PEPTIDES.org

RESEARCH PEPTIDES

THE ULTIMATE GUIDE

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CHAPTER

01 THE ULTIMATE GUIDE ON RESEARCH PEPTIDES

IN THIS CHAPTER, WE INTRODUCE THE WIDE WORLD OF PEPTIDES RESEARCH AND WHAT MAKES THESE COMPOUNDS SO EXCITING.

Research peptides are a novel field of clinical research, showing vast potential in a range of therapeutic contexts. Composed of amino acid chains, peptides are vital to many physiological processes. Recent advances in the development of synthetic peptides indicate their prospective utility in combating numerous diseases and improving quality of life when properly administered. Leading clinicians are optimistic research peptides may offer healing alternatives to invasive and costly medical interventions.

CHAPTER 01

THE TRUSTED SOURCE OF PEPTIDE INFO

The pioneering area of peptide research is dynamic and rapidly evolving, which can present challenges for researchers seeking accurate and up-to-date data on peptides. Valid information is especially important for safe and effective peptide handling. Yet, the market is unfortunately rife with faulty claims from unreliable sources.

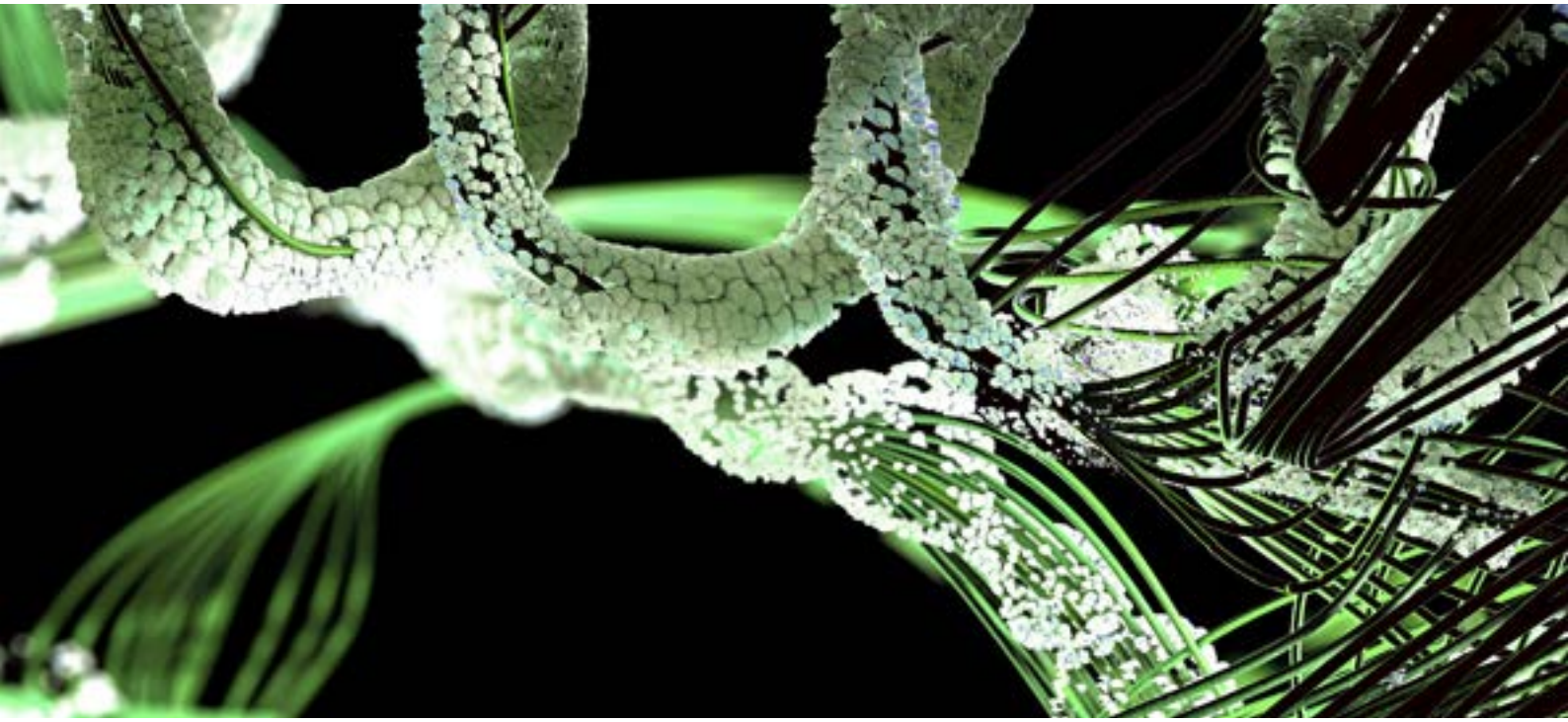
To solve this problem and enable researchers to maximize the great potential of these unique compounds, *Peptides.org* has since become the most trusted source of research peptide information, culled from a wide range of evidence-based materials that encompasses unique clinical cases, vanguard studies, and rigorously peer-reviewed academic literature.

With a passionate belief in the exciting clinical potential of peptides, we appreciate the importance of valid information from reputable sources. Because misinformation can lead to inefficacy or even safety concerns when it comes to the administration of peptides, researchers must have access to accurate, transparent information, vetted by scientific experts.

This guides our uncompromising commitment to integrity, as we source data from far and wide, including cutting-edge clinical studies, unique use cases, and strictly peer-reviewed scientific literature. In this capacity, we equip researchers with key information to safely harness the untapped potential of peptides as alternatives to costly and invasive medical procedures.

CHAPTER 1

THE TRUSTED SOURCE OF PEPTIDE INFO



The skilled *Peptides.org* team saves researchers the hassle of scanning hundreds of articles to obtain the most accurate and recent information on peptides. We know too well the challenge of finding the latest information in this rapidly evolving field. Further, the market is saturated with inaccurate and dubious claims. In our mission to help researchers safely study the potential of peptides, we consult only trusted sources. With an unparalleled depth and breadth of specialty resources at our disposal, *Peptides.org* is the single most reliable online authority for the latest evidence-based information.

Click here to learn more about our research team.

CHAPTER

02 WHAT ARE RESEARCH PEPTIDES?

IN THIS CHAPTER, WE'LL EXPLAIN WHAT RESEARCH PEPTIDES ARE AND THEIR BIOLOGICAL FUNCTIONS.

Peptides are molecules made from amino acids linked by peptide bonds, similar to proteins but considerably shorter. There are naturally-occurring peptides as well as synthetic peptides. By convention, a chain of no more than 50 amino acids is termed a peptide, but essentially a peptide is a small protein.

Their functions depend on the specific sequence of their amino acids, which allows them to target specific receptors and regulate biological processes [1].

Due to the variety of different potential sequences and their diverse properties, peptides are versatile molecules that are central to numerous essential biological functions including, but not limited to:

- **Cellular communication and motility**
- **Neurotransmission**
- **Endocrine signaling**
- **Metabolic process management**
- **Growth stimulation**
- **Recovery promotion**

The pharmaceutical realm has leveraged the potential of peptides by either modifying naturally occurring ones or synthesizing new sequences, leading to therapeutic peptides with better pharmacokinetics, enhanced specificity, or fewer side effects [2].

This advancement has spurred a notable growth in the development and approval of peptide-based therapeutic drugs, with over 60 currently and hundreds more under investigation for their potential benefits [1, 2].

CHAPTER

03

COMMON RESEARCH APPLICATIONS AND BENEFITS

IN THIS CHAPTER, WE'LL LIST THE PEPTIDES COVERED IN THIS GUIDE, CLASSED BY THEIR PRIMARY RESEARCH APPLICATIONS AND BENEFITS.

This expert guide provides researchers with an in-depth look into the budding field of peptides, including an overview of the discipline, best practices, and valuable information on some of the most popular peptides available.

The peptides covered will include the following, classed by their primary research applications and benefits:

- **Weight Loss Peptides:** Semaglutide, Liraglutide, Tirzepatide
- **Muscle Growth Peptides:** Ipamorelin, CJC-1295 DAC, Sermorelin
- **Skin Care Peptides:** GHK-Cu, Argireline
- **Healing Peptides:** BPC-157, TB-500
- **Longevity Peptides:** Epithalon, NAD+
- **Reproductive Health Peptides:** PT-141, Kisspeptin-10, Gonadorelin
- **Nootropic Peptides:** Semax, Selank
- **Immune System Peptides:** Thymosin Alpha-1, KPV
- **Sleep Peptides:** DSIP
- **Tanning Peptides:** Melanotan 1, Melanotan 2

While the list above provides researchers with a general overview of some of the most popular peptides as of writing and their research applications, below there is an in-depth breakdown of each peptide listed above – all backed by clinical data.

CHAPTER

04 LIST OF PEPTIDES AND WHAT THEY DO

IN THIS CHAPTER, WE'LL IDENTIFY KEY PEPTIDES, WHAT THEY DO AND WHERE TO LEARN MORE ABOUT THEM.

Below, we outline the most notable research peptides and categorize them according to their main benefits, as shown by clinical data. These potential benefits include weight loss, improved body composition and muscle growth, tissue healing and recovery, and more.

WEIGHT LOSS PEPTIDES

Peptide analogs of incretin hormones like glucagon-like peptide 1 (GLP-1) and glucose-dependent insulinotropic polypeptide (GIP) have proven to be highly effective tools for weight loss.

Incretin mimetic peptides regulate blood sugar levels and appetite, ultimately aiding weight loss via improved satiety and reduced cravings [3, 4, 5]. Here are three of the most notable weight loss peptides.

SEMAGLUTIDE

Semaglutide, developed by Novo Nordisk in 2012, is a synthetic agonist of the GLP-1 receptor. Its molecular structure consists of 31 amino acids, sharing a 94% similarity with the endogenous GLP-1 molecule [6, 7].

A distinct modification in semaglutide is the incorporation of an octadecanoic (C-18) diacid component, which extends its half-life to seven days, thereby enabling a once-weekly dosing

regimen. It is approved by the United States Food and Drug Administration (FDA) for a range of indications, including type 2 diabetes (T2D) and weight reduction in both diabetics and nondiabetics [8, 9].

The FDA's approval for semaglutide's use in weight management was based on the ongoing STEP clinical development program. This program encompasses several phase-3 trials (e.g., STEP 1-10, STEP TEENS, STEP UP) and mainly includes study volunteers with a body mass index (BMI) of at least 30 or at least 27 coupled with related health conditions such as type 2 diabetes (T2D).

Data from these trials have revealed that weekly administration of 2.4mg semaglutide led to a weight reduction ranging from 9.6% to 17.4% of the volunteers' initial weight over a span of 68 weeks [10, 11].

Click here to learn more about semaglutide for research.

LIRAGLUTIDE

Liraglutide is a GLP-1 receptor agonist consisting of 31 amino acids, with a 97% structural similarity to the native hormone [12].

It was developed by Novo Nordisk in the 1990s and is currently approved for a wide range of indications, such as T2D [13].

The peptide is marketed under the brand name Saxenda (up to 3mg/daily) for chronic weight management in non-diabetic adults, as evidenced by the outcomes of the SCALE clinical development program.

The SCALE Obesity and Prediabetes trial, the largest among the SCALE studies, examined 3,731 participants with a BMI of 30 or greater (or 27 or greater in conjunction with conditions like dyslipidemia or hypertension).

Over 56 weeks, the liraglutide recipients lost an average of 18.5 pounds (approximately 8% from baseline), whereas the placebo group shed an average of 6.2 pounds (around 2.6% from baseline) [14].

Click here to learn more about liraglutide for research.

TIRZEPATIDE

Tirzepatide, a peptide composed of 39 amino acids, is a novel dual agonist of the both GIP and GLP-1 receptors, with a bias towards GIP [15]. Its molecular architecture fuses elements from the GIP hormone and a GLP-1 receptor agonist known as exenatide, alongside a C20 fatty di-acid moiety to extend its half-life to up to five days for once-weekly subcutaneous administration [16, 17].

The FDA approved tirzepatide for type 2 diabetes (T2D) treatment, now available under the brand name Mounjaro, following positive outcomes from the phase-3 trials of the SURPASS program, which showcased a reduction of up to -3.02% in glycated hemoglobin levels [18]. Currently, tirzepatide is under phase-3 evaluation in the SURMOUNT program to ascertain its efficacy for weight management in non-diabetic adults.

The most recent trial within this program, SURMOUNT-3, revealed a 20.8% greater weight reduction than placebo following 72 weeks of tirzepatide therapy at doses of 10-15/mg weekly [19, 20].

Click here to learn more about tirzepatide for research.

PEPTIDES FOR IMPROVED BODY COMPOSITION

Peptides for improving body composition and increasing muscle mass work via a variety of mechanisms to upregulate muscle protein synthesis (MPS) while reducing muscle protein breakdown (MPB).

Perhaps the common mechanism is the upregulation of growth hormone (GH) and its main anabolic mediator, insulin-like growth factor-1 (IGF-1) [21].

Here are three of the most notable peptides for increasing lean muscle mass:

SERMORELIN

Sermorelin, also known as GRF 1-29, is a synthetic analog of growth hormone-releasing hormone (GHRH), engineered by the biopharmaceutical company EMD Serono to stimulate GH production [22].

Sermorelin includes only the initial 29 amino acids of GHRH's 44 amino acid sequence, thereby making it the shortest functional GHRH analog [23]. Initially, the peptide received FDA approval for both diagnostic and therapeutic applications in addressing growth hormone deficiency.

However, this approval was withdrawn for commercial considerations unrelated to its safety or efficacy [24]. Nevertheless, the available research underscores sermorelin's potential for muscle growth, with studies reporting a +2.78lb increase in lean body weight in participants following a 16-week regimen of 10mcg/kg/daily of sermorelin [25].

Click here to learn more about sermorelin for research.

CJC-1295 DAC

CJC-1295 DAC, a tetrasubstituted derivative of the peptide sermorelin, was developed by the Canadian biotechnology company ConjuChem. The primary objective of CJC-1295 DAC was to manage lipodystrophy in HIV/AIDS patients.

CJC-1295's half-life is amplified through the incorporation of a Drug Affinity Complex (DAC), enabling binding to plasma proteins and thereby prolonging its half-life to eight days [26, 27, 28].

This peptide can significantly increase GH and IGF-1 levels, which is expected to exert notable anabolic effects on muscle tissue [29]. Yet, studies investigating its muscle-building potential are currently lacking.

Click here to learn more about CJC-1295 DAC for research.

IPAMORELIN

Ipamorelin is a pentapeptide that mimics the function of the hunger hormone ghrelin and activates its receptors throughout the body.

In the pituitary gland, these receptors are called the growth hormone secretagogue receptors (GHS-Rs) and result in the release of GH [30].

The peptide was developed by Novo Nordisk and Helsinn Therapeutics and designed to emulate the effects of ghrelin within the gastrointestinal tract, thus aiding in peristalsis, a type of intestinal motility [31, 32].

Ipamorelin is under investigation for its potential to preserve muscle while increasing lean mass.

Clinical studies show that ipamorelin can also significantly boost the release of GH without affecting other pituitary hormones [33].

Further preliminary studies suggest that ipamorelin increases appetite and promotes weight gain while providing protection against muscle atrophy in test animals, especially when exposed to catabolic agents [34, 35]. Unfortunately, clinical research regarding the muscle-building potential of ipamorelin is lacking.

Click here to learn more about ipamorelin for research.

SKINCARE PEPTIDES

Skincare peptides can help improve skin complexion and appearance via a wide range of mechanisms, such as by improving collagen production and preventing contraction in subcutaneous muscles.

Here are two of the most notable skincare peptides:

GHK-CU

GHK-Cu (glycyl-l-histidyl-l-lysine-copper), also known as copper tripeptide, is an endogenous peptide that readily binds to copper ions (2+). It occurs naturally in all bodily fluids [36].

GHK-Cu has a sequence present in the structure of type I collagen, and it is thought to be one of the fragments released upon enzymatic collagen breakdown due to injury. Thus, the peptide is thought to act as a repair signal.

It has also been noted for its ability to modulate levels of MMP-1 and MMP-2, which are enzymes involved in the breakdown of old collagen and glycosaminoglycans [37].

Thus, GHK-Cu may promote turnover within the intracellular matrix, facilitating the replacement of old matrix components with newly synthesized ones [36].

These actions contribute to a multitude of skin benefits, including enhanced skin healing, skin tightening, reduction of wrinkles, smoothing of rough skin, and protection against photoaging.

In particular, studies have documented a reduction of 55.8% in wrinkle volume and a 32.8% decrease in wrinkle depth over 8 weeks with daily application [38].

Click here to learn more about GHK-Cu for research.

ARGIRELINE

Argireline, scientifically known as Acetyl Hexapeptide-3 or Acetyl Hexapeptide-8, is a synthetic peptide made of six amino acids.

It is commonly used in skincare products for its potential anti-wrinkle benefits.

Argireline is designed to reduce the appearance of fine lines and wrinkles by inhibiting the muscle movement of subcutaneous muscles, mimicking the effects of Botox.

When applied topically, Argireline passes through the skin and acts as a competitive inhibitor of a protein called SNAP-25 (synaptosome-associated protein 25kDa).

As a result, it blocks the release of acetylcholine at the neuromuscular synapses [39].

Through this action, the muscles relax, and wrinkles become less visible [40]. Studies suggest that a 10% Argireline cream can cause up to 50% wrinkle depth reduction when applied twice daily for one month [41].

Click here to learn more about Argireline for research.

HEALING PEPTIDES

Peptides for healing and injury recovery have risen to the forefront of the research community, with the following two compounds receiving the most attention:

BPC-157

BPC-157, also known as Body Protection Compound-157, PL 14736, PL-10, or Bepecin, is a synthetically engineered pentadecapeptide initially developed in the 1990s [42].

The peptide is posited to stimulate the activity of growth factors and cells pertinent to connective tissue repair, such as fibroblasts.

Additionally, it is suggested to enhance the production of vasodilators, notably nitric oxide (NO), potentially facilitating the healing of skin, tendons, and muscles [43, 44, 45, 46].

Most of the existing data on BPC-157 stem from preclinical trials [47].

Nevertheless, studies report benefits for healing in animal models of crushed muscles, faster tendon-to-bone healing, improved gut healing in models of short bowel syndrome, as well as accelerated tissue healing in wounds [48, 49, 50, 51, 52].

Click here to learn more about BPC-157 for research.

TB-500

TB-500 is a synthetic variant of thymosin beta-4 (TB4), a peptide consisting of 43 amino acids that is prevalent in various human cells.

TB4 was initially isolated from bovine thymus gland extract in 1981 by Low and Goldstein.

Ongoing research is investigating its prospective impact on cell migration, particularly the movement of progenitor cells crucial for tissue repair [53].

This peptide may help healing by also facilitating the formation of new blood vessels, stem cell maturation, cell survival across various types, and inflammation reduction [54, 55]. Synthetic TB4 has been studied primarily for the healing of the eye cornea [56].

The peptide may speed up wound healing in subjects with venous ulcers by 45% [57].

Some trials also suggest it may improve heart muscle function and recovery in subjects who suffered a heart attack and were treated with endothelial progenitor cells [58].

Click here to learn more about TB-500 for research.

LONGEVITY PEPTIDES

Longevity represents one of the most popular fields of peptide research, with the following two compounds garnering considerable interest around the world.

EPITHALON

Epithalon, also referred to as Epitalon or AEDG peptide, is a tetrapeptide composed of the amino acids Alanine-Glutamate-Aspartate-Glycine (Ala-Glu-Asp-Gly).

It was derived from a crude pineal gland extract known as epithalamin [59].

This peptide is purported to enhance telomerase activity, a mechanism crucial for maintaining and elongating telomeres—protective structures located at the chromosomal termini.

Extended telomeres are correlated with enhanced cellular longevity and a deceleration in aging processes [60, 61].

Several trials suggest a potential longevity promoting effect of epithalon, with one trial in 266 study volunteers reporting x1.6-1.8 reduced mortality compared to controls [62, 63, 64].

Additionally, preclinical investigations have explored epithalon's potential in inhibiting tumor genesis, mitigating oxidative stress, and bolstering endocrine as well as immune system functionality [65, 66, 67].

Click here to learn more about epithalon for research.

NAD+

NAD+ (nicotinamide adenine dinucleotide) is a universal coenzyme present in every cell, playing key roles in electron transport and signaling. Its cellular levels decrease with aging. Thus, modulating NAD+ levels is considered an option that could potentially extend lifespan and bolster neurocognitive function [68].

Predominantly found in mitochondria, NAD+ facilitates crucial cellular processes like protein modification and sirtuin enzyme activities, impacting cell growth, energy metabolism, stress resistance, inflammation management, and neuronal function [69]. Studies in mice have shown that boosting NAD+ metabolism may mitigate premature aging diseases and extend lifespan [70].

For example, a 12-month rodent study demonstrated that administering the NAD+ precursor (nicotinamide mononucleotide) NMN curbed weight gain, enhanced energy metabolism, and improved insulin sensitivity [71]. Yet, more research is needed to establish whether such benefits may also translate to clinical trials.

Click here to learn more about NAD+ for research.

REPRODUCTIVE HEALTH PEPTIDES

Peptides for reproductive health work to improve fertility and libido in a variety of ways, such as by interacting with the melanocortin system or the hypothalamic-pituitary-gonadal (HPG) axis. Here are some of the more notable compounds in this realm:

PT-141

PT-141, also known as bremelanotide, is a cyclic heptapeptide that acts as an agonist to melanocortin receptors (MCRs) present in various organs and systems. It replicates the action of endogenous alpha-melanocyte stimulating hormone (alpha-MSH) [72]. Upon administration, PT-141 activates MCRs with increased activity towards the melanocortin 4 receptors in the brain, stimulating sexual function, energy balance, and appetite.

Consequently, PT-141 has shown a notable enhancement in sexual desire and has received approval for use in premenopausal women diagnosed with hypoactive sexual desire disorder (HSDD) [73].

Further studies also underscore the potential of PT-141 in significantly elevating libido and sexual desire in males, alongside prolonging the duration of erections. Interestingly, PT-141 has been posited by some researchers as a viable alternative for males who exhibit no response to PDE5 inhibitors such as Viagra (sildenafil) [74].

Click here to learn more about PT-141 for research.

KISSPEPTIN-10

Kisspeptin-10 is a decapeptide that belongs to the larger kisspeptin family, encoded by the KISS1 gene in hypothalamic cells. Kisspeptins are peptides crucial for reproductive regulation, interacting with the G protein-coupled receptor, GPR54 [75].

As such, kisspeptin-10 can modulate the rhythmic release of gonadotropin-releasing hormone (GnRH), prompting the pituitary gland to produce luteinizing hormone (LH) and follicle-stimulating hormone (FSH).

These hormones trigger testosterone (T) synthesis in the testes, enhancing fertility and boosting T levels [76]. For example, a clinical trial has shown that kisspeptin-10 infusion significantly increased mean serum T levels in healthy male participants from 479ng/dl to 692ng/dl in under 23 hours [77].

Yet, long-term studies are scarce, raising concerns about potential receptor desensitization with repeated administration, which may reduce the peptide's effectiveness, lessen responsiveness to natural kisspeptins, and suppress natural T synthesis.

Given these uncertainties, careful dosage is advised in research involving kisspeptin-10 [76].

Click here to learn more about kisspeptin-10 for research.

GONADORELIN

Gonadorelin is a synthetic version of gonadotropin-releasing hormone (GnRH), mirroring the natural hormone in structure and function.

When administered, it crosses the blood-brain barrier (BBB), prompting the pituitary gland to release LH and FSH [78].

It is clinically used to trigger ovulation in women with menstrual irregularities stemming from hypothalamic issues and to assess HPG axis function [79].

Studies indicate that gonadorelin can enhance HPG axis activity in men with hypothalamic dysfunction and insufficient GnRH levels [80].

According to the research, it also effectively elevates T levels and improves fertility in men with normal testicular and pituitary gland functionality [81].

For example, a study has shown that a regimen of 200mcg of gonadorelin over three days can stimulate normal LH and FSH production in a male patient with impaired pituitary and testicular function due to prior anabolic-androgenic steroid (AAS) use, tripling his testosterone levels beyond the 300ng/dl benchmark [82].

Click here to learn more about gonadorelin for research.

NOOTROPIC PEPTIDES

Nootropic peptides exert their memory and concentration-boosting properties by interacting with various neurotransmitters and neurotrophic factors in the brain. To do so, they need to have the ability to pass through the blood–brain barrier (BBB).

Here are a couple of notable examples that have been engineered to do just that.

SEMAX

Semax is a synthetic peptide composed of a four amino acid fragment (Met-Glu-His-Phe) from the adrenocorticotropic hormone (ACTH) and a Pro-Gly-Pro fragment attached at the C-terminus [83]. It can pass the BBB to reach the central nervous system without exerting hormonal effects [84].

Once there, Semax appears to interact with various neurotrophic factors in the nervous system that support the growth, survival, and maintenance of neurons. It also interacts with several neurotransmitters [85].

It is approved in Russia for neuroprotective and cognitive-enhancing agents in settings of ischemic stroke, encephalopathy, optic nerve atrophy, and other indications, such as cognitive disorders [86]. The peptide also appears to provide nootropic effects in otherwise healthy individuals [87].

For example, a trial in fatigued volunteers who have worked eight-hour shifts reported that a single intranasal administration of Semax at 16mcg/kg of body weight resulted in a sustained nootropic effect lasting up to 24 hours. The treatment group had 71% correct answers on a memory test compared to 41% of those in the control group [87].

Click here to learn more about Semax for research.

SELANK

Selank is another heptapeptide developed in the 1990s and approved as an anxiolytic by the Russian Federation Ministry of Health in 2009 [86].

It is a synthetic analog of the endogenous human tetrapeptide tuftsin (threonine-lysine-proline -arginine) and contains a Pro-Gly-Pro fragment at its C-terminus, which allows it to pass the BBB [87].

Selank has a pronounced effect on opioid, serotonergic, and GABA signaling. These mechanisms are likely central to Selank's ability to reduce stress and anxiety levels [88, 89]. Studies in subjects with generalized anxiety disorder (GAD) report that Selank may be non-inferior to medazepam, meaning that the two agents may produce comparable anxiolytic benefits [89].

Click here to learn more about Selank for research.

IMMUNE SYSTEM PEPTIDES

Below, we outline two of the more notable peptides that may aid the immune system in tackling infections and inflammation.

THYMOSIN ALPHA-1

Thymosin alpha-1 (TA-1) is a vital immune regulator derived from the thymus gland, with secretion peaking in childhood and diminishing from puberty onwards [90].

Based on research, TA-1 oversees immune cell production and maturation and can replenish white blood cells, potentially aiding immunity even in cases of thymus impairment [91].

Low levels of thymosin alpha-1 may result in weakened immune function and heightened disease susceptibility.

Thus, by enhancing the adaptive immune response, TA-1 aids in tackling various infections [92].

Additionally, it appears to stimulate humoral immunity, elevate levels of several interferons and interleukins, and is proposed as a vaccine adjuvant to bolster T-cell-dependent antibody production, improving vaccine efficacy [93].

Click here to learn more about TA-1 for research.

KPV

KPV, standing for lysine-proline-valine, is identified as the C-terminal end of alpha-MSH.

The latter is thought to contribute to several physiological processes, including melanogenesis, appetite modulation, and sexual desire [94].

Its C-terminal fragment (e.g., KPV) may also have anti-inflammatory effects such as the regulation of NF-κB activation, T-cell proliferation, and inflammatory cell migration [95].

Further, several studies have suggested that alpha-MSH has anti-inflammatory and wound-healing effects, which may also translate to KPV [96].

For example, preclinical studies suggest improved corneal epithelial wound healing in rabbits [97].

Yet, more research is needed to evaluate its potential in clinical settings.

Click here to learn more about KPV for research.

SLEEP PEPTIDES

One of the most notable peptides for sleep is delta sleep-inducing peptide (DSIP). Here are the most important facts for researchers to consider.

DSIP

DSIP is a nonapeptide discovered in 1974 by Swiss scientists, who found it to trigger delta sleep when administered to laboratory test animals [98].

Delta sleep is the phase of slow-wave sleep that manifests with delta waves recorded via electroencephalogram (EEG). DSIP appears to increase delta activity in this phase, which is deemed a marker of enhanced sleep quality, as it is linked to minimized external stimuli perception, promoting restorative sleep and minimizing easy awakenings [99].

Moreover, DSIP is reported to positively influence stage-4 or REM sleep, the dream phase, which is crucial for emotional memory processing and consolidation [100].

DSIP's mechanism is speculated to involve interaction with N-methyl-D-aspartate (NMDA) or alpha 1-adrenergic receptors and potentially engaging with neurons through the mitogen-activated protein kinase (MAPK) pathway, a key regulator of intercellular signaling [101].

Clinically, DSIP has exhibited promise in normalizing sleep cycles and alleviating narcolepsy [100]. It is also being explored for treating withdrawal symptoms in cases of alcohol and opiate addiction [102].

Click here to learn more about DSIP for research.

CHAPTER

05

WHERE TO BUY PEPTIDES ONLINE?

IN THIS CHAPTER, WE'LL LIST THE BEST ONLINE PEPTIDE SOURCES FOR RESEARCHERS TO PURCHASE FROM AND ESTABLISH HOW WE ASSEMBLED THIS LIST.

Peptide researchers may be wondering about the best peptides companies that sell high-quality compounds.

But it's not as simple as finding the first online vendor that offers research peptides and placing an order. In fact, it's important to do due diligence when researching the best peptides vendors.

Vendor selection deserves as much research and attention as the peptides themselves. After all, a pure and high-quality product is key to safety and validity in research. Fortunately, our expert team is familiar with the most reputable peptide providers, with the experience to recommend the best places to buy various peptides and other research chemicals.

HOW WE CHOSE THE BEST PEPTIDE SOURCES

Here's how we assembled our list of the best places to buy peptides online:

- **Product Selection:** We included vendors that carry a variety of research peptides in different forms or combinations.
- **Testing & Quality Control:** The most important criterion for us is testing and quality control. The best peptide vendors have multiple-step quality control processes that ensure quality at each step in the manufacturing process, and which utilize in-house testing and/or independent, third-party laboratory evaluation.
- **Shipping & Payment Options:** Some other key things we looked for in reputable peptide vendors were fast, reliable shipping options, and a variety of payment options to help ensure privacy and discretion.
- **Customer Service:** We also assessed peptide vendors based on their customer service, sales and promotions, and return or refund policies.
- **Online Reviews:** In addition, we scoured the internet for reviews from researchers who have ordered from these vendors to get accounts of their experiences.
- **First-Hand Experience:** Finally, we work with many of the listed vendors ourselves, so we can vouch for their legitimacy.

Overall, our research team believes the vendors below are the premier companies to buy peptides online from, in no particular order:

LIMITLESS LIFE

Limitless Life is one of our top preferred websites with peptides for sale.

While this vendor now offers a variety of peptides, they still specialize in nootropics on some level — which are compounds that may help support brain function, mood, memory, focus, and executive function.

We like *Limitless Life* because they put a lot of care and resources into product testing to ensure quality.

They utilize high-performance liquid chromatography and mass spectrometry (HPLC-MS) testing to ensure a standard of purity for all of their products, making them suitable for highly-regulated research studies.

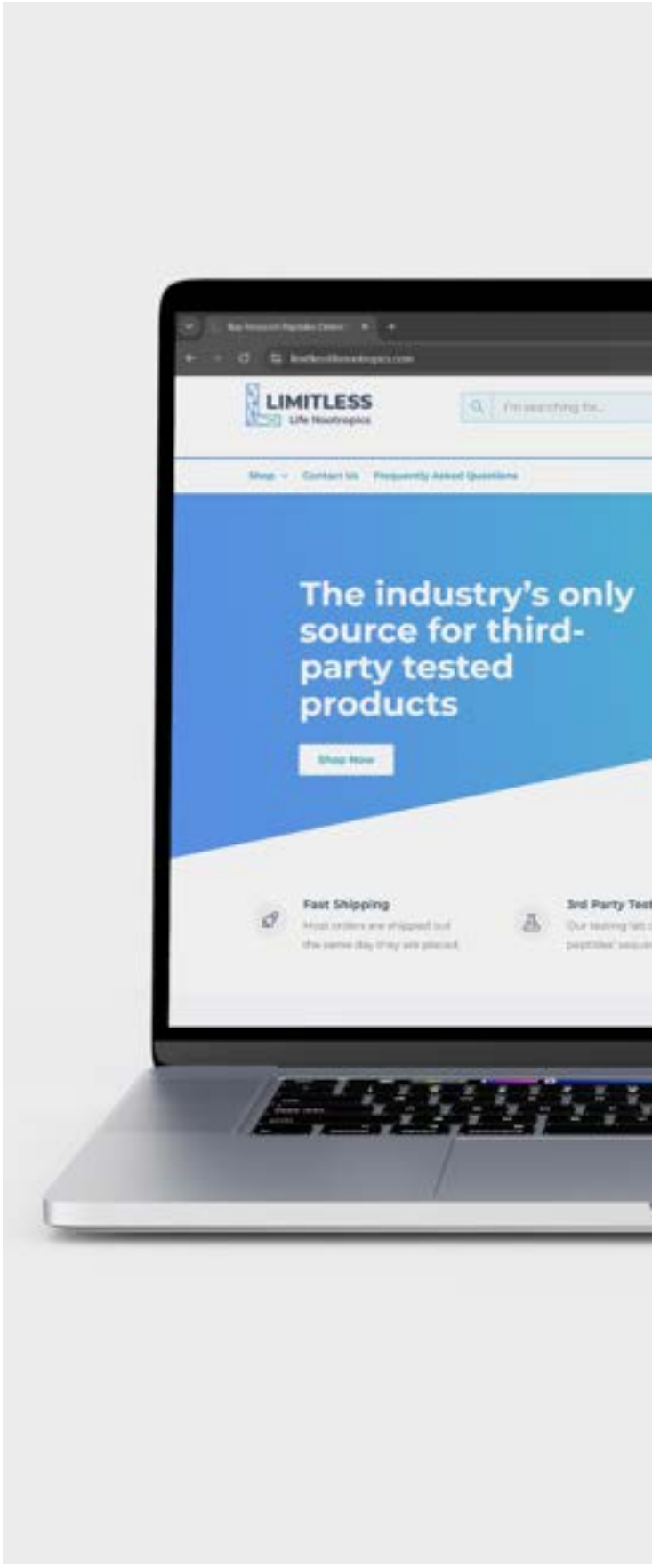
Additionally, *Limitless Life* offers some of the best sales, coupons, and deals on the market.

Their bundles are a cost-effective way to purchase curated peptide combinations. For example, they offer an Obesity Reduction Research Bundle and an Immunity Enhancement Research Bundle.

They also accept various payment options, including Zelle, CashApp, and major credit cards. To ensure safe shipping, they offer shipping insurance at 2% of the order price.

For their sales and comprehensive quality testing processes, *Limitless Life* is one of the best research peptides vendors around.

Limitless Life also offers a "VIP Club" for researchers experimenting with weight loss peptides. Sign up here.



Click here to place an order from *Limitless Life*.

SCIENCE.BIO

***Science.bio* stands out as a leading provider in the field of research peptides, distinguished by their commitment to quality and innovation. We highly recommend them.**

We value *Science.bio* for their rigorous approach to ensuring product excellence. They implement advanced testing methodologies, including third-party analysis, to certify the purity and quality of their peptides. This dedication makes their offerings highly suitable for various research applications.

Due to the high purity and quality standards, *Science.bio* is a pillar in the research community. While they have focused on nootropics and SARMs in the past, the research company is getting into peptides here soon and will be a top source. They currently offer a wide array of nasal sprays, along with some aliquot research peptides.

In terms of payment flexibility, *Science.bio* accepts a variety of payment options, including all major credit cards, debit cards, and cryptocurrency payments.

For their commitment to excellence and thorough quality control processes, we recognize *Science.bio* as a premier vendor in the research peptides industry.

To explore their offerings and place an order, visit *Science.bio* by clicking here.

XCEL PEPTIDES

***Xcel Peptides*, a newer vendor, is emerging as a distinguished name in the arena of research peptides. Our appreciation for *Xcel Peptides* is rooted in their meticulous attention to product quality.**

Xcel Peptides is acclaimed for their unwavering commitment to excellence and precision.

They adopt state-of-the-art testing methods, such as high-performance liquid chromatography and mass spectrometry (HPLC-MS), to affirm the purity and efficacy of their peptides, ensuring they meet the exacting standards required for advanced research projects.

Xcel Peptides accommodates a wide array of payment options, from Zelle and CashApp to all major credit cards. They also accept e-check.

Furthermore, this vendor offers a wide array of high-quality capsule formulations - ideal for certain research projects.

With their strong focus on stringent quality verification processes, *Xcel Peptides* is acknowledged as a top-tier supplier in the research peptides sector.

Visit *Xcel Peptides* to discover their full range of products and place an order.

CHAPTER

06 SIDE EFFECTS AND COMPLICATIONS

IN THIS CHAPTER, WE'LL LIST THE COMMON SIDE EFFECTS AND SAFETY PROFILES FOR ALL SCIENTISTS AND RESEARCHERS TO BE AWARE OF.

Peptides are research chemicals, and the majority of them are yet to be approved for anything outside of research.

Thus, scientists and researchers must exercise utmost caution and adhere to stringent protocols when handling and administering these compounds to ensure safety and success in experimentation.

Researchers are encouraged to prioritize meticulous study designs, rigorous testing, and thorough monitoring of potential side effects to ensure the safe exploration of these compounds.

Nevertheless, promising preliminary findings from studies have demonstrated considerable safety and tolerance associated with peptides [103, 104, 105, 106].

Further, while the majority of peptides are currently restricted to research purposes, certain peptides have obtained regulatory approval.

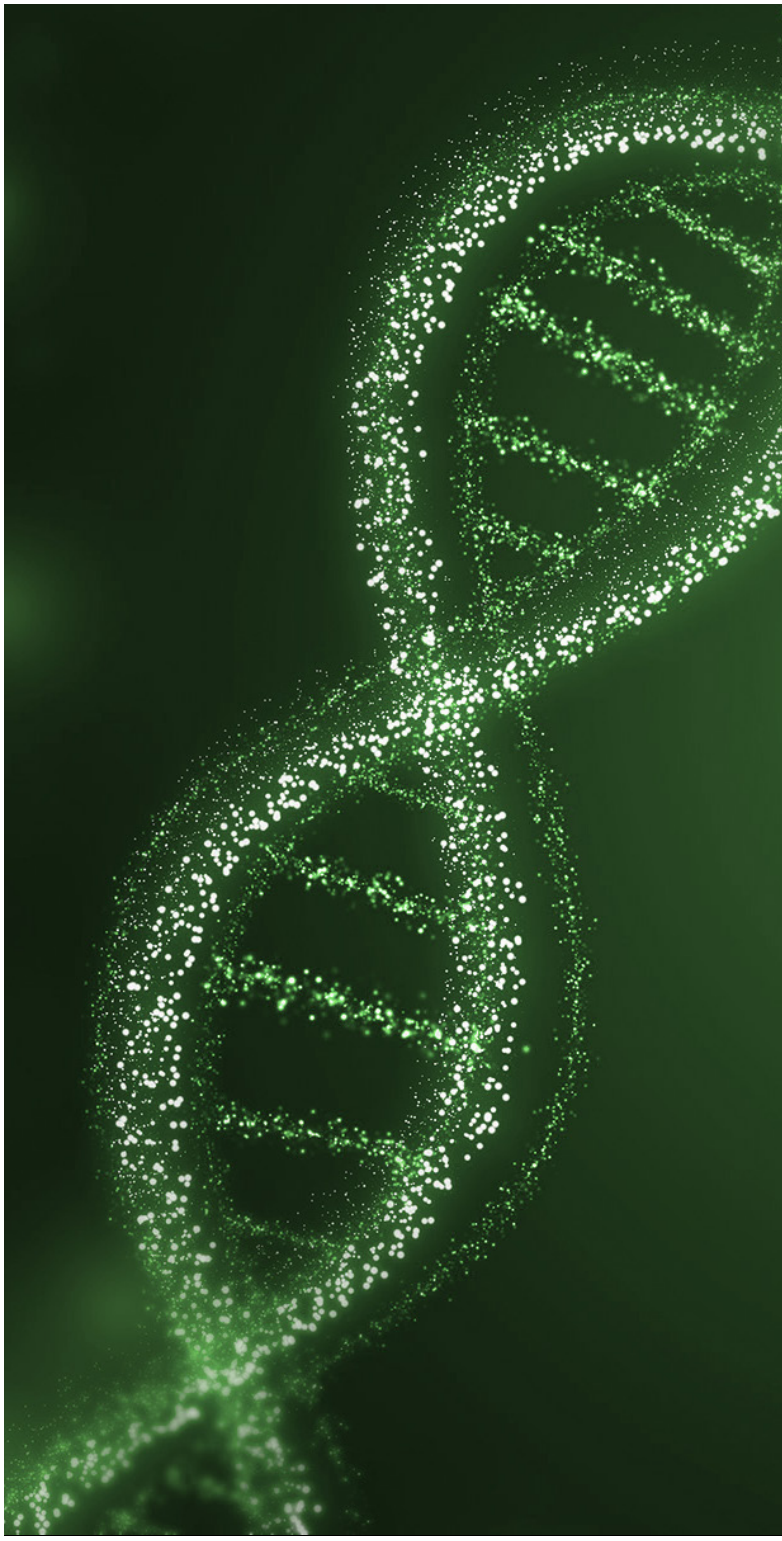
As mentioned, several GHRH analogs and GLP-1 receptor agonists have undergone extensive study and rigorous testing, leading to their approval as prescription medications [107, 108, 109].

These peptides, commonly prescribed for conditions such as muscle-wasting disorders, type 2 diabetes, and chronic weight management, have demonstrated an excellent safety profile.

Potential serious adverse effects have been reported as rare and self-limiting [110, 111, 112, 113].

The approval and availability of certain peptides as prescription drugs further emphasize their established safety and tolerability in research subjects.

Researchers should note that the aforementioned peptides, including the FDA-approved GHRH analogs and GLP-1 receptor agonists, are also generally available as reference materials in controlled research settings.



COMMON SIDE EFFECTS

Research peptides may have side effects related to their route of administration. To minimize the risk of side effects, reduce pain, and minimize discomfort – subcutaneous administration tends to be the preferred method for administering peptides in research settings.

Research reveals that subcutaneous injections have a lower risk of pain, infection, or complications compared to other methods [114]. They are typically administered in the following areas:

- **Into the fatty tissue of the abdominal area, about 2 inches to side of the navel**
- **Outer upper arms**
- **Front outer thighs**

Usually, the abdominal area is the most preferred zone as it is associated with the least amount of pain compared to other regions, even when injecting relatively large volumes. In this regard, studies suggest that the maximum volume generally accepted is 1.5mL, but up to 3mL may be tolerated when injected subcutaneously in the abdomen [115]. The most common reactions linked to subcutaneous injection include:

- **Pain and discomfort**
- **Redness**
- **Bleeding**
- **Swelling**

Pain and discomfort can also be minimized by ensuring the solution is not too cold and applying ice before the injection. Ensuring an appropriate technique is also essential for minimizing side effects. This includes:

- **Turning the bevel of the needle up when piercing the skin to prevent skin tearing**
- **Piercing through the skin with a single swift motion**
- **Avoiding direction changes of the needle while going in or out**
- **Pushing the plunger of the syringe slowly when administering the peptide**

Using inappropriate technique during injections may also lead to injecting the medication within the layers of the skin or in a blood vessel instead of subcutaneously. Such cases diminish the effectiveness of the peptide but do not increase the risk of side effects.

Rarely, infections may also occur, but these tend to be local and self-limiting. They can be prevented by following safety procedures such as always using sterile needles and syringes and disinfecting both the vial's stopper and the subject's skin with an alcohol prep pad before injection.

SAFETY PROFILES

For a more detailed and in-depth review of the side effects and complications of any specific peptide, we recommend researchers consult some of our in-depth guides on the topic.

Below researchers will find side effects and complications information by peptide:

- **Weight Loss Peptides:** Semaglutide, Liraglutide, Tirzepatide
- **Muscle Growth Peptides:** Ipamorelin, CJC-1295 DAC, Sermorelin
- **Skin Care Peptides:** GHK-Cu
- **Healing Peptides:** BPC-157, TB-500
- **Longevity Peptides:** Epithalon
- **Reproductive Health Peptides:** PT-141
- **Nootropic Peptides:** Semax, Selank
- **Immune System Peptides:** Thymosin Alpha-1
- **Tanning Peptides:** Melanotan 2

CHAPTER 07

PREPARATION, STORAGE, AND MORE

IN THIS CHAPTER, WE'LL SHARE A DETAILED STEP-BY-STEP GUIDE WITH RESEARCHERS ON HOW TO RECONSTITUTE PEPTIDES FOR RESEARCH PURPOSES.

Reconstituting peptides refers to the process of dissolving or rehydrating lyophilized (freeze-dried) peptides to prepare them for use in research.

This step is required because research peptides cannot exert their biological activity in a solid state and must be reconstituted back into a liquid state.

Most peptides are also in a liquid state when they are initially synthesized and manufactured. However, liquid formulations tend to be unstable due to their physical and chemical degradation susceptibility.

This is why manufacturers turn them into a solid state via various methods, such as freeze-drying. More specifically, freeze-drying is also known as lyophilization and turns the peptide into a dry, powder form to enhance its shelf life [116].

A lyophilized peptide powder is more stable and can be stored for longer periods without degradation. Lyophilization helps preserve a peptide's integrity and activity, making it easier to handle, store, and transport [117].

Thus, when ordering peptides online, researchers will receive products in a dry, powdered form, which guarantees that they are shelf-stable and still viable for experiments.

These "raw" peptides must be reconstituted back into a liquid form using an appropriate solvent to exert their biological activity in experimental settings.

The most common solvents for reconstitution include bacteriostatic water, sterile water, and organic solvents like dimethyl sulfoxide (DMSO) [118].

The most appropriate solvent will depend on several factors, such as the type of peptide, the research purpose, and desired shelf-life.

For example, most peptides dissolve well in bacteriostatic or sterile water. However, poorly soluble polar and non-polar molecules will require organic solvents such as DMSO [119].

It is important to note that reconstituted peptides should be handled with care to maintain their stability. Factors such as extreme temperature, pH, and exposure to light should be avoided to prevent denaturation and loss of biological activity [120,121].

Further, following established protocols and guidelines specific to the peptide being used is crucial to ensure accurate and reproducible results in research.

Keep reading to find a detailed step-by-step guide on how to reconstitute peptides for research purposes.

HOW TO RECONSTITUTE PEPTIDES

Before we go over the reconstitution process step-by-step, researchers must ensure they have all the supplies needed for the process.

To reconstitute research peptides correctly, researchers will need the following materials:

- **Vial of lyophilized peptide powder ("raw" peptide)**
- **Vial of a sterile solvent, such as bacteriostatic water**
- **Alcohol prep pads**
- **A sterile syringe of at least 3cc**
- **Disposable sharps container**

HOW TO MIX PEPTIDES

1. Before starting, allow the peptide and bacteriostatic water vials to reach room temperature for 30 minutes, away from direct light or heat sources.
2. Start by disinfecting the stoppers of both vials using alcohol prep pads.
3. Assemble the large sterile needle and syringe and draw in about 1mL of air. Then insert the needle into the vial with the sterile solvent.
4. Inject the air inside the vial to prevent negative pressure and immediately withdraw the correct amount of sterile solvent needed for reconstitution (usually 1mL).
5. Pull the needle out of the solvent and insert it into the vial with lyophilized peptide. Then drip or slowly inject the solvent from the syringe while aiming the needle tip at the vial wall. To prevent foaming, do not aim directly toward the powder or spray the solvent.
6. Once researchers have injected the correct amount of solvent, they can dispose of the needle and syringe in a sharps container.
7. Let the peptide dissolve naturally within the solvent. In addition, researchers can use sonication if available or very gently roll/swirl the vial. Avoid forceful tapping or shaking, as this can damage the peptide structure. Also, avoid tapping the syringe before injection.
8. After the peptide has dissolved, check the clarity of the liquid and look for any particles. If the solution is cloudy or if there are any particles, discard it.

Once the peptide is reconstituted, refer to the specific product label for accurate dosage and storage instructions, if any.

UNDERSTANDING PEPTIDE RECONSTITUTION

When reconstituting peptides for research, scientists must start by getting acquainted with the quantity of the lyophilized peptide contained in the vial. This is a fixed amount measured in milligrams (mg) or micrograms (mcg), as stated on the label.

The amount of solvent used will determine the volume of the reconstituted peptide to be withdrawn for a desired dose. For instance, if a researcher adds 2mL of a solvent to a peptide, they will need to inject twice the volume compared to another researcher who wants to administer the same dose but adds only 1mL. Some researchers may find it difficult to calculate the appropriate amount of peptide to administer because, unlike reconstitution, the administration process typically requires smaller insulin syringes for subcutaneous administration.

Insulin syringes come in various sizes, typically ranging from 0.3ml to 2.0ml. However, the tick marks on insulin syringes represent numbers of units (insulin units) rather than milliliters. They are usually labeled as either U-40 or U-100, indicating the type of insulin they are designed for.

BACTERIOSTATIC WATER VS. STERILE WATER

Two of the most commonly used solvents for dissolving research peptides are bacteriostatic water and sterile water.

In general, bacteriostatic water is the preferred option as it contains 0.9% benzyl alcohol, which prolongs the peptide's shelf-life [122].

The benzyl alcohol has no toxicity at these concentrations, while it can effectively suppress the growth of microorganisms.

Due to the presence of the preservative, the pH of bacteriostatic water is typically around 5.7 (4.5 to 7.0), which also helps improve the stability of most peptides [123, 124].

Bacteriostatic water is typically supplied in plastic vials made of specially formulated polyolefin, which has confirmed safety in animal tests. The multiple-dose vials allow repeated withdrawals of bacteriostatic water for the reconstitution of peptides [125, 126].

Unopened and unused bacteriostatic water has a shelf life of over two years when stored properly. After breaching the safety seal and opening the vial, bacteriostatic water has a shelf-life of up to four weeks if refrigerated properly at 36 to 46 degrees F (2 to 8 degrees C).

Similarly, peptides reconstituted with bacteriostatic water have a four-week shelf life when refrigerated at these temperatures.

A downside of bacteriostatic water is that some test subjects may be allergic to benzyl alcohol [127]. In such cases, subjects should receive only peptides reconstituted with sterile water.

In comparison, sterile water does not suppress microbial growth, and its shelf-life is only 24 hours after opening. Any peptide reconstituted with sterile water also becomes unsuitable for use after 24 hours, even if refrigerated.

However, sterile water is the only viable option for test subjects with hypersensitivity to benzyl alcohol.

HOW TO STORE RECONSTITUTED PEPTIDES

Research peptides that are reconstituted with bacteriostatic water must be refrigerated at 36 to 46 degrees F (2 to 8 degrees C) and under these conditions remain viable for up to four weeks.

Avoid freezing reconstituted peptides as this can impact the compound's integrity and functionality. This is because ice crystal formation can disrupt the peptide structure, potentially leading to loss of biological activity or altered properties.

Additionally, freeze-thaw cycles can exacerbate the damage caused by freezing and lead to aggregation or precipitation.

In cases where freezing is absolutely necessary, the United Kingdom National Institute for Biological Standards and Control (NIBSC) recommends that researchers freeze and store aliquots of the peptide at -4°F (-20°C) or lower temperatures [128].

To minimize potential damage, it may be beneficial to use slow freezing methods. Consequently, fast thawing may help reduce the number of ice crystal formations, although the optimal strategy may vary from one compound to another [129].

It is likewise important to avoid multiple freeze-thaw cycles as this leads to cumulative damage. The better alternative would be freezing the reconstituted research peptides (any amount that will not be used within four weeks) as several aliquots in empty sterile vials and then thawing them one by one.

Proper storage conditions, such as using cryoprotectants or stabilizing agents, can further help mitigate damage during freezing and subsequent storage [130].

HOW TO STORE "RAW" PEPTIDES

"Raw" peptides are typically shipped in the form of dry lyophilized powders that are sealed within sterile vials, usually under an atmosphere of dry inert gas.

This significantly extends the shelf life of lyophilized peptides to several years when stored properly in a dark, cool, and dry place. The shelf-life can be further extended by storing the peptides at low temperatures, especially under -4°F (-20°C).

Freezing them is generally safe as they do not contain any water molecules, and there is no risk of ice crystal formation. Before reconstitution, "raw" peptides should be left at room temperature.

Neither lyophilized nor reconstituted peptides should be exposed to heat or direct sunlight.

CHAPTER

08 OTHER FORMS OF RESEARCH PEPTIDES

IN THIS CHAPTER, WE'LL LIST THE TWO MOST COMMON ALTERNATIVE PEPTIDES THAT RESEARCHERS CAN ADMINISTER.

Research peptides may be delivered via different routes of administration. Most clinical data and research is based on injectable peptides, which typically come in lyophilized powder form. This lyophilized powder is then generally mixed with a reconstitution solution, like bacteriostatic water, prior to administration in a research setting.

The main reason for applying peptide injections over other routes of delivery is ***bioavailability***. Both preclinical and clinical studies have shown high levels of absorption and bioavailability of various peptides when injected. Indeed, subcutaneous administration is the most common method of applying the vast majority of research peptides.

While there is high interest in alternative, non-invasive methods of peptide delivery, challenges like poor metabolic stability and low penetration of the blood-brain barrier (BBB) prevent many peptides from being administered using methods other than injection.

However, scientific breakthroughs have enabled the administration of certain peptides in other forms, with the two most common alternatives being:

- **Nasal Spray**
- **Capsules / Tablets**

Let's briefly look at the two in turn.

PEPTIDE NASAL SPRAYS

Researchers have long believed that nasal formulations may be suitable for the delivery of drugs including peptides, namely in contexts like neurological disease.

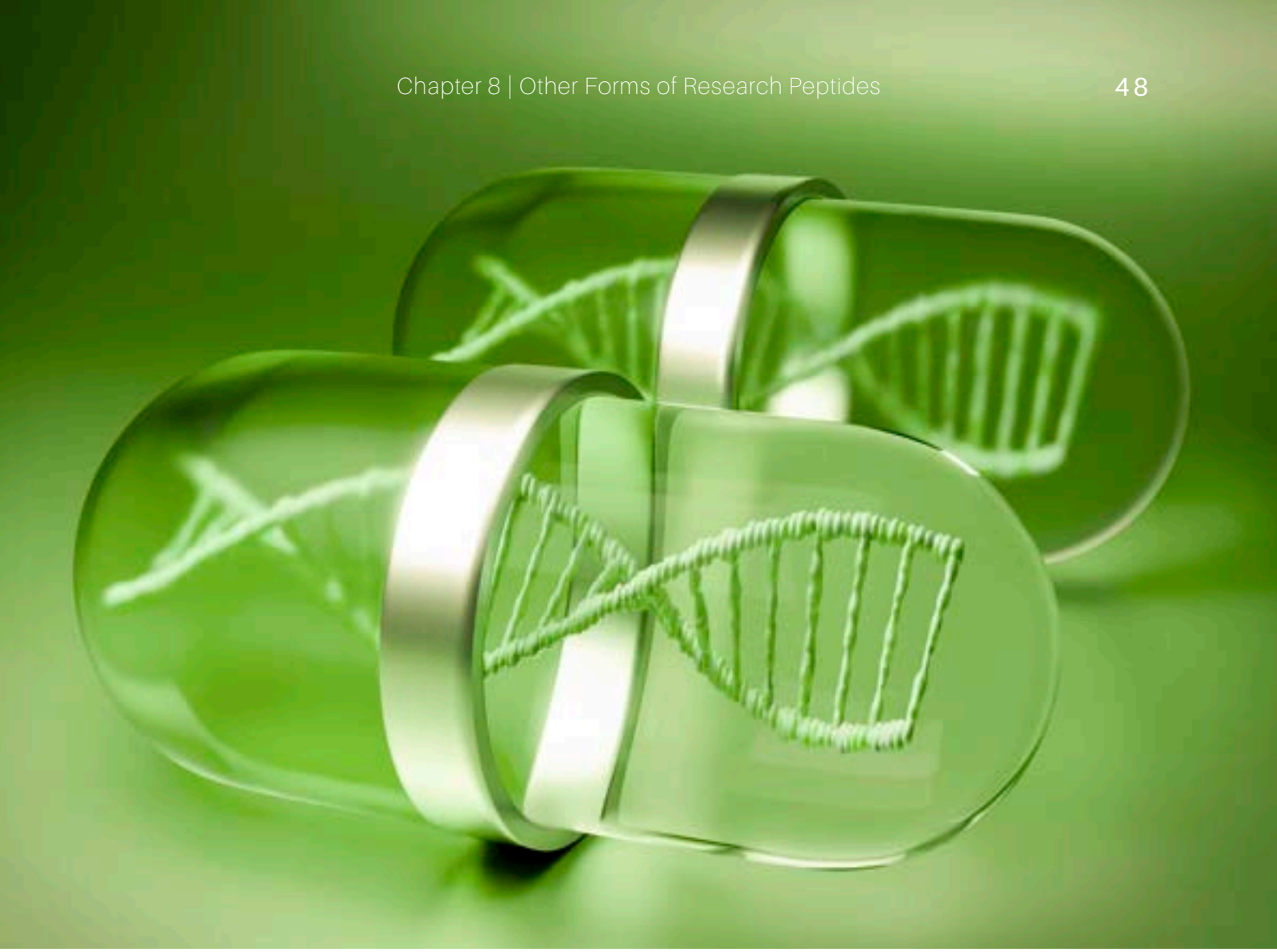
Clinical research has shown that intranasal administration may facilitate the entry of substances into the brain via pathways involving the olfactory bulb and olfactory epithelium.

Intranasal administration may in some cases even bypass the BBB to deliver large-sized molecules to the brain and target the central nervous system.

Nasal sprays are non-invasive, convenient to administer to test subjects, and pre-formulated for the researcher in metered spray bottles.

The following peptides are among those designed for effective delivery via nasal spray and available for purchase through our recommended vendors:

- **DSIP**
- **NAD+**
- **PT-141**
- **Selank**
- **Semax**



ORAL PEPTIDES

Peptide capsules or tablets are easy to take and eliminate the need for peptide reconstitution, injections, or intranasal administration. Capsules always come pre-measured for clear dosing.

This method is especially appealing to scientists who require non-invasive and hassle-free administration.

Some researchers have proposed that the development of peptides with oral bioavailability of 30-50% would suffice to overtake injection as the preferred route of administration.

The use of tools like chemical modifications, mucoadhesive polymeric systems, and certain formulation vehicles have allowed a number of peptides to become sufficiently orally bioavailable for delivery through capsules or tablets.

Thanks to breakthroughs in the field, the following research compounds are suitable for oral delivery and may be purchased through our endorsed online vendors:

- **5-Amino-1MQ**
- **BPC-157**
- **MK-677**
- **TB-500**
- **Tesofensine**

Chapter 06

RESEARCH PEPTIDES

THE ULTIMATE GUIDE

This concludes our ultimate guide on research peptides. With an expanding repertoire of potential applications, peptides are a topic of great interest to medical and pharmaceutical researchers worldwide. In this guide, researchers have been briefed on the key features, evidenced benefits, and recent developments of this burgeoning field.

When purchased from a trusted supplier, research peptides may be safely handled by qualified individuals.

Visit our favorite retailer today to obtain top-caliber peptides for research into this truly groundbreaking area of study.

PEPTIDES.org

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