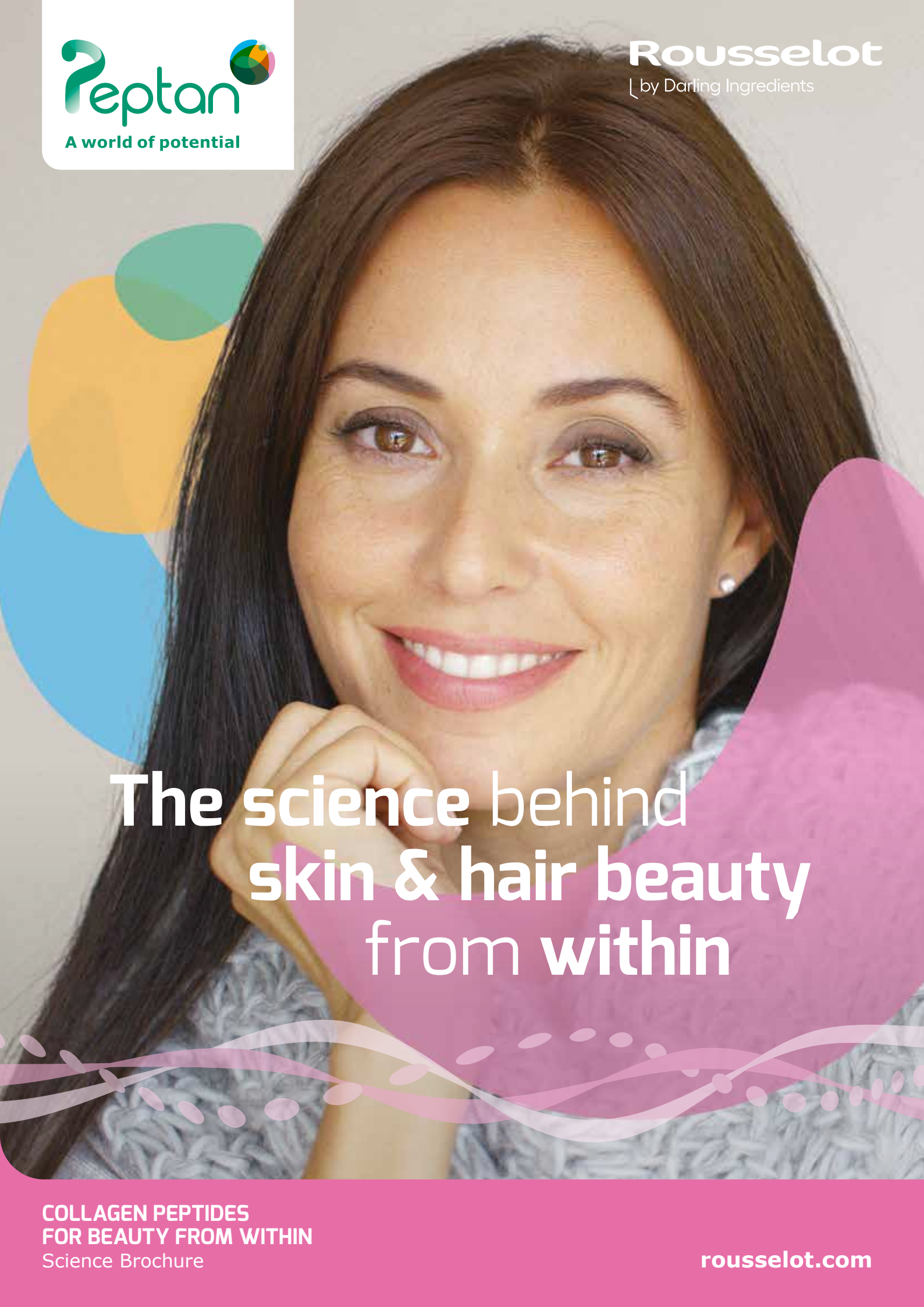




The science behind skin & hair beauty from within

A close-up photograph of two women smiling and embracing each other. The woman on the left is younger with dark hair, wearing a light pink shirt. The woman on the right is older with brown hair, wearing a grey sweater. They are both looking towards the camera with warm expressions. A pink circular graphic is overlaid on the bottom right of the image, containing text.

Underpinned by
robust, innovative
research, Peptan®
bioactive collagen peptides
are an ingredient truly
backed by science.

THE SCIENCE BEHIND SKIN & HAIR BEAUTY BROUGHT TO YOU by Peptan COLLAGEN PEPTIDES

There has always been a link between beauty and health: beautiful skin quickly tells people around us that we're in good health - and, in fact, looking good can make us feel better physically and mentally. Healthy-looking skin, in short, is associated with attractiveness and confidence. This holistic well-being is one of Peptan's key pillars: we are here to help consumers look their best.

Collagen and beauty

Collagen, the body's most abundant protein, is crucial for our skin. It's responsible for its strength and flexibility (Box 1: Skin structure). Collagen also supports hair and nails, the skin's main appendages, even though they are not made of collagen.

Around our mid-twenties, collagen production in our skin diminishes, leading to well-known signs of aging: wrinkles, dry skin, and loss of elasticity [1]. And hair becomes thinner and weaker, which eventually can lead to hair loss [2].

What the science tells us

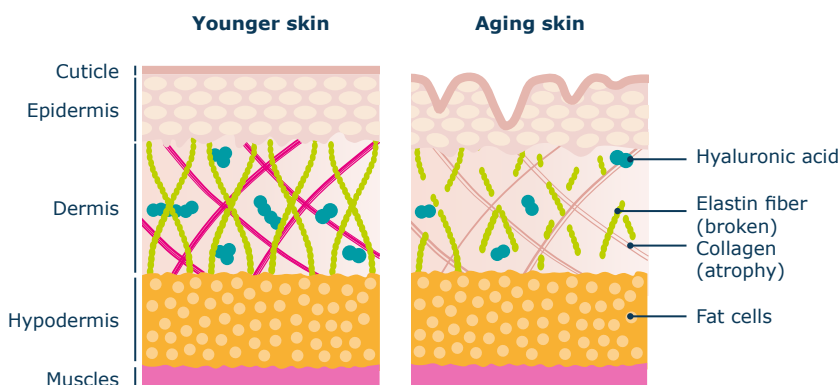
Rousselot's scientific research has shown that collagen peptides can delay the signs of aging and improve the appearance of skin and hair. More than 10 years of Rousselot studies demonstrate that oral intake of Peptan collagen peptides can help us achieve firmer skin and healthier looking hair.

The future of beauty

Our scientific portfolio is constantly growing with new findings, as we use the latest technologies to better understand collagen's role in promoting beauty from within.

Discover the latest insights into Peptan and beauty from within! (Box 2: Peptan science for Skin and Hair Beauty)

Skin structure as we age



As aging takes place, collagen's endogenous production decreases, causing thinner, drier and less elastic skin leading to wrinkles.

Daily oral collagen peptide supplementation can play a key role in delaying and diminishing the signs of aging.

Box 1: Skin structure

Summary of Referenced Studies

This table summarizes the collagen and beauty studies referenced in this document.

Topic	Author	Study type	Population	Country/Ethnicity	Dosage
Skin density	Asserin <i>et al.</i>	Randomized, placebo-controlled, double blind	99 women (40-65 years old)	France (Caucasian)	10g
Skin hydration	Asserin <i>et al.</i>	Randomized, placebo-controlled, double blind	33 women (40-59 years old)	Japan (Japanese)	10g
Skin density, skin elasticity, skin hydration and wrinkle reduction	Vleminckx <i>et al.</i>	Randomized, placebo-controlled, double blind	85 women (40-65 years old)	China (Chinese)	5 g
Skin elasticity and skin hydration	Kuninty* <i>et al.</i>	Randomized, placebo-controlled, double blind	40 women (35-48 years old)	Germany (Caucasian)	5g/10g
Hair growth/loss	Pappelbaum <i>et al.</i>	<i>ex-vivo</i>	6 hair follicles of both men and women	Germany (Caucasian)	n/a

Box 2: Peptan science for Skin and Hair Beauty

* Rousselot clinical data

Peptan and the science behind skin beauty

Skin density

Our placebo-controlled studies have shown that **Peptan can increase skin firmness by improving skin density.**

The Asserin *et al.* scientific study on 99 Caucasian women (age 40-65) [3] has shown that ingestion of 10 g of Peptan F for 12 weeks significantly increased skin density compared to placebo (Figure 1a). Similar positive results were observed in the Vleminckx *et al.* study with 85 Chinese women (age 40-65) [4], where a significant improvement of skin density was observed after taking 5 g of Peptan P for 12 weeks (Figure 1b), compared to the placebo group.



Peptan increases skin firmness by improving skin density

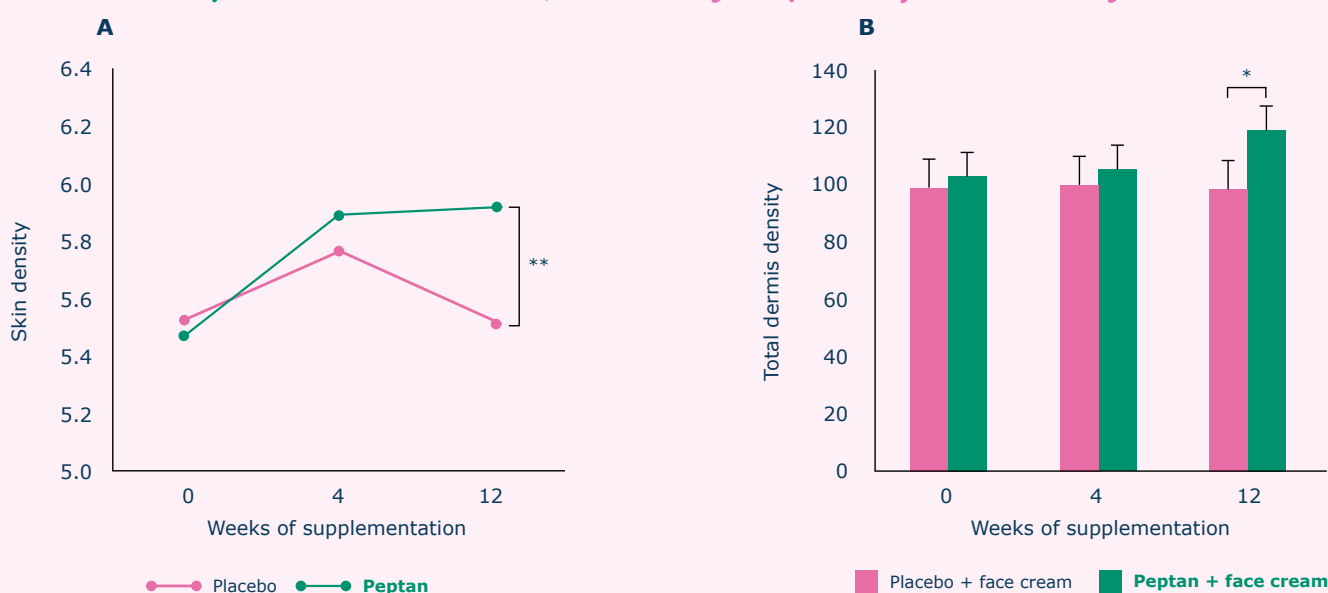


Figure 1. Effect of 12 weeks of Peptan supplementation on skin density. (A) 10 g Peptan F in Caucasian women using high frequency, real-time ultrasound; (B) 5 g Peptan P in East Asian women, measured by ultrasound scanning and subsequently quantified on a gray-scale (0-255).

* $p < 0,05$; ** $p < 0,01$ compared to placebo

Skin elasticity

Skin elasticity is vital for a healthy appearance, since the **loss of elasticity leads to sagging and wrinkling of the skin** [3]. In our studies, **Peptan positively impacted skin elasticity**.

In the Vleminckx *et al.* study [4], an expert in dermatology assessed skin elasticity with clinical scoring (0-9) based on visual and tactile assessment (Figure 2a). The results demonstrate that after four weeks of oral supplementation of 5 g Peptan P, the skin elasticity of the participants significantly improved by 7% compared to placebo. This beneficial influence on skin elasticity was confirmed in the Kuninty *et al.* study in 40 Caucasian women (age 35-48) using gold standard elasticity-measuring technology after 12 weeks of supplementation with different Peptan F dosages [5]. Oral intake of 5 to 10 g of Peptan F significantly elevated skin elasticity compared to placebo within 12 weeks (Figure 2b).



Peptan positively impacts skin elasticity

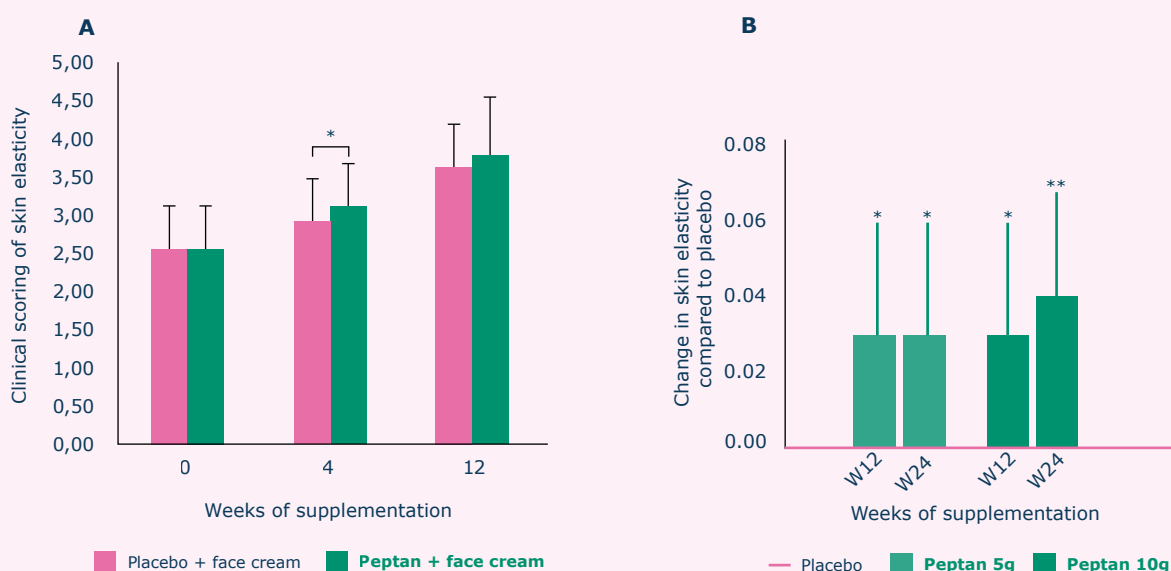


Figure 2. : (A) Clinical scoring of skin elasticity after four weeks of oral supplementation of 5 g Peptan P in East Asian women. (B) Changes in skin elasticity (mean and 95% CI) in Caucasian women under 48 years old, compared to placebo (pink line at $\Delta = 0$) after 12 and 24 weeks of oral supplementation with Peptan F at different dosages.

* $p < 0.05$, ** $p < 0.01$ compared to placebo at a given time point.

Skin hydration

For a natural glow, our skin needs enough hydration. Peptan has been observed to improve skin hydration levels. The study conducted by Asserin *et al.* [3] showed that a daily dose of 10 g Peptan P significantly improved skin hydration in 33 healthy Japanese women within 8 weeks compared to a placebo (Figure 3a). Additionally, supplementation with either Peptan P or Peptan F showed significantly enhanced skin hydration levels after 8 weeks when compared to baseline.

The Vleminckx *et al.* study performed on 85 Chinese women (age 40-65) shows that daily supplementation with only half the dose (5 g) of Peptan P was sufficient to increase skin hydration (Figure 3b; [4]). This study demonstrates a significant difference between the Peptan and placebo group after 12 weeks. Notably, the participants also used a face cream during the study period to standardize their facial care, highlighting the efficacy of Peptan in combination with routine

facial care and making these results valuable as they mimic real-life beauty routines.

The positive effects of Peptan supplementation on skin hydration were once again confirmed in the Kuninty *et al.* study [5]. Taking 10 g of Peptan F significantly improved skin hydration already within 12 weeks compared to placebo.

+14%
enhanced
skin hydration
(Peptan vs Placebo)^{3,4}

Peptan improves skin hydration levels

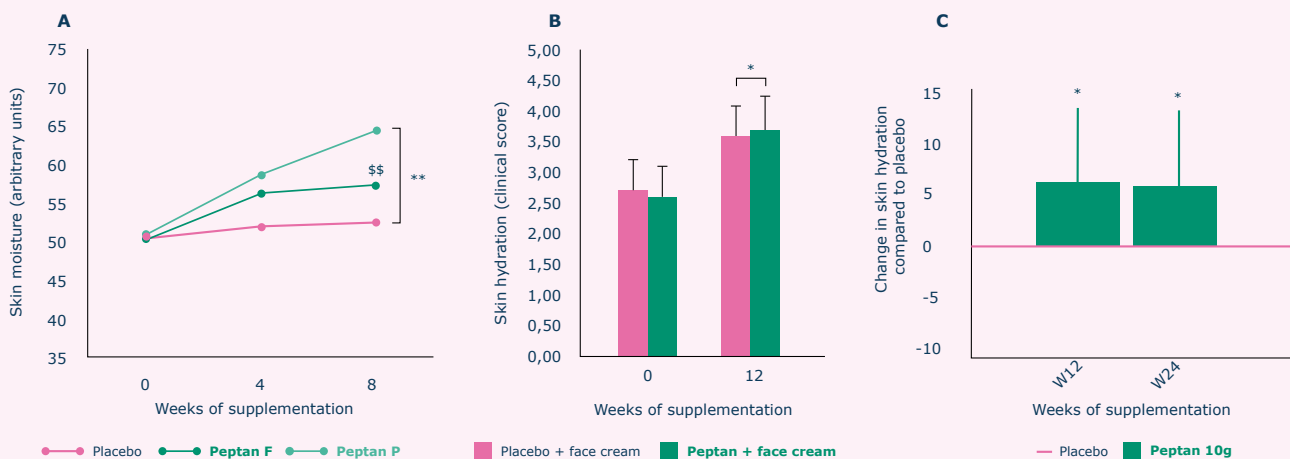


Figure 3. : Assessment of skin hydration (A) by conductivity in a Japanese population after supplementation with Peptan P or Peptan F; (B) clinical scoring by a dermatology expert in 40-65 years old East Asian women after supplementation with Peptan P. (C) Changes in skin hydration (mean and 95% CI) in women under 48 years old, compared to placebo (pink line at $\Delta = 0$) with Peptan F at different dosage. * $p < 0,05$; ** $p < 0,01$ denotes significant differences between Peptan and placebo group at a given time point. \$\$ $p < 0.05$ compared to baseline (Week 0).

Wrinkle reduction

We call them 'laugh lines', but many of us do not welcome those wrinkles around the eyes or mouth that are one of the most common physical signs of aging. Our research has revealed that Peptan can reduce wrinkle visibility in women within 4 weeks [4]. In the placebo group, this significant effect was only observed after 12 weeks possibly due to properties of the face cream. This study shows that Peptan and face

cream will work faster against wrinkles than using a face cream alone.

Finally, adding to these findings and considering as shown above that Peptan can help improve skin hydration, density, and elasticity, it is concluded that overall wrinkle appearance could be diminished by Peptan supplementation.

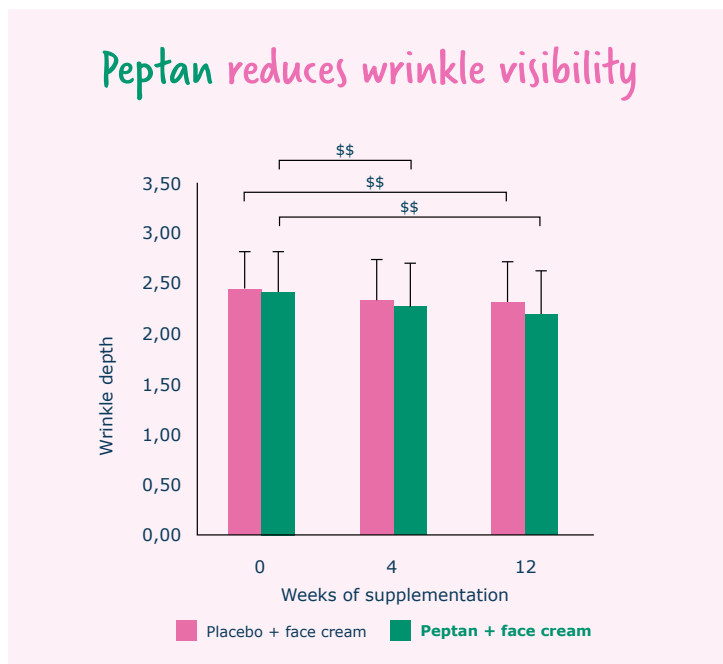


Figure 4. : Influence of Peptan on the appearance of wrinkles: a) depth of crow's feet wrinkles in East Asian women after supplementation with Peptan P. \$\$ $p < 0.05$ compared to baseline (Week 0)

**Faster and
more visible
wrinkle reduction
effect**

(Peptan + face cream
vs face cream)⁴

Dosage & origin: which is the best choice?

Together, the studies mentioned above illustrate that Peptan can positively impact skin beauty and wrinkle visibility. Beneficial effects were obtained after supplementation with different dosages [5], but it's worth noting that the desired result might be reached faster with a higher daily dose. The demonstrated effects were observed independently of the Peptan raw material used and across populations with diverging ethnicities.



Peptan and the science behind hair beauty

We all know how our hair can influence our mood. A good hair day means looking and feeling good. But many people do not know that diminishing hair health does not just come with aging. Stress, hormones and even seasonal shifts can affect our hair and, consequently, cause hair loss. Hair care is essential for everyone.

Zooming in on hair

First, we need to take a closer look at our hair (Figure 5). Aside from the visible part on your scalp, hair also contains a second structure, called the hair follicle, located inside the skin. This hair follicle is a living mini-organ, containing hair follicle stem cells (HFSCs) responsible for the growth and structure of our hair. The presence of these HFSCs ensures that our hair keeps growing and renewing through the regulation of the hair cycle [6]. Disturbances in the growth cycle of these hair cells result in (age-induced) hair loss. If we want to keep our hair, we need to keep our stem cells alive.

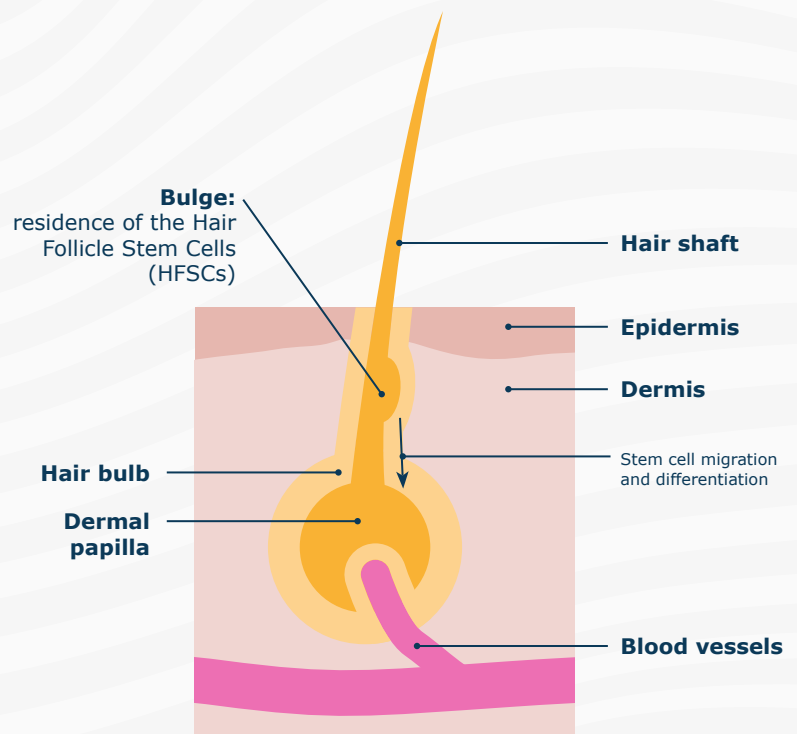


Figure 5. Schematic representation of a hair follicle.



Every day
can be a good
hair day!



**All Peptan studies
for Beauty have
been conducted in
compliance with
regulation (EC)
N1223/2009 with no
tests on animals**

**Glowing
skin & hair
start from
within!**

Growing beautiful hair from within

As hair follicles are situated in the skin, nurturing healthy hair starts from within. One promising solution is Peptan. The pioneering, ex vivo Pappelbaum *et al.* study on hair follicles, harvested from 6 people (men and women, age 27-59), revealed that *in vitro* digested Peptan B (mimicking the body's digestive process) increased the amount

of active stem cells (HFSCs) in the hair follicle (Figure 6a) and inhibited their death (Figure 6b) [7]. Since the aging process is linked to a decline of HFSCs, these findings suggest that **Peptan may play a positive role in addressing (age-induced) hair loss** by reinforcing the stem cells numbers and, consequently, sustaining hair follicle health.

Peptan increases the number of hair follicle stem cells while reducing their death

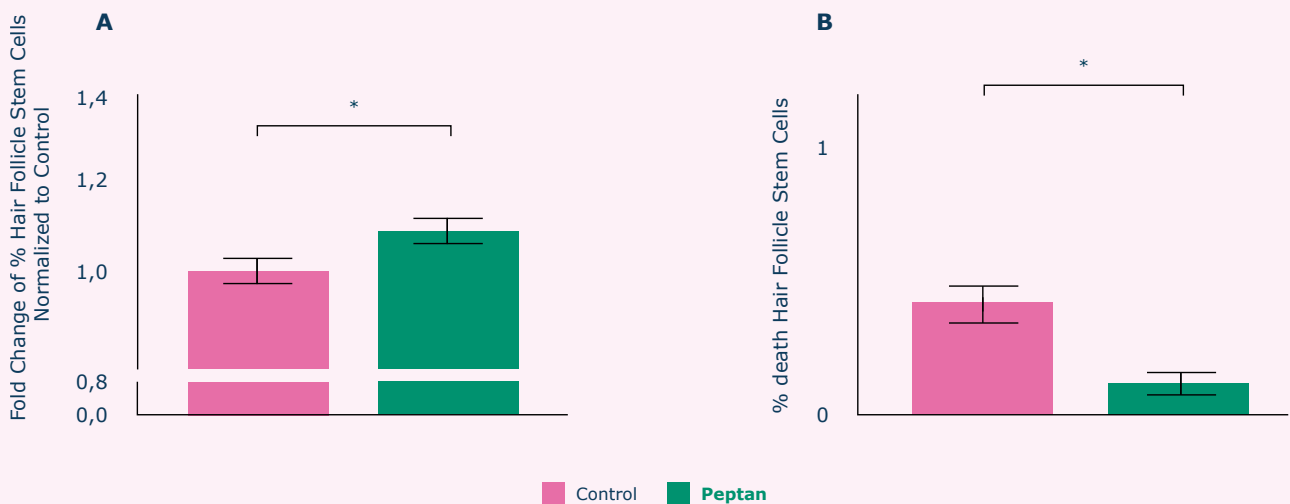


Figure 6. : Effect of Peptan B on A) presence and B) death of hair follicle stem cells: Hair follicles were harvested from 6 human donors and cultured ex vivo in the presence or absence of 0.01 mg/ml *in vitro* digested Peptan or blank. * $p < 0.05$.

As hair does not contain collagen, this pioneering study demonstrates that Peptan's benefits may extend beyond the effects of collagen production. It's a clear indication that collagen peptides could support the HFSCs and keep them active and alive. This, in turn, could contribute to effective hair care and beauty.

Peptan
features
pioneering science
in hair beauty
research

References

1. Bianchi *et al.* Evaluation of the Efficacy of a Hydrolyzed Collagen Supplement for Improving Skin Moisturization, Smoothness, and Wrinkles. *J Clin Aesthet Dermatol.* 2022;15(3):48-52. Epub 2022/03/29. PubMed PMID: 35342502; PubMed Central PMCID: PMCPMC8944283.
2. Turner *et al.* Hair and Aging. *Skinmed.* 2016;14(5):338-43. Epub 2016/11/23. PubMed PMID:27871344.
3. Asserin *et al.* The effect of oral collagen peptide supplementation on skin moisture and the dermal collagen network: evidence from an ex vivo model and randomized, placebo controlled clinical trials. *J Cosmet Dermatol.* 2015;14(4):291-301. Epub 2015/09/13. PubMed PMID: 26362110. doi: 10.1111/jocd.12174.
4. Vleminckx *et al.* Influence of collagen peptide supplementation on visible signs of skin and nail health and aging in an East Asian population: A double blind, randomized, placebo controlled trial, 2024 *Journal of Cosmetic Dermatology*, <https://doi.org/10.1111/jocd.16458>
5. Kuninty *et al.* Rousselot clinical data
6. Purba *et al.* Human epithelial hair follicle stem cells and their progeny: current state of knowledge, the widening gap in translational research and future challenges. *Bioessays.* 2014 May;36(5):513-25. Epub 2014 Mar 25. PMID: 24665045. doi: 10.1002/bies.201300166.
7. Pappelbaum *et al.* Revealing novel insights on how oral supplementation with collagen peptides may prevent hair loss: Lessons from the human hair follicle organ culture. *Journal of Functional Foods* 2024, 116, 106124. doi.org:10.1016/j.jff.2024.106124

Complete your product brand story with Peptan.

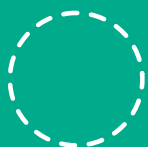
Complete your product brand story with Peptan. Rousselot is a world leader in trusted, science-backed collagen-based solutions. Many of our customers have engaged us in co-developing successful ingredient branding strategies. Selected customers benefit from our endorsement of their products, with access to the Peptan brand name and marketing materials.



Peptan collagen peptides are:

- An upcycled ingredient made from natural resources
- Of natural origin, available from fish, bovine, and porcine origin
- Kosher and Halal certified (on demand)
- Highly bioavailable
- Pure and neutral in sensory
- Backed by science
- World-class, safe products
- Convenient and easy to use
- Clean label, with no additives or e-numbers

Rousselot Health & Nutrition can help you with virtually any product requirement or innovation you have in mind, offering:



Transparency



Full traceability



High standards
of quality and safety

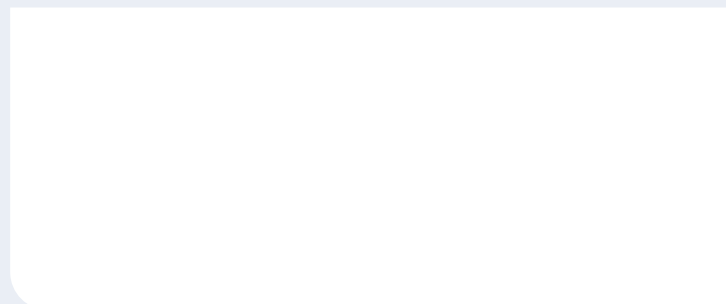


Committed to the
environment and
to our clients



Global support
and expert advice

Your Rousselot sales contact information



About Rousselot Health & Nutrition

At Rousselot's strategic segment dedicated to health and nutrition, we are committed to developing innovative ingredients answering today's demand for solutions offering proven efficacy, full safety, and premium quality. Our customers can rely on best-in-class products backed by trusted science, as well as on our expert support in formulation, product development, and regulatory advice. Our range of products includes Peptan®, the leading collagen peptide brand worldwide, Colartix®, ProTake® and Peptinex™ and offers "A world of potential for the consumer" for a healthier tomorrow.

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