromosomes — in human cells. *Finding:* It induced telomerase activity and telomere lengthening in cultured human cells. *Source:* Khavinson et al., *Bulletin of Experimental Biology and Medicine*, 2003. *Study type:* Laboratory — striking, but most Epithalon research comes from one group and lacks independent Western replication.

11. CJC-1295 raises growth hormone in people

Peptide: CJC-1295 (a GHRH analog). *Tested:* Growth hormone and IGF-1 levels in healthy adults. *Finding:* It produced sustained, dose-dependent increases in both. *Source:* Teichman et al., *Journal of Clinical Endocrinology & Metabolism*, 2006. *Study type:* Human pharmacology study — confirms the hormonal effect, not long-term outcomes.

12. Ipamorelin, a selective GH secretagogue

Peptide: Ipamorelin. *Tested:* Its ability to release growth hormone without raising stress hormones like cortisol. *Finding:* It stimulated GH release with notable selectivity. *Source:* Raun et al., *European Journal of Endocrinology*, 1998. *Study type:* Preclinical pharmacology — established its selective profile.

13. NMN (an NAD+ booster) in older adults

Compound: Nicotinamide mononucleotide, a precursor to NAD+ (note: NAD+ is **not** a peptide). *Tested:* 250 mg/day for 12 weeks in healthy older men. *Finding:* Raised blood NAD+ levels and modestly improved measures like gait speed and grip strength; well tolerated. *Source:* Igarashi et al., 2022. *Study type:* Small human randomized trial — encouraging early signal; effects were modest.

14. NAD+ boosters and cognition (a reality check)

Compound: Nicotinamide riboside, another NAD+ precursor. *Tested:* Cognitive measures in older adults. *Finding:* Results have been inconsistent, with some trials showing no clear cognitive benefit. *Source:* summarized across randomized trials (e.g., reviews in geriatric and metabolism journals, 2022–2023). *Study type:* Human trials — included here to show that not every promising mechanism pans out.

The takeaway from the evidence: The approved GLP-1-class medicines stand on solid ground. Most of the "wellness" and "recovery" peptides rest on animal and laboratory work that is genuinely interesting but has not yet been confirmed in well-designed human trials. That gap is the single most important thing to keep in mind.

4. Types of Peptides

A brief profile of each well-known peptide, with its primary use case and regulatory status. *"Research chemical"* here means it is sold for laboratory study and is **not approved for human use** in Canada or the U.S.

BPC-157 (pentadecapeptide)

A 15-amino-acid fragment derived from a protein in stomach fluid. *Primary interest:* gut protection and healing of tendon, ligament, and muscle. *Status:* research chemical; evidence is mostly animal-based.

TB-500 / Thymosin β4

TB-500 is a synthetic version of part of thymosin β4, a natural repair and cell-migration peptide. *Primary interest:* tissue repair, recovery, anti-inflammatory effects. *Status:* research chemical; landmark animal data, little human data.

Ipamorelin

A selective growth-hormone secretagogue. *Primary interest:* stimulating the body's own GH for recovery and body composition, without raising cortisol. *Status:* research chemical (studied in a clinical trial for post-surgical gut function, but not approved for wellness use).

CJC-1295 (with or without DAC)

A GHRH analog that stimulates GH release. The "no-DAC" version (also called Modified GRF 1-29) acts shorter and is often paired with Ipamorelin. *Primary interest:* GH/IGF-1 support. *Status:* research chemical. (Notably, the longer-acting DAC version's clinical program was halted years ago following a participant death in a trial, a reminder that "natural-acting" does not mean risk-free.)

GHK-Cu (copper peptide)

A naturally occurring copper-bound tripeptide. *Primary interest:* skin repair, collagen stimulation, wound healing — strongest evidence is **topical**. *Status:* widely and safely used in cosmetics; injectable use is a research-chemical context.

Epithalon (Epitalon)

A four-amino-acid peptide derived from a pineal-gland extract. *Primary interest:* longevity, telomere maintenance, sleep/circadian rhythm. *Status:* research chemical; most evidence from a single Russian research program.

IGF-1 LR3

A modified, longer-lasting version of insulin-like growth factor 1, a potent growth signal. *Primary interest:* muscle growth. *Status:* research chemical, **banned in sport**, and of particular concern: it's a powerful growth factor with theoretical links to abnormal cell growth, and there's essentially no human safety data for this variant. This is one to be especially cautious about.

Semaglutide

A GLP-1 receptor agonist. *Primary use:* type 2 diabetes and weight management; also proven to reduce cardiovascular events. *Status:* **approved prescription medicine** (Ozempic, Wegovy, Rybelsus).

Tirzepatide

A dual GIP/GLP-1 receptor agonist. *Primary use:* type 2 diabetes and weight management. *Status:* **approved prescription medicine** (Mounjaro, Zepbound).

Retatrutide

A triple GIP/GLP-1/glucagon agonist. *Primary interest:* obesity, with the largest weight-loss numbers seen so far. *Status:* **investigational** — still in clinical trials, not approved or legally available as a treatment.

NAD+ (and precursors like NMN/NR)

NAD+ is a coenzyme essential to energy metabolism — **not a peptide**, though it's often grouped with them in wellness settings. *Primary interest:* cellular energy, healthy aging. *Status:* NAD+ itself is used in some clinics (often IV); precursors like NMN/NR are sold as supplements with mixed regulatory standing and modest human evidence.

Others you may hear about

Selank and **Semax** (studied for anxiety and cognition, mainly in Russian research), **Tesamorelin** (an approved GHRH analog for HIV-related fat redistribution), and **MOTS-c** (a mitochondrial peptide studied for metabolism) round out the commonly discussed list.

5. How Peptides Are Used

This section explains the *concepts* behind peptide use at an educational level. It deliberately does **not** provide self-injection protocols or specific doses for unapproved compounds, because doing so could encourage unsafe self-treatment. Specifics should come from a qualified clinician.

Administration methods

- **Subcutaneous injection** (a small injection into the fat layer under the skin) is the most common route for most peptides, including the approved GLP-1 medicines and the research peptides.
- **Topical** application is standard for cosmetic copper peptides.
- **Oral and nasal** formulations exist for a few peptides where the chemistry allows it, but most peptides are destroyed by digestion if swallowed.
- **Intravenous (IV)** delivery is used in some clinical settings, for example with NAD+.

Research peptides are typically sold as a freeze-dried powder that must be reconstituted with sterile liquid before use — a step that introduces real risks of contamination and dosing error when done outside a controlled setting.

Dosing considerations

For the **approved medicines** (semaglutide, tirzepatide), dosing is standardized, started low, and increased gradually ("titration") under prescription to manage side effects like nausea. For the **research peptides**, there are no established, regulator-validated human doses — protocols circulating online are based on anecdote and animal data, not clinical evidence. This uncertainty is a core reason medical supervision matters.

Cycling

"Cycling" refers to using a compound for a defined period, then pausing. The rationale offered is to avoid the body adapting (reducing its own response) and to limit cumulative exposure. Whether cycling is necessary or beneficial varies by compound and is largely unstudied for the wellness peptides.

What to expect

Honest expectations matter. For the approved weight-management medicines, clinical trials show substantial, gradual weight loss over months, commonly accompanied by early gastrointestinal side effects that often ease over time. For the research peptides, reported experiences (improved recovery, sleep, or skin) are largely anecdotal; results, if any, are typically modest and not guaranteed, and the absence of quality human data means both benefits and risks are uncertain.

6. Safety & What to Know

The honest safety picture

- **Approved peptide medicines** (semaglutide, tirzepatide) have well-characterized safety profiles from large trials. Common effects include nausea, vomiting, and diarrhea; rarer but serious considerations include pancreatitis and a thyroid-tumor warning seen in rodents. They require a prescription and monitoring.
- **Research-chemical peptides** have not undergone the testing required to establish human safety. Specific concerns include unknown long-term effects, lack of quality control over what's actually in the vial (purity, contaminants, correct identity, sterility), and risks inherent to self-injection (infection, incorrect dosing).
- **Growth-promoting compounds** (especially IGF-1 LR3, and to a lesser extent GH-axis peptides) carry a theoretical concern: anything that drives cell growth could, in principle, promote the growth of undetected abnormal cells. This is why people with a personal or family history of cancer should be especially cautious.

Who should consult a doctor first (and really should not go it alone)

- Anyone who is pregnant, breastfeeding, or trying to conceive
- Anyone with a history of cancer, diabetes, thyroid disease, or significant heart, kidney, or liver conditions
- Anyone taking prescription medications (interactions are possible and often unstudied)
- Anyone under 18
- Honestly — anyone considering these at all. A knowledgeable physician can assess whether there's a legitimate medical use, monitor for problems, and steer you away from poor-quality or dangerous products.

Quality and sourcing

Because most of these peptides are sold outside the regulated medical supply chain, product quality is a genuine and documented problem: independent testing of grey-market peptides has repeatedly found mislabeled contents, wrong doses, impurities, and bacterial contamination. The only way to know you're getting a verified product at a known dose is through a regulated pharmacy and a prescription — which, for most of these compounds, isn't available because they aren't approved. That tension is worth sitting with before spending money on, or injecting, an unverified product.

Legality (Canada)

- **Semaglutide and tirzepatide** are legal with a valid prescription.

- **Retatrutide** is investigational and not legally available as a treatment.
- The remaining compounds are **not approved by Health Canada for human use.** They are generally sold only as research chemicals labeled “not for human consumption,” and selling or importing them for human use sits in a prohibited or grey-market space. Legality is not the same as safety, and “available to buy online” is not the same as “legal and safe to use.”

Final word

Peptides are a real and exciting frontier in medicine, and a few of them have already changed lives. The most useful thing you can do is hold two truths at once: the promise is real, and so are the gaps in evidence and regulation. Let that balance — not marketing on either side — guide any decision you make, ideally alongside a doctor who knows you.

Educational use only. Not medical advice.