WINDOME BANKING PARTNERS

Study on the Market Segment of PDRN- and PN-based medical aesthetics, dermocosmetics and biorevitalization products and medical devices

March 2025

Disclaimer

This document has been prepared by WINDOME BANKING PARTNERS SAS (WBP) solely for use at this presentation. This document is confidential and is not to be reproduced by any person nor to be distributed. Certain information contained in this presentation includes forward-looking statements

Forward-looking statements and such evaluations are not guarantees of future performance of the Potential Partners and its actual financial condition, actual results of operations and cash flows and the development of the industry in which it operates may differ materially from those made in or suggested by the forward-looking statements contained in this presentation. In addition, even if the Potential Partners' financial condition, results of operations and cash flows and the development of the industry in which the Potential Partners operates are consistent with the forward-looking statements contained in this presentation, those results or developments may not be indicative of results or developments in future periods.

WBP does not undertake, nor does it have any obligation, to provide updates or to revise any forward-looking statements to reflect events that occur or circumstances that arise after the date of this presentation. the Potential Partners takes no responsibility for the use of this information by any person. The information contained in this presentation has not been subject to independent verification. No representation, warranty or undertaking, express or implied, is made as to, and no reliance should be placed on, the fairness, accuracy, completeness or correctness of the information or opinions contained herein. The information set out herein is subject to updating, completion, revision, verification and amendment and such information may change materially.

WBP is under no obligation to keep current the information contained in this presentation and any opinion expressed in them is subject to change without notice.

WBP shall have no liability whatsoever (in negligence or otherwise) for any loss arising from any use of this document or its contents or otherwise arising in connection with this document. It is not the purpose of this presentation to provide, and you may not rely on this presentation as providing, a complete or comprehensive analysis of the Potential Partners' financial or commercial position or prospects.

This document represents estimates as of February 2025 is based on WINDOME BANKING PARTNERS **SAS's intelligence** leveraging a number of independent sources and publications, clinical studies abstracts and reports as well as market studies and articles in the professional press in the fields of medical aesthetics, dermocosmetics/skincare, beauty, anti-ageing and healthy wellbeing and lifestyle

Table of contents

, ,

Scope of Analyzed Sources

1/ The POLARIS Market Research Report

2/ Polydeoxyribonucleotide (PDRN) and Polynucleotide (PN) Growth Projections: Trends to Watch by DiMarket

3/ Kim et al., 2016 – "Polydeoxyribonucleotide promotes wound healing in diabetic ulcers via activation of the A2A receptor pathway."

4/Fioramonti et al., 2018 – "Biological effects of polynucleotides and their applications in regenerative medicine."

5/ "Principles of Nucleic Acid Structure" – S. Neidle

6/Polydeoxyribonucleotide: A promising skin anti-aging agent, science direct - 皮肤抗衰老剂前瞻研究, 中国医学美容研究院

7/South Korea Skin Boosters Market Size, Share & Trends Analysis Report By Type - Grand View Research

8/ Global Data – Medical Device Market Intelligence

9/ Dr. Kieren Bong, Essence Medical

10/ #SkinSchool: Polynucleotides are the latest innovative injectables storming the tweakments scene – Harper's Bazaar, September 2023

11/ Kumar, P.S., Yaashikaa, P.R. (2019). Separation and Purification of Nucleotides, Nucleosides, Purine and Pyrimidine Bases by Ion Exchange. In: Inamuddin (eds) Applications of Ion Exchange Materials in Biomedical Industries. Springer, Cham. Materials in Biomedical Industries. Springer, Cham. https://doi.org/10.1007/978-3-030-06082-4_8

12/ Pharmacological Activity and Clinical Use of PDRN, Frontiers in Pharmacology, April 2017 https://doi.org/10.1007/978-3-030-06082-4_8

13/ Consensus report on the use of PN-HPT™ (polynucleotides highly purified technology) in aesthetic medicine

Maurizio Cavallini MD, Emanuele Bartoletti MD, Laura Maioli MD, Alberto Massirone MD, Isabella Pia Palmieri MD, Marco Papagni MD, Maurizio Priori MD, Gloria Trocchi MD

14/Recent advances on polydeoxyribonucleotide extraction and its novel application in cosmeceuticals – ScienceDirect, Thi Hanh Nguyen a b, San-Lang Wang b, Van Bon Nguyen

15/ PDRN, PN, PDRN/PN科研创新. 恒昱生物. - PDRN, PN, PDRN/PN Research and Innovation. Heng Yu Bio.

Glossary Of Selected Key Terminology

- **A2A receptor :** The adenosine A2A receptor, also known as ADORA2A, is an adenosine receptor, and also denotes the human gene encoding it. The A2A receptor binds with the Gs protein at the intracellular site of the receptor
- **FACIT:** Fibril Associated Collagens with Interrupted Triple Helices (Type IX, XII, XIV, XIX, XXI)
- **MAPK:** A mitogen-activated protein kinase (MAPK or MAP kinase) is a type of serine/threonine-specific protein kinases involved in directing cellular responses to a diverse array of stimuli, such as mitogens, osmotic stress, heat shock and proinflammatory cytokines.
- **TGF-β/Smad:** The Smad-dependent TGF-β signaling pathway is involved in embryogenesis and tissue homeostasis. Key components of the pathway can be modified (e.g., via posttranslational modifications) to transmit context-dependent signals.
- **NF-κB signalling pathway:** NF-κB pathway consists of canonical and non-canonical pathways. The canonical NF-κB is activated by various stimuli, transducing a quick but transient transcriptional activity, to regulate the expression of various proinflammatory genes and also serve as the critical mediator for inflammatory response.
- **OsRR26:** a type-B response regulator, modulates salinity tolerance in rice via phytohormone-mediated ROS accumulation in roots and influencing reproductive development
- **cAMP Concentration:** Cyclic adenosine monophosphate (cAMP) is an important intracellular second messenger in GPCR signal transduction. Agonist activation of GPCRs that couple to the $G_{\alpha s}$ protein leads to an increased production of intracellular cAMP levels, whereas activation of GPCRs that couple to the $G_{\alpha i}$ protein leads to reduced production of intracellular cAMP levels. Both of these intracellular cAMP changes are mediated through the modulation of adenylate cyclase activity. cAMP regulates the activity of cAMP-dependent protein kinase A (PKA), which plays an important role in a variety of downstream cellular processes

Purpose of the Report and Methodology

- **Purpose**

This report aims to provide comprehensive insights into the global Polynucleotides (PN) and Polydesoxyribonucleic Acid (PDRN) markets, especially in healthcare and regenerative aesthetics, skincare as well as anti-ageing and "medicalized beauty treatments", assessing its current status, growth potential, and future trends. PN and PDRN , the pivotal biopolymers composed of nucleotide monomers has witnessed escalating demand across various industries such as healthcare, pharmaceuticals, cosmetics, and food and beverages. The multifaceted applications of PN and PDRN, ranging from medical products to beauty enhancers, have driven its market to evolve continuously, adapting to varying consumer needs and technological advancements.

The primary purpose of this study is to furnish stakeholders, including industry leaders, investors, and policymakers, with an in-depth analysis of the PN and PDRN market. It seeks to uncover the driving forces behind the market's expansion, understand the challenges and constraints faced by the sector, and identify the opportunities for future growth. By evaluating market dynamics, consumer behavior, and competitive strategies, the report intends to aid in strategic decision-making and offer forecasts that help in planning long-term growth strategies in the industry.

- **Methodology**

It encompasses a combination of primary and secondary research to ensure comprehensive and accurate results. The approach is outlined as follows:

- **Secondary Research:** Initially, an extensive review of existing literature was conducted. This included analyzing industry reports, scholarly articles, company annual reports, and market analysis publications to gather historical data and understand the current trends. Secondary research helped in identifying the market segmentation and key players, forming a solid foundation for the report.
- **Primary Research:** Interviews were carried out with industry experts, including CEOs, marketing managers from leading collagen-producing firms and KOLs from the industry including: plastic surgeons, owner of medical beauty spas. Insights from these interactions provided a real-time understanding of market dynamics and expert opinions on future trends.
- **Quantitative and Qualitative Analysis:** Both quantitative data (market size, growth rates, and revenue forecasts) and qualitative insights (market trends, growth drivers, and challenges) were analyzed.
- **Market Forecasting:** Using time-series analysis, regression models, and market forecasting techniques, the report predicts future market trends. This section provides stakeholders with expected market developments and potential investment opportunities.

The methodology adopted in this study ensures that the report provides a holistic view of the global PN and PDRN market, supported by reliable data and expert opinions, facilitating strategic decision-making for stakeholders involved.

Section I

Definition, Extraction, Properties and Mechanisms of Action of PN and PDRN

Definition of PN

- **Polynucleotides (PNs)** are a natural biocompatible long-chain polymers of nucleotides, the basic structural units of nucleic acids like DNA and RNA.
- They stimulate collagen and elastin production in skin care, promoting skin regeneration and improving texture, elasticity, and firmness. By enhancing fibroblast activity, polynucleotides help reduce fine lines, wrinkles, and other signs of aging.
- They consist of repeating nucleotide monomers, each containing the following key active components:

  A pentose sugar (deoxyribose in DNA or ribose in RNA)

  A phosphate group

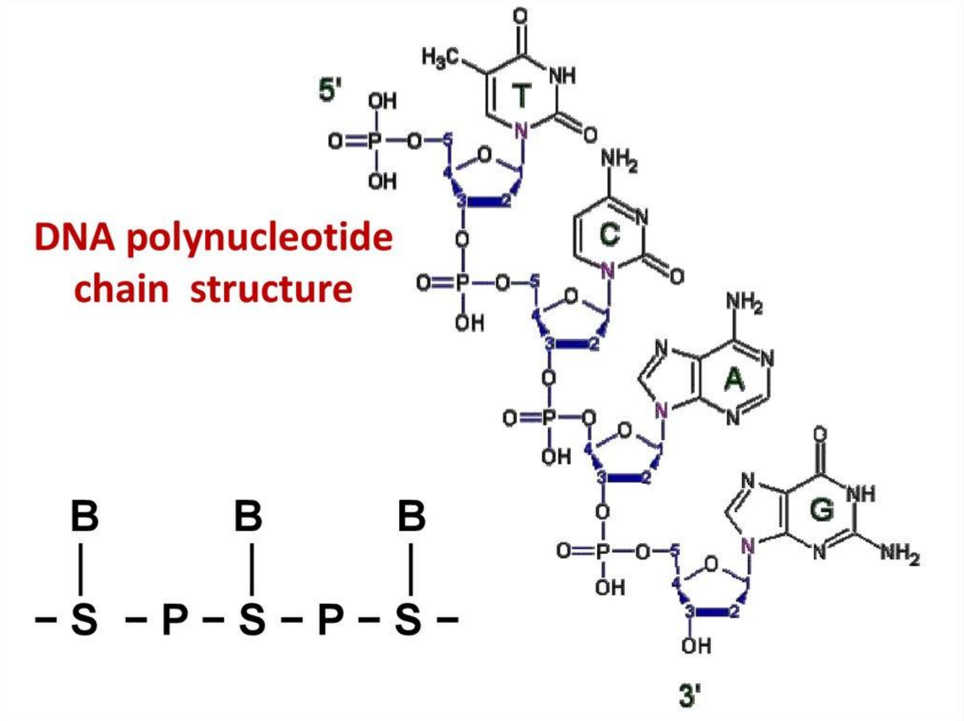
  A nitrogenous base (adenine, guanine, cytosine, and thymine for DNA; uracil replaces thymine in RNA)
- **Polynucleotide (PN)** are a new approach in aesthetic medicine with potential benefits for facial rejuvenation and skin enhancement. A Polynucleotide treatment is an injectable skin booster derived from salmon DNA used to stimulate cellular regeneration, collagen synthesis, and tissue repair.
- They have been scientifically evidenced in numerous clinical studies to bolster the skin's natural healing process, accelerating recovery and boosting overall skin vitality. Regular use of polynucleotides can lead to smoother, healthier, and more youthful-looking skin, making them a powerful tool for long-term skin rejuvenation and anti-aging treatments.

Chemical Configuration and Structure of Polynucleotides

Chemical Formula

$$(C_5H_10O_5)_n \cdot (PO_4)_n \cdot (C_5H_5N_X)_n$$

Chemical Configuration



Sources: CIRS, QY research, Capital IQ, Globaldata, science direct

Definition of PDRN

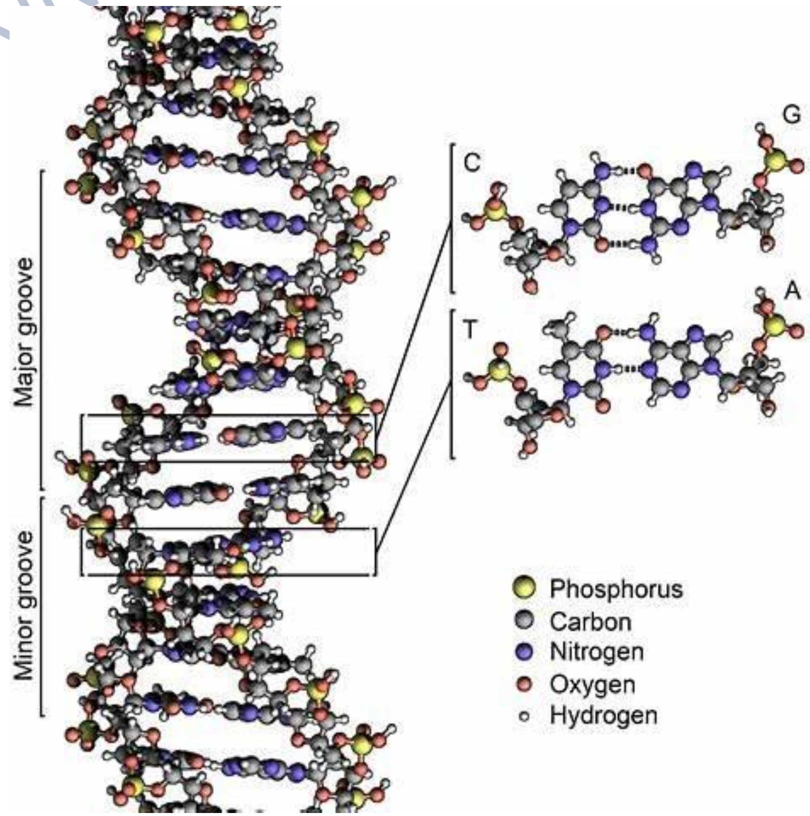
- **PDRN** is a specific subset of polynucleotides, derived from deoxyribonucleic acid (DNA), primarily extracted from salmon or trout sperm. It consists of short DNA fragments (50–2000 base pairs) that act as biological response modifiers, promoting cell regeneration, collagen synthesis, and anti-inflammatory effects.
- **PDRN is known for its ability to:**
- Activate the A2A adenosine receptor, leading to anti-inflammatory and tissue repair effects.
- Serve as a substrate for DNA synthesis, facilitating tissue and skin regeneration.
- Enhance formation of new blood vessels , accelerating wound healing.
- PDRN holds a mixture of deoxyribonucleotides with molecular weights ranging between 50 and 1,500 KDa, it is derived from a controlled purification and sterilization process of Oncorhynchus mykiss (Salmon Trout) or Oncorhynchus keta (Chum Salmon) sperm DNA.
- **The procedure guarantees the absence of active protein and peptides that may cause immune reactions.**
- In vitro and in vivo experiments show that PDRN's most relevant mechanism of action is the engagement of adenosine A2A receptors. Besides engaging the A2A receptor, PDRN offers nucleosides and nucleotides for the so called "salvage pathway." Binding to adenosine A2A receptors is a unique property of PDRN and seems to be linked to DNA origin, molecular weight and manufacturing process. PDRN represents thus a new advancement in the pharmacotherapy.

Sources: *Pharmacological Activity and Clinical Use of PDRN, Frontiers in Pharmacology, April 2017 https://doi.org/10.1007/978-3-030-06082-4_8*

Chemical Formula Configuration and Structure of Poly deoxyribonucleic acid

Formula

$$(C_5H_1 0O_4)_n \cdot (PO_4)_n \cdot (C_5H_5N_X)_n$$



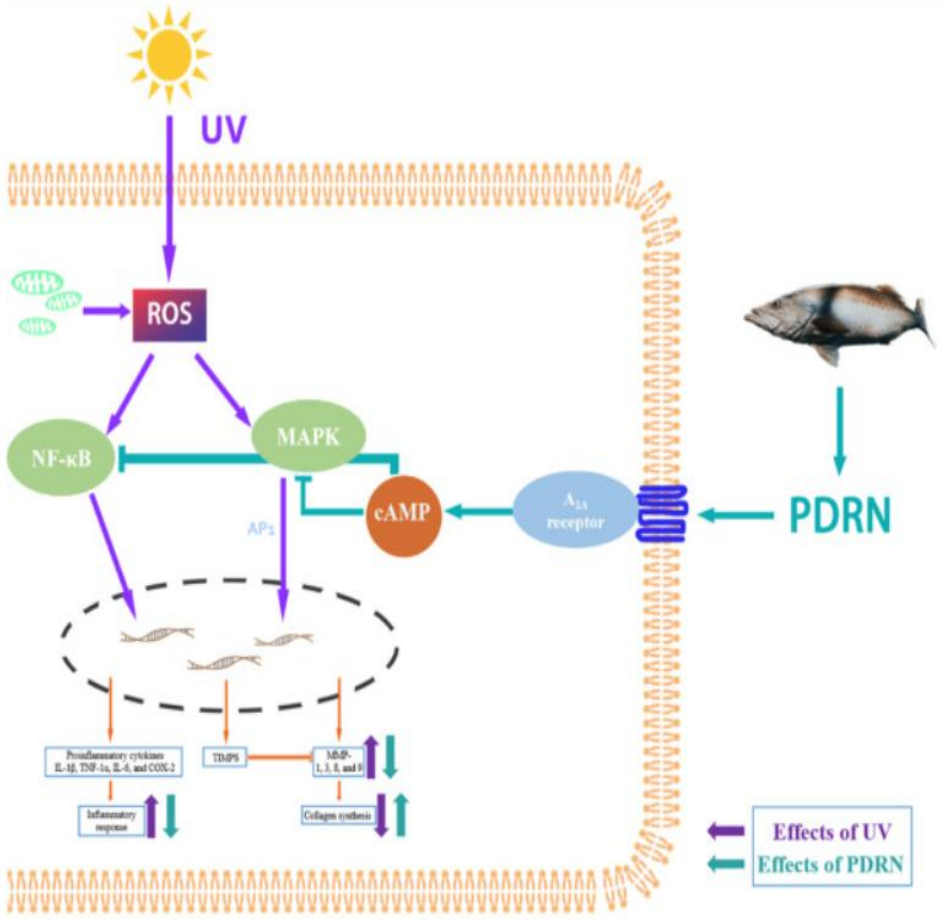
Mechanism of PDRN

Skin aging process and PDRN mechanism of action. The production of ROS initiates a cascade of events starting with the activation of the MAPK and NF-κB signaling pathways, which eventually lead to an increased expression of pro-inflammatory cytokines and MMPs and a decrease in TGF-β/Smad signaling and collagen synthesis. It triggers the following receptor activations:

1/ Activation of the A2A receptor. This leads to the blocking of the NF-κB pathway, thus inhibiting the release of several pro-inflammatory cytokines and stimulating the release of anti-inflammatory cytokines. PDRN, polydeoxyribonucleotide; ROS, reactive oxygen species; MAPK, mitogen-activated protein kinase; NF-κB, nuclear factor-kappa B; MMP, matrix metalloproteinase; TGF-β, transforming growth factor-beta; UV, ultraviolet; ROS, reactive oxidative species; cAMP, cyclic adenosine monophosphate; IL, interleukin; TIMPS, tissue inhibitors of metalloproteinases.

2/ Adenosine A2A receptor.25 Adenosine receptors have been recognized as promising targets for the management of ROS-related disorders. In particular, A2A receptor activation can modulate the inflammatory response and apoptotic process and improve tissue repair and healing. The activation of A2A receptors inhibits the NF-κB and MAPK signaling pathways, which are further accelerated by ROS.26 Blocking the NF-κB pathway inhibits the release of several pro-inflammatory cytokines and stimulates the release of anti-inflammatory cytokines.27

3/ Increase in cAMP concentration, which consequently inhibits the MAPK pathway.26 PDRN inhibits MMP-1 expression and increases collagen synthesis.28 Inhibition of the NF-κB and MAPK pathways clearly blocks the series of events initiated by ROS



Sources: science direct

Derivation and purification of Polynucleotides

There are several methods for the separation and purification of polynucleotides, each with its own advantages and applications. Here are some commonly used techniques:

1.Chromatography:

1. Ion Exchange Chromatography: This method separates polynucleotides based on their charge. It is particularly useful for separating nucleotides, nucleosides, and related substances.
2. Affinity Chromatography: This technique uses specific interactions between the polynucleotide and a ligand attached to a stationary phase. For example, oligo-dT columns can be used to purify mRNA by binding to the poly-A tail.
3. Size Exclusion Chromatography: ITseparates molecules based on their size and is useful for purifying large polynucleotides.

2.Electrophoresis:

1. Agarose Gel Electrophoresis: This technique separates polynucleotides based on their size by applying an electric field to a gel matrix. It is commonly used for DNA and RNA analysis.
2. Polyacrylamide Gel Electrophoresis (PAGE): This method provides higher resolution than agarose gel electrophoresis and is used for separating smaller polynucleotides.

3.Precipitation:

1. Ethanol Precipitation: adding ethanol to a PN solution to precipitate the PN, which can then be collected by centrifugation.
2. Isopropanol Precipitation: Similar to ethanol precipitation, this method uses isopropanol to precipitate polynucleotides.

4.Solid-Phase Extraction:

1. Spin Columns: These columns contain a solid support that binds polynucleotides, enabling their separation and purification by washing and elution steps.

5.Ultracentrifugation:

1. Density Gradient Centrifugation: This technique separates polynucleotides based on their density by spinning them at high speeds in a density gradient medium.

These methods can be used individually or in combination to achieve the desired level of purity and separation for polynucleotides. If you have a specific application or type of polynucleotide in mind, I can provide more detailed information on the most suitable method.

Sources: *Kumar, P.S., Yaashikaa, P.R. (2019). Separation and Purification of Nucleotides, Nucleosides, Purine and Pyrimidine Bases by Ion Exchange. In: Inamuddin (eds) Applications of Ion Exchange Materials in Biomedical Industries. Springer, Cham. Materials in Biomedical Industries. Springer, Cham. https://doi.org/10.1007/978-3-030-06082-4_8*

Derivation, purification of PDRN

Isolation of polydeoxyribonucleotide

PDRN is a registered DNA-derived proprietary drug isolated at high temperatures; the process ensures recovery of >95 % pure active substance without pharmacologically active peptides and proteins [44]. It is usually obtained as white to off-white powder or fibrous solid with a pH of 6–8, and is soluble in water. PDRN is a DNA molecule of length 50–2000 bp and molecular weight of 50 and 1500 KDa [34,38,39]. The spatial structure of these polymer chains is a double helix.

The extraction source of polydeoxyribonucleotide

Until now, PDRN has been collected from some sources, including animals, humans, algae, and plants (Fig. 3). Some advantages and disadvantages of PDRN extraction from different sources are presented in Table 1. PDRN is mainly collected from sperm cells of some salmon species [45], such as rainbow trout (O. mykiss) and chum salmon (O. keta). In fact, adult salmon testicles are filled with sperm, and the DNA content is 7.5 % of its wet weight. Farmed salmon or trout sperm is the most optimum source for the safe extraction.

Some procedures for polydeoxyribonucleotide extraction from different sources

PDRN has continued to attract significant attention in research and application. Concurrently, to ensure the effective application of PDRN, identifying a PDRN purification process with high efficiency and purity is also a critical step and is still under continuous investigation. In this regard, some procedures used for successful PDRN extraction from various sources have been presented schematically. These procedures can be used as references for further experimental studies.

Source: Recent advances on polydeoxyribonucleotide extraction and its novel application in cosmeceuticals – ScienceDirect, Thi Hanh Nguyen a b, San-Lang Wang b, Van Bon Nguyen

Clinical Evidence of PDRN(1/2)

Polynucleotides (PN)

Polynucleotides are **long-chain nucleotides** known for **tissue repair, hydration, and anti-inflammatory** properties. They have been widely used in aesthetic medicine and regenerative medicine.

Skin Rejuvenation & Anti-Aging

- Studies have demonstrated that PN injections improve **skin elasticity, hydration, and wrinkle reduction** by stimulating fibroblast activity and increasing collagen production.
- A study in *Dermatologic Surgery* (2020) found that PN-based injectables significantly improved **skin texture and elasticity** in aging skin.

Wound Healing & Scar Treatment

- PN has been shown to **accelerate wound healing** by promoting fibroblast proliferation and reducing inflammation.
- A randomized controlled trial (RCT) showed that PN **improved post-surgical scar healing** by enhancing tissue remodeling.

Orthopedics (Cartilage & Tendon Repair)

- PN has been tested for **tendon and cartilage repair** in patients with sports injuries and osteoarthritis.
- A study published in *The American Journal of Sports Medicine* found that PN injections **improved tendon healing and reduced pain** in Achilles tendinopathy.

Polydeoxyribonucleotide (PDRN)

PDRN is a subtype of PN, specifically derived from salmon DNA, known for its wound healing, anti-inflammatory, and angiogenesis-promoting effects.

Wound Healing & Diabetic Foot Ulcers

- Multiple RCTs have shown that **PDRN enhances wound healing** in **diabetic foot ulcers** and chronic wounds by stimulating angiogenesis (via A2A adenosine receptors).
- A study in *Advances in Wound Care* (2018) reported a **significant increase in wound closure rates** in diabetic patients treated with PDRN.

Osteoarthritis & Joint Repair

- Clinical trials have shown that PDRN injections **reduce pain and improve joint function** in patients with knee osteoarthritis.
- A 2022 study in *Cartilage* found that PDRN reduced inflammation and improved **cartilage regeneration**.

Aesthetic & Dermatology Applications

- PDRN has been used in **skin rejuvenation, acne scar treatment, and hair growth**.
- A 2021 study in *Journal of Cosmetic Dermatology* found that PDRN mesotherapy **improved skin hydration and reduced wrinkles** in aging patients.

Source: Pubmed Central, Polynucleotides in Aesthetic Medicine: A Review of Current Practices and Perceived Effectiveness, Pharmacological Activity and Clinical Use of PDRN

Clinical Evidence of PDRN(2/2)

Study	Category	Summary	Evidence Level
Yi et al.	Skin Boosters	Overview of injectable treatments to improve skin texture and appearance, focusing on PN.	V
Morganti et al.	Delivery Systems for Cosmeceuticals	Explores the use of PN as a novel delivery system for cosmeceuticals.	IIa
Yi et al.	Skin Boosters	Reviews various types of skin boosters used in aesthetic treatments, focusing on PN.	Ia
Lis et al.	Treatment for Neck Skin Aging	Investigates the use of PN for reducing signs of aging in neck skin.	IV
Cesare et al.	Biorevitalization Protocols	Describes a combined treatment protocol for biorevitalization, including PN.	IV
Samizadeh et al.	General Overview of PN in Aesthetic Medicine	Provides an overview of the role of PN in aesthetic medicine.	V
Minoretti et al.	Topical Strategies for Skin Aging	Provides a primer for aesthetic medicine practitioners on topical strategies for skin rejuvenation using PN.	V
Yip et al.	Trends in Anti-Aging Dermatology	Discusses current trends and treatments in anti-aging dermatology, focusing on PN therapy.	V
Arora et al.	Facial Fillers	Discusses advancements in facial fillers for aesthetic purposes, highlighting PN.	V
Cheng et al.	Facial Fillers	Provides an overview of recent advancements in skin fillers, including PN.	V

The review found that polynucleotides have been used to improve skin texture, reduce wrinkle depth, and enhance facial appearance. The studies reported varying degrees of efficacy and safety, with some studies demonstrating significant improvements in skin elasticity and hydration. However, others reported limited or no benefits. The review also highlighted the need for further research to establish the optimal use and efficacy of polynucleotides in aesthetic medicine. While the existing literature suggests that polynucleotides may have potential benefits in aesthetic medicine, more research is needed to fully understand their mechanisms of action and optimal use. Clinicians should be aware of the current limitations and potential risks associated with the use of polynucleotides in aesthetic medicine.

Not an exhaustive list

Source: *Pubmed Central, Polynucleotides in Aesthetic Medicine: A Review of Current Practices and Perceived Effectiveness*

Section II

Differentiation and Skin Regeneration Results

Key Differences Between PN and PDRN

	PN (Polynucleotide)	Polydeoxyribonucleotide (PDRN)
Molecular Type	General category of long nucleotide chains (RNA & DNA)	A specific type of **short DNA fragments**
Sugar Backbone	Ribose (RNA) or Deoxyribose (DNA)	**Deoxyribose only** (DNA-based)
Source	Synthetic or natural (salmon, yeast, etc.)	Extracted from salmon sperm
Molecular Weight	High molecular weight (>50 kDa)	Lower molecular weight (10–50 kDa)
Function & Main Use	Broad regenerative effects, higher hydration capacity, for Skin rejuvenation, regenerative medicine	Stronger anti-inflammatory and wound healing properties for Wound healing, orthopedics, post-surgical recovery
Regulation	-	Medical device III in EU and South Korea

Sources: CIRS, QY research, Capital IQ, Globaldata, science direct

Results and differentiation in tissular rejuvenation enabled by PN and PDRN products

Polynucleotides are a powerful skincare solution composed of DNA fragments and nucleic acids that significantly enhance skin repair and regeneration. These elements help heal soft tissues, boost collagen production, and support skin rejuvenation.

Main effects are as follows:

•**DNA Fragments:** These fragments stimulate the growth of new blood vessels, accelerate tissue healing, and improve collagen production.

•**Nucleic Acids:** They repair damaged DNA, promote cellular growth, and ensure efficient fibroblast function, vital for collagen and elastin production.

Polynucleotide treatments offer substantial benefits for reducing fine lines, scars, and hyperpigmentation. Unlike Botox, which relaxes muscles to smooth wrinkles, polynucleotides regenerate skin at a deeper level, promoting healthier, more resilient skin.

They also help reduce side effects from other treatments by enhancing the skin's natural healing process. Safe and non-invasive polynucleotides provide long-term skin health and rejuvenation without the harsh chemicals found in some alternatives

Before

After

Sources: Dr. Kieren Bong, Essence Medical , (American River College) , Dr. Deboleena Roy

Section III

The Global PN & PDRN Market

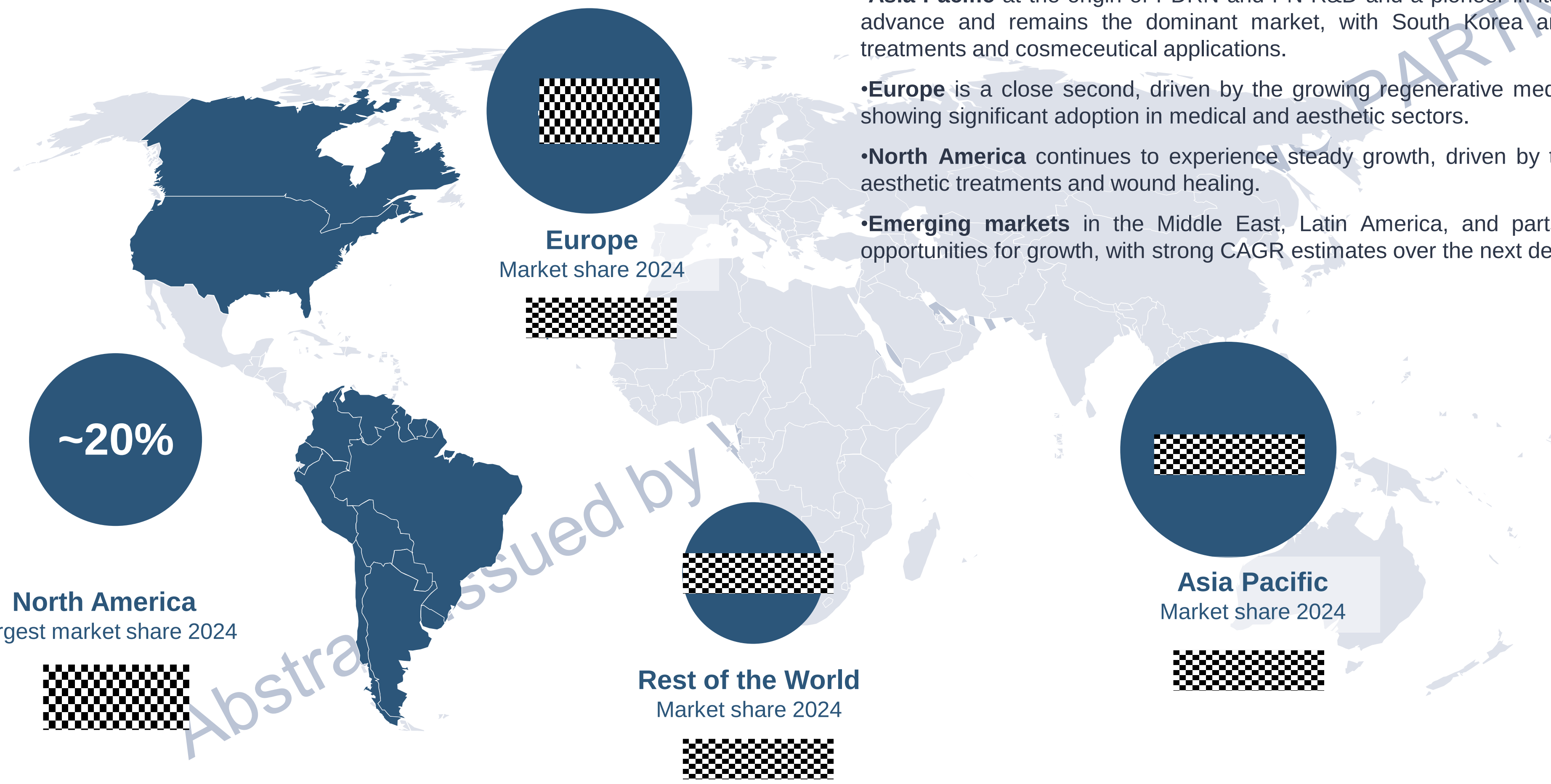
Market Overview of PN And PDRN

•**Asia-Pacific** at the origin of PDRN and PN R&D and a pioneer in its commercialization keeps its frontrunner advance and remains the dominant market, with South Korea and China leading the way in aesthetic treatments and cosmeceutical applications.

•**Europe** is a close second, driven by the growing regenerative medicine market, with Germany and France showing significant adoption in medical and aesthetic sectors.

•**North America** continues to experience steady growth, driven by the increasing popularity of non-invasive aesthetic treatments and wound healing.

•**Emerging markets** in the Middle East, Latin America, and parts of Southeast Asia present significant opportunities for growth, with strong CAGR estimates over the next decade.



Global market of PN and PDRN Market

$1.2bn in 2024

[redacted] in 2030

[redacted]

CAGR 2024-2030

Sources: Precedenceresearch, sphericalinsights, mordorintelligence

THE PN and PDRN MARKETS ARE PROPELLED BY A FAST GROWTH TRACTION

Key Facts and Figures

Global market of PN and PDRN Market

$1.2bn in 2024

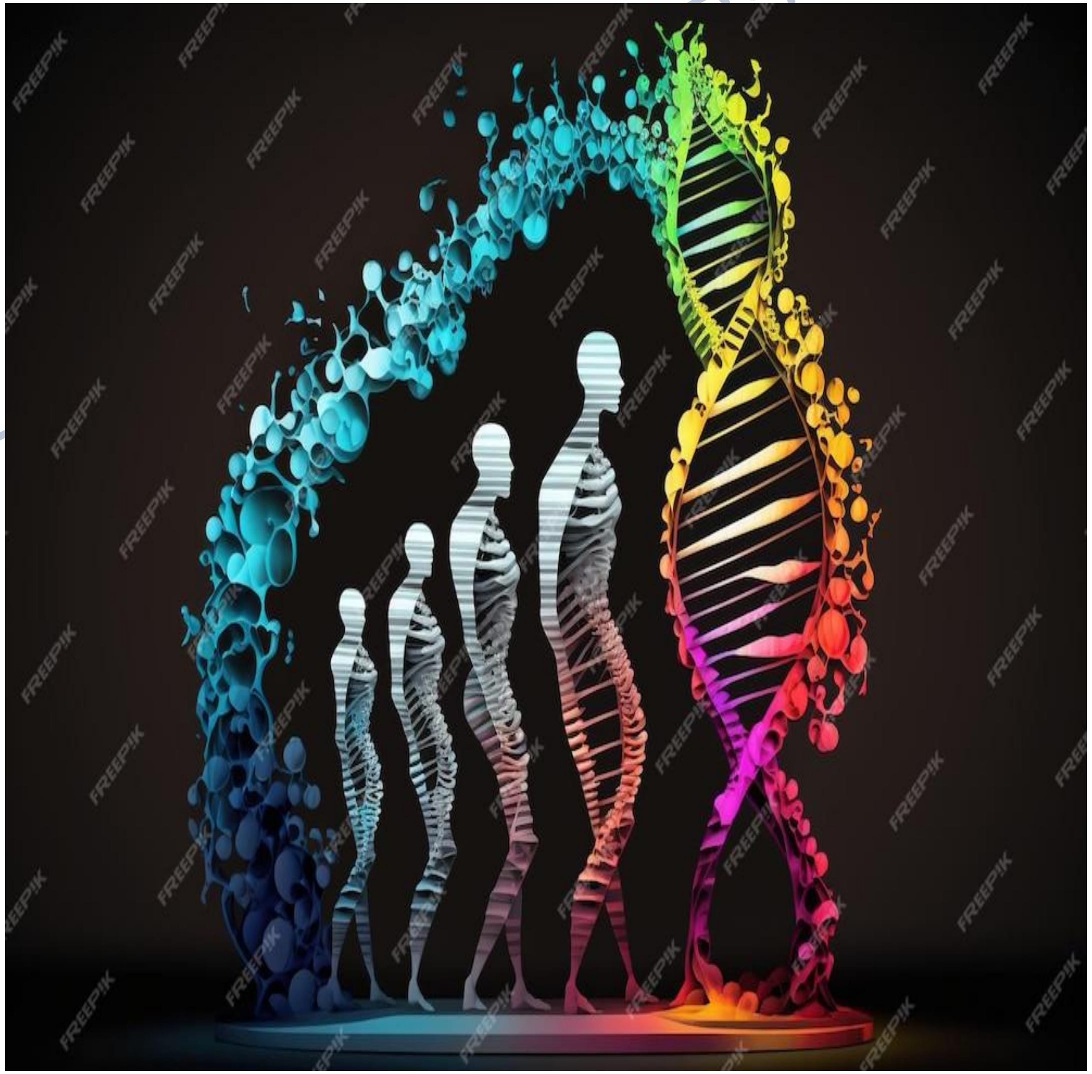
[redacted] in 2030

[redacted]

CAGR 2024-2030

Main Drivers

- Propelled by the underlying traction of the regenerative, anti-ageing and reverse ageing markets, including prejuvenation
- Diversification away from conventional hyaluronic acid dermal fillers
- Quest for natural, long lasting results
- Emphasis on skin quality and fitness as well as sustainable report
- Growing attraction to proiducts unleashing the organism’s own healing power
- Manufacturing Cost-efficiency
- Doctors’ and patientss alike flight to novelty



The PN And PDRN Markets are Propelled by a Fast Growth Traction

Key Facts and Figures

Global market of PN and PDRN Market

$1.2bn in 2024

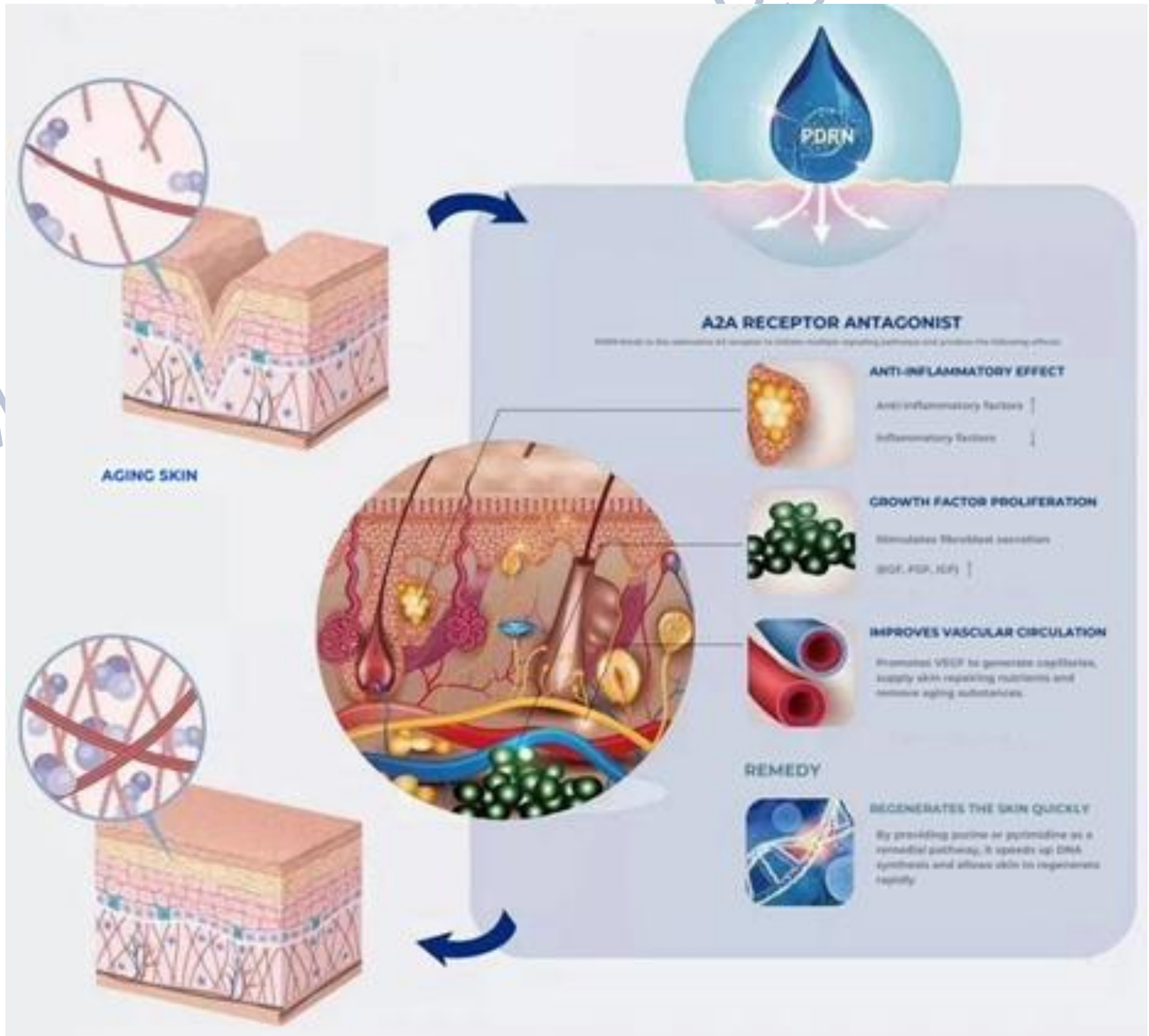
[redacted] in 2030

[redacted]

CAGR 2024-2030

Main Drivers

- Propelled by the underlying traction of the regenerative, anti-ageing and reverse ageing markets, including prejuvenation
- Diversification away from conventional hyaluronic acid dermal fillers
- Quest for natural, long lasting results
- Emphasis on skin quality and fitness as well as sustainable report
- Growing attraction to proiducts unleashing the organism’s own healing power
- Manufacturing Cost-efficiency
- Doctors’ and patientss alike flight to novelty



Market Drivers, Restraints, Opportunities, Risks

Drivers

- **Regenerative properties:** PDRN is known for promoting tissue repair, wound healing, and regeneration by stimulating the production of growth factors like VEGF (Vascular Endothelial Growth Factor).
- **Anti-inflammatory effects:** It helps reduce inflammation, making it beneficial in treating conditions like skin aging and chronic wounds.
- **Non-toxic and biocompatible:** It's derived from salmon DNA, which is biocompatible and poses little risk of toxicity or immune response.

Restraints

- **Securing and sustainability** of stable source, purification and Biocompatibility: Polynucleotides are often derived from fish sperm, such as salmon or trout. Injecting foreign species' DNA into humans can be problematic because humans do not have receptors for polynucleotide chains. This means that the body must break down these foreign DNA molecules before they can be utilized.
- **Energy Requirement:** When polynucleotides are introduced into the body, they need to be broken down into their constituent parts, such as sugar pentose, phosphoric acid, and purine or pyrimidine bases. This process requires energy, leading to an energy deficit in the body.

Opportunities

- **Aging population:** As demand for anti-aging treatments grows, PDRN could become a more widely used tool in aesthetic medicine.
- **Expanding research:** Further clinical studies could expand the understanding of PDRN's benefits in treating chronic diseases or accelerating tissue repair in various medical specialties.
- **Integration with other treatments:** PDRN could be integrated into multi-modal therapies, such as combination treatments with PRP (Platelet-Rich Plasma) or stem cell therapies.

Risks

- **Potential Side Effects:** While polynucleotide treatments are generally considered safe, they can cause short-term side effects such as small bumps, bruising, swelling, redness, and tenderness at the injection site. These side effects are typically mild and temporary.
- **Metabolic Substrate:** The breakdown products of polynucleotides, such as sugar pentose, may not be optimal for human metabolism. For example, using sugar as a metabolic substrate can have different effects on mitochondrial function compared to non-sugar products.
- **Limited Clinical Data:** Even though the Antiaging physiological manifestation of the products have been demonstrated in observational studies, so far there is a large fundus of Double blinded randomized assessment of wrinkles clinical assessments of polynucleotides with different molecular weights.

Sources: Clinical applications of PN and PDRN

Section IV
Main players of PN and PDRN

Main Suppliers of PN and PDRN

Company	Country	Sales	No. Employees	Main Products
PharmaResearch		[redacted]	[redacted]	PDRN, PN
Humedix		[redacted]	[redacted]	PDRN, PN
htl BIOTECHNOLOGY		[redacted]	[redacted]	PDRN, PN
瑞吉明生物 RUIJIMING BIOLOGICAL		[redacted]	[redacted]	PDRN, PN
R&J Bio 潤輝生物		[redacted]	[redacted]	PDRN, PN
BOC Sciences Best of Chemicals		[redacted]	[redacted]	PDRN

Sources: Grand View Research, Di Market, 1 USD = 7.25 CNY, 1 USD = 1428.24 KRW, Capital IQ as of February 26, 2025

Main players in the PN and PDRN segments

Brand	Company	Country	Sales	No. Employees	Market Cap	Main Composition
DCELL,REJURAN	PharmaResearch		[redacted]	[redacted]	[redacted]	PDRN, PN
REBERNA	BNC KOREA		[redacted]	[redacted]	[redacted]	PN
HP Cell Vitaran	BR PHARM		[redacted]	[redacted]	[redacted]	PDRN
PDRN Solution Salmon Ampoule	DERMALINE		[redacted]	[redacted]	[redacted]	PDRN
CELLMON DNA	SKINDEC		[redacted]	[redacted]	[redacted]	PDRN
PERERAN, ABREJU	Breju 碧瑞		[redacted]	[redacted]	[redacted]	PDRN
Placentex, Mastellinewest, Plinest	MASTELLI AESTHETIC SINCE 1952		[redacted]	[redacted]	[redacted]	PDRN
MY Skinchemistry	MY SKIN CHEMISTRY		[redacted]	[redacted]	[redacted]	PDRN
Juvenus	croma For creators of beauty.		[redacted]	[redacted]	[redacted]	Polymerized PN
Prollenium Medical Technologies	PROLLENIUM®		[redacted]	[redacted]	[redacted]	PDRN, PN

Sources: Grand View Research, Di Market 1 USD = 1431.61 KRW, Capital IQ as of February 26, 2025

Key Partnership Transactions of PN and PDRN

Licensor	Licensee	Remarks
MASTELLI AESTHETICS SINCE	croma est. 1976	In-licensing by Croma of Mastelli's PN product for EU and the US
MASTELLI AESTHETICS SINCE	壹芯控股 YXINTENT	In-licensing by Y Xintent of Mastelli's PN product for Greater China

Sources: Grand View Research, Di Market

Section V

Profiles of key Selected Players

WINDOME
BANKING PARTNERS
PARIS

JEAN-YVES COSTE
CO-FOUNDER, CHAIRMAN AND PARTNER

JYCOSTE@WINDOME-BANKING.COM
+33 6 21 82 95 48

FLORIAN PUCHLY
CO-FOUNDER, CEO AND PARTNER

FPUCHLY@WINDOME-BANKING.COM
+33 699392010

ZHONGSHI CONG
SENIOR ASSOCIATE

ZCONG@WINDOME-BANKING.COM
+33 6 68 28 57 02