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Snake Venom Viper Peptide as Aesthetic Agent: A Review of its Potential Use

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Abstract: The integration of animal-derived toxins into the aesthetic pharmacopeia represents a transformative shift in the management of cutaneous senescence and structural skin dysfunction. This review evaluates the emergence of snake venom-derived peptides, specifically those mimicking the neuromuscular blocking activities of viper venom, as high-performance aesthetic agents. Central to this analysis is the evolution of "venomics" facilitated by advancements in mass spectrometry, genomics, and proteomics. By synthesizing clinical data from venom-derived pharmaceutical trials, including studies on alfimeprase and cenderitide, the safety profile and receptor specificity of these compounds are established. The analysis reveals a significant commercial shift toward neurocosmetics, with synthetic viper-mimetic peptides now occupying a substantial portion of the premium skincare market.

Keywords: *Neurocosmetics, Biomimetic Peptides, Viper Peptide, Aesthetic Medicine.*

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I. INTRODUCTION

Animal venoms are complex mixtures made up of many biologically active compounds, each designed to interact with specific receptors and help venomous species defend themselves or capture prey. Interestingly, these same compounds are now attracting growing interest in the medical field for their potential therapeutic applications. The term “venomics” was first introduced by Juárez and colleagues to describe the comprehensive analysis of the full protein composition of snake venom. Since then, major advances in analytical technologies. such as genomics, mass spectrometry, and proteomics have made it much easier for researchers to map and understand venom components in detail. Combined with modern high-throughput screening techniques that allow rapid testing of bioactive compounds, these developments have significantly accelerated efforts to harness the therapeutic potential of animal venoms for medical use (1).

Beyond their well-known anti-aging effects, snake venom peptides have been studied for a range of additional cosmetic benefits. These include improving skin firmness, providing antioxidant protection, enhancing moisture retention, supporting skin barrier repair, and even helping reduce periorbital hyperpigmentation (dark circles around the eyes). As interest in “neurocosmetics” containing snake venom grew and consumer demand for anti-aging products continued to rise while researchers began developing synthetic peptides designed to mimic the beneficial effects of natural venom. These laboratory-created alternatives offer similar cosmetic results while being more affordable and practical than using purified venom itself (2).

Synthetic peptides whether biomimetic (designed to imitate natural biological molecules) or bioactive are now widely used in topical skincare formulations. When applied to the skin, they offer promising options for preventing or improving visible signs of skin dysfunction, including aging, hyperpigmentation, and wrinkle formation. These compounds can stimulate collagen and elastin production, promote wound healing, and increase fibroblast activity. In addition, many peptides provide antioxidant, antimicrobial, and skin-brightening benefits (3,4).

Peptides have been part of the cosmetic field since 1973, when Pickart introduced the synthetic peptide GHK (glycyl-L-histidyl-L-lysine). He described it as a signal peptide capable of stimulating collagen synthesis and functioning as a carrier peptide when bound to copper (Cu II). Despite this early discovery, peptides did not become widely recognized in cosmetics until the early 2000s, when Palmitoyl Pentapeptide-4 was launched with claims of reducing facial wrinkles. Since then, their versatility and targeted mechanisms have led to the development of many new cosmeceutical peptides, formulated to meet evolving consumer expectations and skincare needs (5,6).

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II. COMPOSITION OF SNAKE VENOM AND ENZYMATIC PROTEIN

In general, snake venom is a complex secretion produced by a pair of specialized exocrine glands that are connected to the fangs through ducts. Rather than being a single substance, venom is a sophisticated cocktail made up of numerous toxics and biologically active molecules. Studies have identified around 100 different components in some individual venoms, although the exact number of proteins and peptides present is still not fully known. What is clear, however, is that proteins and peptides make up most of the venom's dry weight likely around 90–95%. Among these components, some proteins have enzymatic functions, actively catalyzing biochemical reactions, while others are non-enzymatic proteins and peptides that exert their effects through different biological mechanisms. In addition to these major constituents, snake venom also contains smaller amounts of other substances such as nucleosides, metal ions, carbohydrates, and trace levels of free amino acids and lipids, which generally have less pronounced biological activity (7).

Peptides are among the most fascinating components of snake venom. While the venom is toxic, certain venom-derived peptides can be highly beneficial when used in carefully controlled doses or when structurally modified through bioengineering. In fact, several of these peptides have been developed either as therapeutic drugs or as promising starting points for new drug development (2,8).

Their value lies in their diverse and highly specific pharmacological actions, as well as their strong affinity and selectivity for receptors. Snake venom toxins, for example, have been extremely useful in helping scientists understand the structure and function of various receptors, α-neurotoxins being a well-known case. Another notable feature of snake venom peptides is their stability; they are remarkably resilient molecules, capable of withstanding the harsh, enzyme-rich environment within the venom gland itself (9,10)..

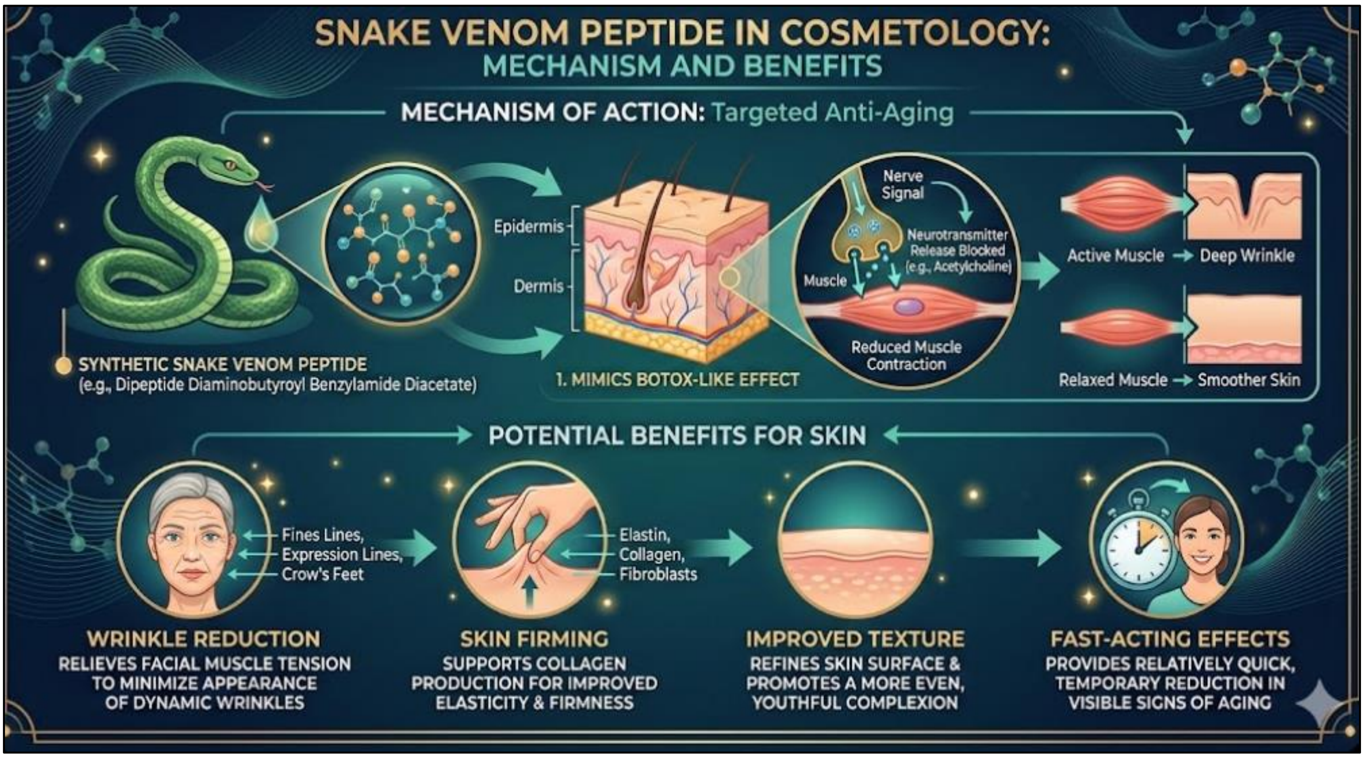

Fig 1 Schematic Diagram of Snake Venom Peptide and its Benefit.

More recently, argiotoxin-636 (ArgTX-636), a compound isolated from the venom of the Argiope lobata spider, has been patented for use in skin and teeth whitening products. Although its exact mechanism of action has not yet been fully clarified, it is thought to work primarily by inhibiting melanogenesis, the process responsible for melanin production. This effect is believed to underlie its potential benefits in cosmetic applications (9).

When discussing such products, it is important to distinguish between regulatory approval for drugs and for cosmeceuticals. Drugs are required to demonstrate clear therapeutic efficacy and safety based on well-established biological mechanisms. In contrast, cosmeceuticals occupy a more nuanced space: they are marketed as providing pharmaceutical-like benefits, but they are not always required to demonstrate the same level of scientifically established biological effect as approved medications (11).

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III. CLINICAL TRIAL VENOM-DERIVED DRUG

Considerable research has focused on harnessing natriuretic peptides, such as atrial natriuretic peptide (ANP), B-type (or ventricular) natriuretic peptide (BNP), and C-type natriuretic peptide (CNP) as potential treatments for heart failure. These naturally occurring peptides play important roles in regulating fluid balance, blood pressure, and cardiac workload (10).

The first reptile-derived natriuretic peptide to be characterized was dendroaspis natriuretic peptide (DNP), which was isolated from the Eastern green mamba (*Dendroaspis angusticeps*). DNP is a 38–amino acid peptide that closely resembles human natriuretic peptides in structure. It strongly activates guanylate cyclase A in cardiomyocytes, promoting cardiac unloading and potentially offering therapeutic benefits in heart failure. Building on this discovery, researchers at the Mayo Clinic developed cenderitide, a synthetic peptide created by combining the 22–amino acid sequence of CNP with the 15–amino acid C-terminal portion of DNP, aiming to enhance its therapeutic potential (8).

Another strategy for translating snake venom components into medical therapies involved isolating fibrolase, a metalloproteinase enzyme found in the venom of the southern copperhead snake (Agkistrodon contortrix contortrix). This 203–amino acid protein was genetically engineered through DNA recombination to produce alfimeprase, a modified compound designed to directly break down fibrin and promote thrombolysis. Alfimeprase showed promising early results and successfully completed a phase I clinical trial in patients with acute peripheral arterial occlusion. It was generally well tolerated, with no reported cases of significant bleeding or systemic thrombolysis. However, despite advancing to phase II and III trials, further development was eventually discontinued because the drug did not demonstrate a meaningful benefit compared with placebo (2).

The current proliferation of anti-aging dermatological products is closely linked to the widespread commercial adoption of SYN®-AKE, a synthetic tripeptide engineered to mimic the neuromuscular blocking effects of snake venom. Functioning through a mechanism analogous to botulinum toxin, this active ingredient targets expression lines and fine wrinkles by inducing a localized "lifting" effect, thereby modulating the visible signs of cutaneous senescence. Within the broader taxonomy of personal care, which categorizes formulations by their physiological application (body, hair, oral, and skincare), SYN®-AKE has achieved significant market penetration, appearing in approximately 86.5% of analyzed skincare samples. This synthesized compound is predominantly integrated into diverse delivery systems, including emulsions such as facial and ophthalmic creams (n = 114), high-potency serums (n = 64), and specialized topical applications like facial masks and eye pads (7).

IV. CONCLUSION

The emergence of snake venom viper peptides as aesthetic agents marks a significant milestone in the development of targeted, mechanism-based skincare. Through the lens of venomics, science has successfully decoded the complex protein architecture of animal toxins, transforming them from agents of predation into instruments of rejuvenation. The widespread adoption of synthetic tripeptides demonstrates the clinical and commercial viability of neurocosmetics, offering patients a non-invasive method for reducing expression lines and smoothing the skin surface.

REFERENCES

[1]. Mohamed Abd El-Aziz T, Soares AG, Stockand JD. Snake venoms in drug discovery: valuable therapeutic tools for life saving. Toxins (Basel). 2019;11(10):564.
[2]. Moisa DG, Gligor FG, Rus LL, Morgovan C, Frum A, Juncan AM. Snake venom-an emerging challenge in cosmetology. In: NAUNYN-SCHMIEDEBERGS ARCHIVES OF PHARMACOLOGY. Springer ONE NEW YORK PLAZA, SUITE 4600, NEW YORK, NY, UNITED STATES; 2022. p. S72–S72.
[3]. Munawar A, Ali SA, Akrem A, Betzel C. Snake venom peptides: tools of biodiscovery. Toxins (Basel). 2018;10(11):474.
[4]. Coulter-Parkhill A, McClean S, Gault VA, Irwin N. Therapeutic potential of peptides derived from animal venoms: current views and emerging drugs for diabetes. Clin Med Insights Endocrinol Diabetes. 2021;14:11795514211006072.
[5]. Skaribas EE, Kashyap A, Black TA, Yang N, Ali I, Rashid RM. Snakes and Skin: A Review of Aesthetic, Analgesic, and Anesthetic Snake Venom Applications. Int J Dermatol. 2025;64(7):1213–9.
[6]. Zona Rubio DC, Aragón DM, Almeida Alves I. Innovations in snake venom-derived therapeutics: a systematic review of global patents and their pharmacological applications. Toxins (Basel). 2025;17(3):136.
[7]. Moisă DG, Juncan AM, Rus LL, Vonica-Țincu AL, Cormoș G, Gligor FG. Viper Venom and Synthetic Peptides: Emerging Active Ingredients in Anti-Ageing Cosmeceuticals. Appl Sci. 2025;15(8):4501.
[8]. Kang TS, Georgieva D, Genov N, Murakami MT, Sinha M, Kumar RP, et al. Enzymatic toxins from snake venom: structural characterization and mechanism of catalysis. FEBS J. 2011;278(23):4544–76.
[9]. Georgiana D, Juncan AM, Rus L liviu, Gligor FG, Vonica-t AL. Viper Venom and Synthetic Peptides : Emerging Active Ingredients in Anti-Ageing Cosmeceuticals. 2025;1–20.
[10]. Gopalakrishnakone P, Inagaki H, Mukherjee AK, Rahmy TR, Vogel CW. Snake Venoms. Springer Berlin, Germany:; 2017.
[11]. Dutertre S, Nicke A, Tsetlin VI. Nicotinic acetylcholine receptor inhibitors derived from snake and snail venoms. Neuropharmacology. 2017;127:196–223.