

Interpreting Skin Hydration and Water Loss in Film Forming Formulations

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28 October 2026 | Version 1.1 | Critical narrative research report

Author approved release edition. Literature analysis and proposed research; no new VARUNÉ experimental results are reported.

Abstract

A film can reduce evaporation, alter a hydration instrument's response, change the water distribution within skin, and modify perceived comfort. These outcomes may coincide, but none establishes the others. This critical narrative report connects skin measurement theory, primary formulation studies, deposited-film characterisation, and human observations to ask which evidence can distinguish a useful surface effect from a persistent change in skin function. The synthesis identifies four especially consequential sources of ambiguity: transient water storage, instrument-induced boundary conditions, the location at which measurements are taken, and conditioning the analysis on a film remaining intact. Published work demonstrates both useful formulation effects and disagreement between endpoints. The analysis proposed here therefore treats a measurement as an observation of a specified formulation, skin region, environment, time, and measurement procedure. Four equations express conservation, transport, chamber accumulation, and a controlled treatment contrast; they are standard models or statistical definitions, not new physical laws. The report proposes a staged VARUNÉ Bio study in which deposited-film properties are established before a qualified human evaluation, with both film durability and the intended skin endpoint retained in the analysis. Its principal contribution is a claim-specific interpretation procedure that can prevent an attractive hydration result from becoming an unsupported barrier-repair claim. No new experimental results, product efficacy, safety determination, or validated VARUNÉ material are reported.

1 Research question and scope

The central question is straightforward: when a film-forming formulation changes a hydration or water-loss result, what changed in the physical and biological system? Answering it requires deciding whether the useful function is temporary evaporation control, increased water in a specified skin compartment, a mechanical or sensory improvement, or a persistent alteration of skin function. Those are different research objectives. A material can be valuable through one of them without establishing all of them.

The report concerns cosmetic and material research, particularly hydrophilic polymers, polysaccharides, and deposited formulations. Marine or polar origin supplies a discovery context; it does not supply evidence of skin efficacy. The same measurement logic applies to a synthetic polymer, a fermentation-derived material, and a conventional formulation. A comparison should therefore turn on useful performance and interpretable evidence, rather than origin or an ingredient narrative.

The argument extends the earlier VARUNÉ Bio reports on material identity, purification, and accessible function. Here, the crucial transition is from a material measured in a container to a deposit that changes whilst interacting with skin and the surrounding atmosphere. The particular contribution is to connect that transition to the observations used to support product claims. This is an analytical synthesis for author review, with research proposals clearly distinguished from findings reported by other investigators.

2 Evidence selection and reading method

This is a targeted critical narrative synthesis, not a systematic review or meta-analysis. Sources were selected to test competing explanations, rather than to estimate the average effect of moisturisers. Online searches on 28 October 2026 included “transepidermal water loss occlusion film corneometer confocal Raman moisturizer comparison primary study”, “skin hydration corneometer topical formulation interference glycerol experimental study”, and exact-title searches for the measurement and formulation studies cited below. Searches prioritised publisher pages, PubMed records, and primary author manuscripts. Studies were retained when they addressed transport, instrument response, measurement history, film morphology, or the correspondence between endpoints. No claim of exhaustive retrieval is made.

The supplied fifth edition of *Textbook of Cosmetic Dermatology* provided the main conceptual foundation. Chapter 3 was reread in continuous text; targeted passages from chapters 2 and 58 were checked against the preceding chapter analysis. Their verified locations are chapter 2, printed pages 16-26, physical PDF pages 29-39; chapter 3, printed pages 28-30, PDF pages 41-43; and chapter 58, printed pages 561-581, PDF pages 574-594. These ranges identify the textbook main text and relevant tables, not fresh claims that every cited page was reread for this report. The unrelated material appended to the supplied PDF is excluded. [1-3]

Selected results and methods were inspected directly in the supplied papers by Yu and colleagues, Gonçalves and colleagues, and Bennett-Kennett and colleagues. For online sources, access varied: the Ruini publisher full text was accessible for targeted methods and interpretation; several other studies were assessed through their indexed or publisher abstracts. This difference is recorded in the reference list. Abstract-only sources support the narrow findings stated here, not unseen details of randomisation, blinding, analysis, or adverse events. The report does not pool effect sizes across those access levels.

3 What the observations can establish

The textbook account separates diffusion through the stratum corneum from vapour detected above it. A probe observes evaporation under particular boundary conditions; identifying that observation with endogenous transepidermal water loss requires assumptions about steady state and sweat. Anatomical location, skin condition, and environmental history further affect interpretation. There is no single universally optimal water-loss value that can classify every person or site. [1]

That distinction becomes especially important immediately after application. A formulation introduces water, volatile constituents, a new surface geometry, and potentially an additional resistance to transport. Its deposition can also alter how an electrical probe makes contact. The observation therefore belongs to the combined system. Naming the instrument output “hydration” does not remove the need to identify what contributed to it.

Table 1 summarises the evidential task. It is a proposed interpretation map, not a classification of a tested VARUNÉ product.

Proposed function	Observation needed	Important unresolved alternative
Water binding by a material	Controlled sorption or water-activity behaviour of a characterised preparation	Binding in isolation may not persist after formulation or deposition
Temporary evaporation control	Interpretable flux contrast whilst deposit status is known	Surface storage, altered gradient, or probe interaction
Increased stratum-corneum hydration	Water-related evidence attributable to the relevant depth and region	Electrical or optical response from deposited formulation
Persistent improvement in skin function	Appropriate functional evidence after the intended exposure interval, with deposit and removal effects addressed	Residual film, changed measurement history, or background recovery
Improved comfort or feel	Relevant participant-reported outcome with a suitable comparator	A sensory change without the proposed hydration mechanism

An immediate consequence follows. The strongest claim is not necessarily the most biological claim. A reliable, comfortable film that controls evaporation for its intended wear interval could be useful. It should be evaluated as such. Requiring it to demonstrate structural repair would ask a different question, whilst describing it as repair without evidence would obscure the actual contribution.

4 Water balance and the meaning of a time course

Consider a fixed control volume containing the complete deposited film and the water stored within it, per unit area of skin. Its simplest water balance is:

$$\frac{dS}{dt} = J_{SC} + J_{ext} - J_{vap}$$

Equation 1. Water conservation across the film control volume.

Here S is retained water in g m^{-2} , t is time in hours, and each J is a water mass flux in $\text{g m}^{-2} \text{h}^{-1}$. J_{SC} enters from the skin; J_{ext} is any subsequent external addition across the boundary; J_{vap} is evaporation from the film to the surrounding air. Water already present in the applied formulation belongs in the initial value of S . It must not also be included in J_{ext} . With no later addition, J_{ext} is zero. The expression assumes negligible sweat, lateral flow, loss of liquid droplets, and transport into unaccounted components. It is a standard conservation statement applied to the measurement distinction in sources [1] and [4].

A falling stored-water term allows measured evaporation to exceed the water arriving from the skin. Rising storage allows the reverse. Thus an early spike need not signify barrier damage, and an early fall need not signify repair. Neither interpretation is ruled out; neither is identified by the time course alone. A useful experiment asks whether the estimated storage change is large enough, on the same timescale, to explain a substantial part of the observed difference.

Under stronger assumptions, a simple series-resistance representation can help organise the alternatives:

$$J = \frac{\Delta p_v}{R_{SC} + R_{film} + R_{air}}$$

Equation 2. An illustrative steady-state transport model.

J is water mass flux in $\text{g m}^{-2} \text{h}^{-1}$; the vapour-pressure difference Δp_v is in Pa; each effective resistance is in $\text{Pa m}^2 \text{h g}^{-1}$. R_{SC} , R_{film} , and R_{air} describe the stratum corneum, deposited film, and adjacent air, respectively. The relation assumes a common pressure-based driving potential, one-dimensional steady transport, and effective linear resistances over the observed range. It is a conceptual reduction of coupled transport, not a validated skin model. Hydration-dependent permeability, discontinuous coverage, lateral paths, and changing partition behaviour can violate its assumptions. [1,4]

Its analytical purpose is nevertheless useful: a lower flux can follow an increase in any one of the resistances. A single flux measurement cannot identify which increased. Even a precise measurement leaves this structural ambiguity. Adding more participants reduces uncertainty about the average observation; it does not, by itself, identify the mechanism.

5 Primary studies that challenge simple interpretations

5.1 Instrument response is part of the evidence

Imhof and colleagues distinguish the skin's supply of water from the capacity of the local environment to evaporate it. Their work explains why the microclimate imposed by different chamber designs matters, and why agreement in readings does not establish identical performance. The account also treats calibration as a separate requirement. Manufacturer affiliations are disclosed in the article, which should be considered when interpreting comparative device claims. [4]

Nuutinen and colleagues developed a closed, unventilated chamber and compared its evaporation estimates with gravimetric water loss and an open-chamber instrument. The abstract reports strong correlations and repeatability assessments on water and ten healthy volunteers. These observations establish a useful calibration example, but do not show that every deposited formulation behaves equivalently under every chamber. [5]

For an ideal closed chamber:

$$J_{vap} = \frac{V dc_v}{A dt}$$

Equation 3. Vapour accumulation in an ideal fixed-volume chamber.

V is effective chamber volume in m^3 , A is exposed area in m^2 , and c_v is volume-averaged vapour concentration in g m^{-3} . With t in hours, J_{vap} is in $\text{g m}^{-2} \text{h}^{-1}$. The equation assumes negligible leakage, condensation, wall sorption, and volume change, and a concentration estimate representative of the chamber average. Relative humidity must be converted using temperature; it is not itself a mass concentration. This ideal mass balance is consistent with the measurement principles in [4,5], but is not a replacement for device-specific calibration.

The proposed VARUNÉ analysis is to treat disagreement between devices as information before treating it as failure. A film-dependent disagreement could reflect microclimate sensitivity, contact

geometry, a non-steady surface reservoir, or an operating-range problem. Each explanation implies a different next comparison. It would be premature either to select the device producing the most favourable result or to declare that both devices are invalid.

5.2 Electrical signals are informative but not chemically exclusive

Li and colleagues tested formulations with sodium chloride and glycerin using three electrical instruments. Their abstract reports that salt decreased readings without glycerin but increased them in its presence. The result argues against a single correction that treats salt as having a fixed influence independent of the formulation. The study evaluated short-term measurements after application; it does not establish a universal long-term relationship. [6]

Crowther subsequently compared direct responses to liquids using a PTFE holder with a filter-paper approach. The study found that the supporting filter paper could itself influence the result, and that components other than water affected the instruments differently. This is particularly relevant to assay development: an apparently inert test support can become part of the measured signal. [7]

The appropriate inference is limited. Electrical measurements need not be discarded. They can describe a reproducible treatment response and can correlate with dryness. The more specific claim that their change quantifies water in a particular skin compartment requires additional evidence. A candidate film should therefore be characterised on its own and in the measurement configuration, rather than assuming that every signal change comes from underlying skin.

5.3 More hydration is not synonymous with a less permeable barrier

Albèr and colleagues applied simple formulations under occlusion for four hours to healthy forearm skin. Their randomised controlled study examined water activity and low-molecular-weight humectants using corneometry, water loss, and a benzyl-nicotinate response. Higher formulation water activity increased hydration and permeability; glycerol and urea also promoted hydration and permeability under lower-water-activity conditions. The protocol demonstrates that hydration and permeability need not move in the direction implied by an undifferentiated “stronger barrier” narrative. It does not determine how an untested film behaves during normal wear. [8]

This provides a counterexample to the assumption that all favourable-looking hydration outcomes indicate the same underlying state. A formulation objective must state which transport direction, molecule, exposure, and duration matter. Reduced outward water flux, increased inward penetration of a test substance, and improved subjective dryness are not interchangeable properties.

5.4 Additional endpoints can reveal differences rather than agreement

Crowther and Matts compared conventional hydration and dryness measures with depth-resolved confocal Raman observations on lower-leg skin. They found correlations, but also information associated with different regions of the stratum corneum. That supports choosing complementary measurements according to the question, rather than demanding that every output collapse onto a single score. The abstract does not justify a universal conversion between devices. [9]

In an exploratory study involving twelve younger and twelve older adults, Kottner and colleagues found that prior measurements could change later TEWL readings: pH measurement increased the result, whereas stratum-corneum measurements decreased it. The study supplies evidence that

measurement order can matter. It does not supply a correction transferable to every film or device. [\[10\]](#)

The analytical connection is that increasing the number of endpoints may increase experimental disturbance as well as information. A research plan should specify which observations share a site, which require untouched matched sites, and which must occur in a fixed order. A correlated panel collected through a disturbing sequence is weaker evidence of mechanism than its apparent breadth suggests.

6 A closer reading of deposited-film evidence

6.1 The elastic second skin study and the geography of measurement

Yu and colleagues evaluated a crosslinked polysiloxane film using several material and human endpoints. Their conductance study involved 24 volunteers, but the methods specify a deliberately bare annulus at the measurement location to permit probe contact. In a separate dry-skin study, 22 subjects completed TEWL assessment; 24-hour measurement required the film to remain at least 80% continuous. The paper therefore offers more precise information than “the film hydrates skin”: measurement location and film-survival criteria are part of what was tested. The authors disclosed financial interests in the companies involved. [\[11\]](#)

Two research questions follow from these design choices. First, does an accessible bare region represent the skin directly beneath a continuous deposit? A nearby effect may be real, but its spatial relation to the film must be retained. A measurement window can alter local evaporation and may not reproduce the state under the surrounding material. The issue is not that such a design is inherently wrong; it is that it answers a particular spatial question.

Second, what population of applications does a durability-conditioned result describe? A result among deposits that meet an integrity threshold estimates performance under that condition. It does not automatically estimate performance across every attempted application. If fragile films fail preferentially on particular participants or sites, omitting them can remove precisely the circumstances relevant to product use. The proposed VARUNÉ study would therefore report both the effect among intact films and the proportion of attempted applications retaining the required integrity. Reasons for missing observations would remain visible.

6.2 Structural imaging can establish the deposit without establishing skin efficacy

Gonçalves and colleagues used X-ray microtomography to characterise foundation films on a controlled PDMS micropillar substrate. The methods include measurements at centre and edge locations, with repeated structural measurements within the imaged regions. The artificial substrate deliberately separates material geometry from much of living skin's biochemical complexity. Its value is film characterisation; its measurements do not constitute independent human participants or demonstrate hydration. [\[12\]](#)

This distinction opens a practical connection. Before asking whether a polymer changes skin water loss, establish whether comparable deposits were actually formed. Equal applied mass does not guarantee equal thickness, coverage, or continuity. A material that accumulates in valleys could produce a different local transport pattern from one spanning raised regions. Conversely, a visually

continuous film could contain pathways below the imaging resolution. Structural imaging and water transmission therefore answer complementary questions.

6.3 Negative and mixed endpoint findings are useful constraints

Ruini and colleagues studied twenty women before and after two weeks of moisturiser use, with an untreated forearm and follow-up one week after cessation. Their multimodal assessment found selected changes, including reduced roughness, but did not establish broad significant changes across skin morphology and composition. The restricted participant group and short treatment period limit generalisation. The study is useful because it shows that a well-defined exposure need not produce a uniform response across endpoints. [13]

Logger and colleagues evaluated fourteen healthy volunteers thirty minutes after applying two cream vehicles. Stratum-corneum thickness increased, whilst TEWL, water content, and erythema did not significantly change. This is not proof that those other effects were absent; the pilot's size and timing matter. It does demonstrate why a thickness change cannot substitute for a measured water-loss or hydration effect. [14]

Bennett-Kennett and colleagues combined ex vivo mechanics, computational modelling, and participant self-assessment to investigate skin sensations after topical treatment. Reported perceptions correlated with predicted neural stimulation. The model supports examining a mechanical route to sensation; it does not mean that neural activity was directly recorded from every treated participant or that a favourable sensation establishes hydration. [15]

These findings sharpen the proposed research rather than weakening it. A useful material may affect one endpoint on one timescale. The task is to identify that effect, determine its robustness, and avoid extending it to unmeasured outcomes.

7 Varun analysis of what the connected evidence changes

The synthesis suggests that the unit of interpretation should be a defined application episode: a specified preparation deposited at a known site, exposed to a recorded environment, and examined through a known measurement sequence. The ingredient name alone is too coarse. This proposal is an organisational device derived from the evidence above, not a validated new measurement standard.

Four linked deductions follow. First, time is mechanistic information. Early measurements are especially sensitive to the transition from a wet formulation to a deposit; later measurements introduce wear, removal, skin adaptation, and participant behaviour. Choosing only a favourable time point can hide a trade-off between immediate signal and durable function. A time course should be planned around the intended use and plausible physical transitions, with a prespecified principal comparison.

Second, spatial coverage and endpoint location must be joined. An average thickness and an average TEWL result could conceal distinct pathways. If a film is patchy, water may escape preferentially through uncovered regions. Measuring a deliberately bare region, an intact patch, and a mixed region could answer different questions. The strongest next study is therefore not automatically a larger hydration trial; it may be a smaller experiment connecting deposition geometry to the exact measurement footprint.

Third, evidence of persistence requires a defined meaning of removal. Solvent, wiping, washing, or adhesive stripping can alter skin independently. A post-removal difference cannot identify lasting biological change unless matched removal controls address that disturbance and residual material is considered. “Still present after removal” is otherwise ambiguous between persistent effect, incomplete removal, and a removal-induced difference.

Fourth, a formulation can make measurement easier or harder. A uniform deposit might reduce variability even with a modest mean effect; a heterogeneous deposit might produce a large average signal with unreliable individual performance. Mean efficacy and dependable application should be reported separately. For a buyer, the latter may determine whether the effect is usable outside a controlled demonstration.

Research ambiguity	Discriminating comparison	Interpretation if the ambiguity persists
Electrical increase reflects the film	Film response on a suitable reference plus a complementary depth-sensitive skin observation	Describe the instrument response; do not quantify skin water from it alone
Lower flux reflects added surface resistance	Deposit characterisation and transport evidence, with skin comparisons at matched conditions	Temporary evaporation control remains a possible valid function
Benefit exists only where the film survives	Full application denominator, integrity record, and conditional performance analysis	Restrict the performance statement and address application reliability
Persistent effect follows film removal	Matched removal procedure, residue assessment, and appropriately timed follow-up	Keep residual-film and removal effects unresolved
Sensory improvement establishes hydration	Independently assessed perception, mechanics, and water-related endpoints	Preserve the sensory claim without assigning an unsupported mechanism

A serious counterargument is that this approach could make every observation seem inconclusive. That would be a misuse. Research does not require measuring every imaginable mechanism. It requires excluding alternatives that would change the intended decision. If the buyer needs a comfortable temporary evaporation-control film, evidence of a persistent biological change is unnecessary. If the proposed claim is barrier repair, the additional burden becomes relevant. The method is therefore intended to narrow experiments, not accumulate instruments indefinitely.

8 A proposed VARUNÉ Bio research programme

The first application should be one defined film function, preferably temporary evaporation control with acceptable wear, rather than a broad promise of skin regeneration. This is a proposed research focus, not a selected commercial programme. A qualified scientific lead, an appropriate formulation, suitable rights, facilities, and financing remain prerequisites to experimental work.

The initial material stage would compare the candidate formulation with its vehicle and a relevant established comparator. It would record material identity, dry-solids content, deposition method, applied mass, final coverage, and changes under the intended humidity range. Independent preparations are necessary to evaluate batch reproducibility; repeated readings from one deposit cannot replace them. Water sorption, loss during drying, and transmission through the formed film would be measured separately. The preferred output is an explicit account of what the film does before asking skin to resolve an inadequately characterised material.

A measurement-compatibility stage would examine whether the deposit affects contact, response, or recovery of the chosen instrument. Reference substrates must be justified rather than assumed inert. Where two measurement principles disagree, the work would test the competing physical explanations instead of averaging incompatible outputs. This stage should establish whether the planned endpoint can be interpreted in the formulation's presence.

Only then would a qualified human-study team develop an ethically reviewed evaluation of the intended cosmetic function. Participant selection, skin site, comparator, randomisation, blinding where feasible, environment, application, sequence, and follow-up would be specified in advance. Sample size should follow the chosen estimand, meaningful effect, variability, and intended precision; the small published studies here do not justify copying their sample sizes. Adverse reactions and withdrawal reasons require explicit capture, irrespective of the primary performance result.

A simple treatment contrast can be expressed as:

$$\Delta = (\bar{Y}_{T,t} - \bar{Y}_{T,0}) - (\bar{Y}_{C,t} - \bar{Y}_{C,0})$$

Equation 4. Difference in change between treatment and comparator.

Y is the prespecified endpoint; T and C denote treatment and comparator; 0 and t denote baseline and the chosen follow-up. Δ retains the endpoint's units, such as $\text{g m}^{-2} \text{h}^{-1}$ for water flux. This is a statistical definition, not a causal guarantee. Randomised allocation, a valid comparator, appropriate handling of baseline differences and repeated observations, and credible missing-data assumptions are still needed. For a split-body design, analysis must account for participant pairing. A qualified statistician may favour a baseline-adjusted repeated-measures model over this descriptive contrast.

The decisive records would include every attempted application, film integrity, endpoint location, environmental conditions, and reasons an endpoint could not be measured. The primary estimand should be chosen before observation: performance across intended applications or performance conditional on an intact film. Both can be informative, but substituting one for the other after seeing the data would change the research question.

Decision stage	Evidence required to continue	Reason to stop or redirect
Characterised material	Reproducible identity and deposit with a relevant physical function	Function depends on uncontrolled preparation or an unsuitable formulation
Interpretable measurement	Endpoint remains usable in the deposit's presence	Apparent benefit is dominated by unresolved measurement response

Decision stage	Evidence required to continue	Reason to stop or redirect
Defined human performance	Prespecified comparator contrast with acceptable uncertainty and tolerability	No useful contrast, unacceptable reactions, or impractical application reliability
Commercial evaluation	Buyer values the demonstrated function and the company can retain useful rights	Required performance, cost, rights, or qualification cannot support a viable product

9 Useful contributions to existing programmes

A realistic VARUNÉ contribution could be an application and measurement package for a material already being developed elsewhere. The useful output would connect preparation identity, deposit geometry, water transport, and the intended endpoint. It could help a university materials team decide whether a promising polymer merits a cosmetic study, or help a formulation partner distinguish a genuine product effect from a device-dependent signal. This is a proposal to validate with counterparties; no named organisation has agreed to it.

The work could also support existing film-characterisation programmes by testing whether structural observations predict transport under a specified exposure. For marine-polysaccharide researchers, the question would be whether a controlled preparation forms a reproducible useful deposit after formulation. Environmental-sampling projects would require a separate use case; preservation chemistry cannot be transferred to skin simply because both involve water retention.

Potential funding structures include a paid comparative feasibility study, sponsored method development, or an application-specific licence accompanied by agreed validation. None is currently confirmed. Before an external proposal, the scope would need a buyer decision, acceptance criteria, qualified owner, costs, data access, and explicit background and output rights. The commercial value would lie in a decision-enabling method or material application that VARUNÉ can legitimately own or reuse, rather than in attaching its name to another team's achievement.

10 Limitations and conclusion

The evidence is heterogeneous in materials, populations, instruments, timing, and access depth. Abstract-only studies cannot support a full risk-of-bias assessment. Some primary work involves commercial interests; these do not invalidate results, but they reinforce the value of independent replication. Several human cohorts are small or restricted, so extension across skin types, ages, conditions, and climates remains an evidence question. Historical textbook device descriptions are not current product specifications.

The analysis does not establish that the proposed framework is novel relative to all existing measurement science. Its intended value is the explicit connection between film formation, spatial sampling, water balance, and the meaning of a claimed benefit. No VARUNÉ candidate has been shown here to improve skin hydration, repair a barrier, or outperform an existing formulation. Publication would present a critical literature report and proposed research, not original efficacy data.

The strongest conclusion is that film-based skin research becomes more useful when the physical function, observation, and claim are aligned. A temporary surface effect can be valuable. A persistent

biological effect needs its own evidence. The next VARUNÉ decision should identify one function worth demonstrating, establish that it can be measured in the chosen formulation, and compare it against a meaningful alternative under conditions relevant to use.

References and access record

- [1] Kottner J, Vogt A. Transepidermal Water Loss. In: Baran R, Maibach HI, editors. *Textbook of Cosmetic Dermatology*. Fifth edition. CRC Press; 2017. Chapter 3, pp. 28-30; supplied PDF pp. 41-43. Continuous main text reread; references inspected selectively.
- [2] Rohr M, Schrader A. Climatic Influence on Cosmetic Skin Parameters. In: Baran R, Maibach HI, editors. *Textbook of Cosmetic Dermatology*. Fifth edition. CRC Press; 2017. Chapter 2, pp. 16-26; supplied PDF pp. 29-39. Targeted climate, baseline-state, and formulation passages checked against the existing reading record.
- [3] Hannon W. Assessing the Efficacy of Moisturizers. In: Baran R, Maibach HI, editors. *Textbook of Cosmetic Dermatology*. Fifth edition. CRC Press; 2017. Chapter 58, pp. 561-581; supplied PDF pp. 574-594. Targeted measurement-method passages and existing table analysis used; no current device specification inferred.
- [4] Imhof RE, De Jesus MEP, Xiao P, Ciortea LI, Berg EP. Closed-chamber transepidermal water loss measurement: microclimate, calibration and performance. *International Journal of Cosmetic Science*. 2009;31:97-118. <https://doi.org/10.1111/j.1468-2494.2008.00476.x>. Indexed abstract and publisher synopsis checked online; earlier selected chamber-physics reading retained as context, not a new full-paper review.
- [5] Nuutinen J, Alanen E, Autio P, Lahtinen MR, Harvima I, Lahtinen T. A closed unventilated chamber for the measurement of transepidermal water loss. *Skin Research and Technology*. 2003;9:85-89. <https://doi.org/10.1034/j.1600-0846.2003.00025.x>. PubMed abstract checked, <https://pubmed.ncbi.nlm.nih.gov/12709124/>.
- [6] Li F, Conroy E, Visscher M, Wickett RR. The ability of electrical measurements to predict skin moisturization. I. Effects of NaCl and glycerin on short-term measurements. *Journal of Cosmetic Science*. 2001;52:13-22. <https://pubmed.ncbi.nlm.nih.gov/11382840/>. Indexed abstract checked; DOI not established in this review.
- [7] Crowther JM. Understanding effects of topical ingredients on electrical measurement of skin hydration. *International Journal of Cosmetic Science*. 2016;38:589-598. <https://doi.org/10.1111/ics.12324>. PubMed abstract checked, <https://pubmed.ncbi.nlm.nih.gov/27028308/>.
- [8] Albèr C, Buraczewska-Norin I, Kocherbitov V, Saleem S, Lodén M, Engblom J. Effects of water activity and low molecular weight humectants on skin permeability and hydration dynamics: a double-blind, randomized and controlled study. *International Journal of Cosmetic Science*. 2014;36:412-418. <https://doi.org/10.1111/ics.12136>. Publisher and PubMed abstracts checked, <https://pubmed.ncbi.nlm.nih.gov/24786192/>.
- [9] Crowther JM, Matts PJ. What defines dry skin? Correlating a range of skin hydration parameters with In Vivo Confocal Raman Spectroscopy. *International Journal of Cosmetic Science*. 2024;46:610-622. <https://doi.org/10.1111/ics.12990>. PubMed abstract and bibliography checked, <https://pubmed.ncbi.nlm.nih.gov/39113320/>.
- [10] Kottner J, Ludriksone L, Garcia Bartels N, Blume-Peytavi U. Do repeated skin barrier measurements influence each other's results? An explorative study. *Skin Pharmacology and Physiology*. 2014;27:90-96. <https://doi.org/10.1159/000351882>. Indexed abstract and publisher record checked, <https://pubmed.ncbi.nlm.nih.gov/24157535/>.

- [11] Yu B, Kang SY, Akthakul A, et al. An elastic second skin. *Nature Materials*. 2016;15:911-918. <https://doi.org/10.1038/nmat4635>. Supplied full paper, selected conductance and dry-skin results and Methods, particularly supplied PDF pp. 9-10, checked directly; publisher metadata and competing-interest statement verified.
- [12] Gonçalves M, Han Y, Baek HS, Song C, Weon BM. Advanced Characterization of Soft Cosmetic Film Deposits with X-Ray Microtomography. *Small Methods*. 2025. <https://doi.org/10.1002/smtd.202402202>. Supplied full paper; selected substrate, centre/edge measurement, imaging, and limitation passages checked directly. The experimental system was artificial skin, not human efficacy testing.
- [13] Ruini C, Kendziora B, Ergun EZ, et al. In vivo examination of healthy human skin after short-time treatment with moisturizers using confocal Raman spectroscopy and optical coherence tomography: Preliminary observations. *Skin Research and Technology*. 2022;28:119-132. <https://doi.org/10.1111/srt.13101>. Publisher full text accessed for targeted abstract, design, and methods; not an exhaustive reanalysis of all outcomes.
- [14] Logger JGM, Olydam JI, Woliner-van der Weg W, van Erp PEJ. Noninvasive Skin Barrier Assessment: Multiparametric Approach and Pilot Study. *Cosmetics*. 2019;6:20. <https://doi.org/10.3390/cosmetics6010020>. Publisher-indexed abstract and subject-method passages checked; direct page opening intermittently failed.
- [15] Bennett-Kennett R, Pace J, Lynch B, Domanov Y, Luengo GS, Potter A, Dauskardt RH. Sensory neuron activation from topical treatments modulates the sensorial perception of human skin. *PNAS Nexus*. 2023;2:pgad292. <https://doi.org/10.1093/pnasnexus/pgad292>. Supplied full paper, abstract, study logic, and competing-interest declaration checked; computational prediction distinguished from direct neural measurement.

Authorship and research provenance

Varun Sharma is the sole author and approved this edition for release on 28 October 2026. No new experimental data are reported; published findings remain attributable to the cited investigators.

Competing interests. Varun Sharma founded VARUNÉ Bio, which may benefit commercially from applications discussed here. Funding and contributor declarations remain subject to author confirmation.

This report shares concepts and sources with the five companion reports dated 28 October 2026; it presents a distinct literature analysis.