

The Sunny Skin Microbiome 2.0

Reframing daily sun protection
for acne-prone skin

March 2026

dsm-firmenich 

How we use 'Acne' in this presentation

This presentation is intended for B2B communication only.

All acne-related terminology reflects scientific insights for professional discussion. Final consumer-facing claims remain the full responsibility of the finished-product manufacturer and must comply with local cosmetic regulations in their markets.

Understanding 'Acne' in a Cosmetic Context

Acne-prone skin

- A skin type that is more likely to develop visible blemishes (breakouts, clogged pores, shine).
- **Not a medical diagnosis.**

Visible acne concerns

- **Common consumer language** describing pimples, blackheads/whiteheads, oily or blemish-prone skin.
- Refers strictly to appearance-level concerns.

Diagnosed acne

- **A medical condition** assessed by a dermatologist using clinical criteria.
- Cosmetic products cannot claim to treat, cure, or prevent diagnosed acne.

In this presentation, 'acne' refers only to:

- Visible concerns associated with acne-prone skin
- UV-related microbial imbalances linked to blemish-prone conditions of acne
- and does not imply any medical treatment or disease prevention of acne

Beauty is undergoing a fundamental shift

Consumers are moving away from chasing quick fixes and toward maintaining long-term skin health.

Skin Longevity

is gaining growing attention. Moving beyond outdated anti-aging claims toward a philosophy of well-aging, consumers are exploring holistic, long-term strategies that support the skin as an interconnected ecosystem for sustained health and resilience.

Sun Care

has been outperforming the personal care market. This significant growth underscores the global shift toward proactive skin health and prevention.



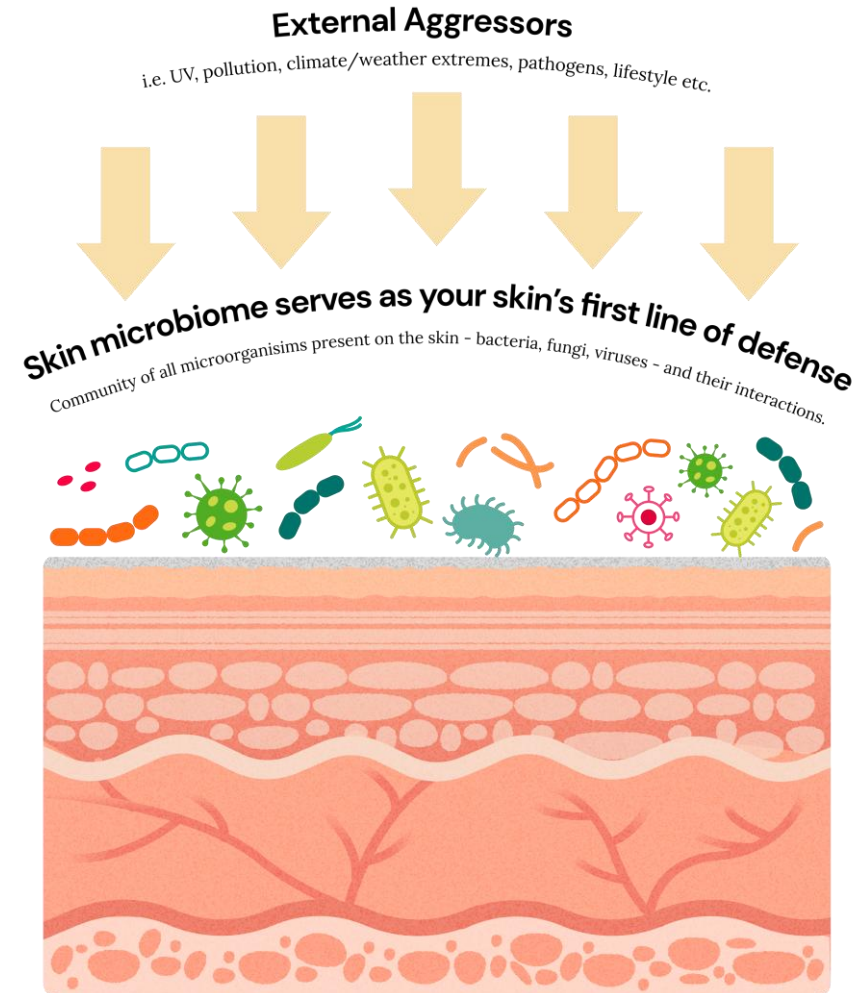
The microscopic guardian is vital to skin resilience

When it comes to ecosystems, few are as vital — or as overlooked — as the billion-strong community thriving on our skin: the microbiome eco-system.

A stable and well-balanced microbiome eco-system is the skin's first line of defense against external aggressors, helping maintain its barrier and supporting immune responses.

UV exposure stands among the most potent external stressors for skin — an unseen force that shapes both immediate and long-term skin quality.

- In the short term, UV can trigger visible redness, pigmentation, and a momentary weakening of skin's natural defenses.
- But its deeper impact unfolds over time: accelerated photoaging, loss of youthful radiance, and a heightened risk of long-term damage driven by cumulative exposure i.e. photocarcinogenesis.



The interaction between UV exposure and skin microbiome has been explored

In 2023, dsm-firmenich conducted its first exploratory study to uncover the science behind the topic. The findings related to *C. acnes* has caught our attention.

1. **UV exposure triggers overproduction of *C. acnes***, a key acne-associated bacteria *in vivo*.
2. A combination of PARSOL® EHT, PARSOL® 1789, and PARSOL® Shield can **help mitigate acne propagation** when included in sunscreen *in vitro*.

Click [here](#) for Sunny Skin Microbiome 1.0 full review.



Acne is noticeably rising as a concern

Acne is no longer just a teenage problem.

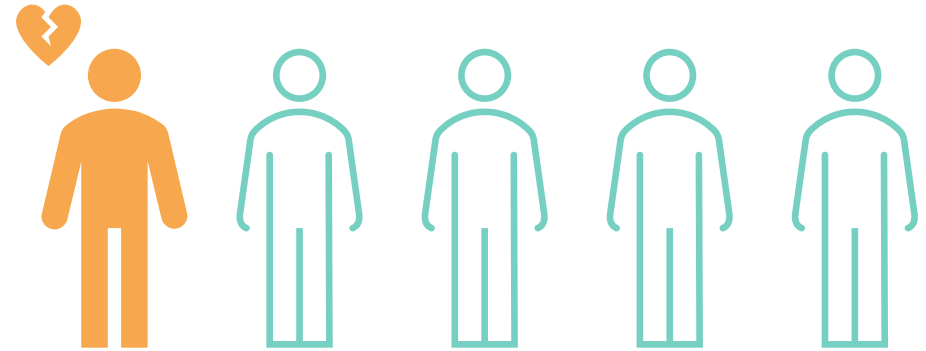
With around 1 in 5 adults experience acne, the increase of adult acne is confirmed.

Epidemiological research shows **particularly sharp increases across Asia** — with China, South Korea, Japan, and Southeast Asia reporting some of the fastest-growing rates globally.

Urban density, heat, humidity, pollution, changing diet patterns, and relentless environmental stressors are creating the perfect storm for acne formation. In the cosmetic context, this refers to visible skin concerns such as breakouts, clogged pores, excess sebum, and blemish-prone skin.

The conditions that fuel acne are not only increasing – they're part of daily life.

Wang Y. *et al.*, *Sec. Dermatology*, 2022
Tian L. *et al.*, *Skin Research and Technology*, 2024
Roengritthidet K. *et al.*, *Acta Derm Venereol.* 2021
Saurat J. *et al.*, *JAAD*, 2024



"Our study confirmed the increase in adult acne, with approximately **1 out of 5 individuals between 25 and 39 years of age being diagnosed with acne.**" (JAAD)

The SPF–acne dilemma

The latest dsm–firmenich survey identified that...

While sunscreen has been **very well adopted as daily routine** among Asian consumers...

...the perception that a
sunscreen can cause acne
discourages certain
sunscreen users to wear
more often.

Among those extremely concerned about acne or blemished skin, **22%** don't use sunscreens more often because of acne barrier.



Brands are making efforts to alleviate the dilemma

Early launches are starting to claim acne-related benefits and encouraging for daily protection.

With anti-acne in the product name, addressing the topic by enriched bioactives.

For acne-prone and sensitive skin with a prebiotic formula, with bioactive 'helps reduce acne, restore microbial balance to healthy skin'.

'The world's first microbiome-friendly certified sunscreen', suitable for all skin types including acne-prone skin.

'Acnemy is the natural enemy of acne.' This non-comedogenic sunscreen is formulated for acne-prone skin with 'unique combination of acne-fighting ingredients'.



Closing the gap with microbiome insights

- Today's sun care products mostly promise "non-comedogenic" safety—a limited view of acne prevention.
- Some go further with bioactives or pre-/postbiotics, but these solutions remain fragmented and incomplete.
- **The missing piece? A science-driven approach that connects UV protection, microbiome health, and acne risk management for truly holistic skin care.**

The Opportunity: lead the next evolution in sun care with formulations powered by real science – combining UV defense, microbiome balance, and acne risk reduction to move beyond single claims to comprehensive solutions that respect and protect the skin ecosystem.



The Sunny Skin Microbiome 2.0: targeted daily sun protection for acne-prone skin

Our scientists expanded the frontiers with new evidence to reflect evolving consumer behaviors and market dynamics.

The main goal is to investigate how daily application of an SPF 50 sunscreen influences the skin microbiome of acne-prone skin under real-life UV exposure conditions



Clinical study on acne-prone Asian skin

This placebo-controlled study explored how UV exposure and sunscreen affect acne-prone Asian skin. We focused on *C. acnes* balance, overall microbiome diversity, and porphyrin levels, which signal acne-related bacterial activity.

Study at a glance

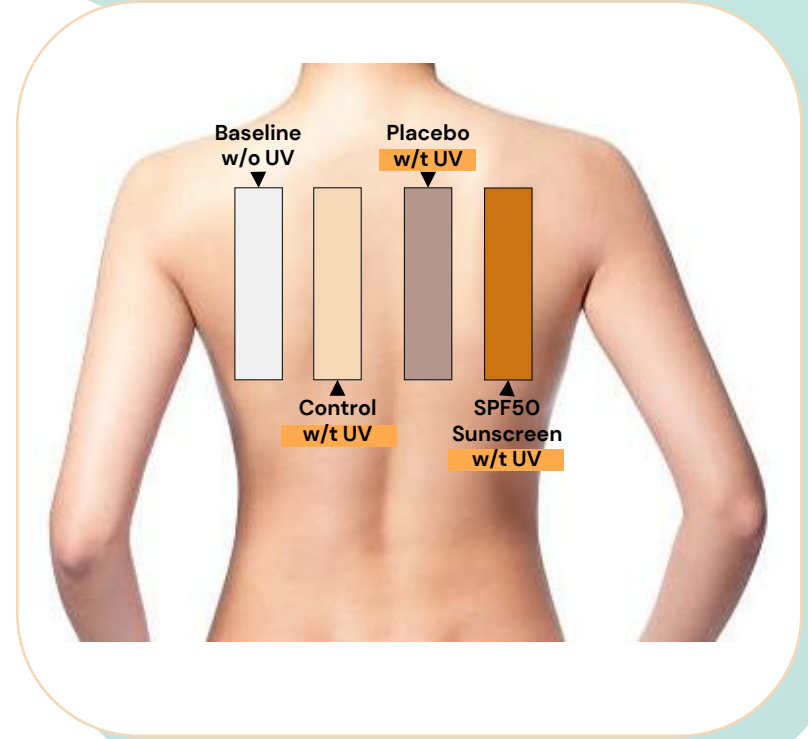
- **32 Asian* subjects** with acne-prone skin on face/back
- **SPF 50 formulation vs. placebo** (without UV filters)
- **4 x 0.5 MED (sub-erythema) per day for 4 days** – comparable to the amount of sun your skin gets during typical daily activities, not extreme sunbathing
- **Randomized test zones** to minimize the bias

Analysis

1. Holistic skin microbiome diversity
2. *C. acnes* abundance
3. Porphyrin change

Each analysis detailed individually in the following pages

Click [here](#) for test formulations.



**In real tests, test zones are randomized per subject to minimize the bias.*

The results validate that:

For acne-prone skin, daily SPF 50 is a smart and proactive habit that supports a balanced skin microbiome and keeps *C. acnes* in check for a clearer, healthier-looking complexion.



Breaking it down:

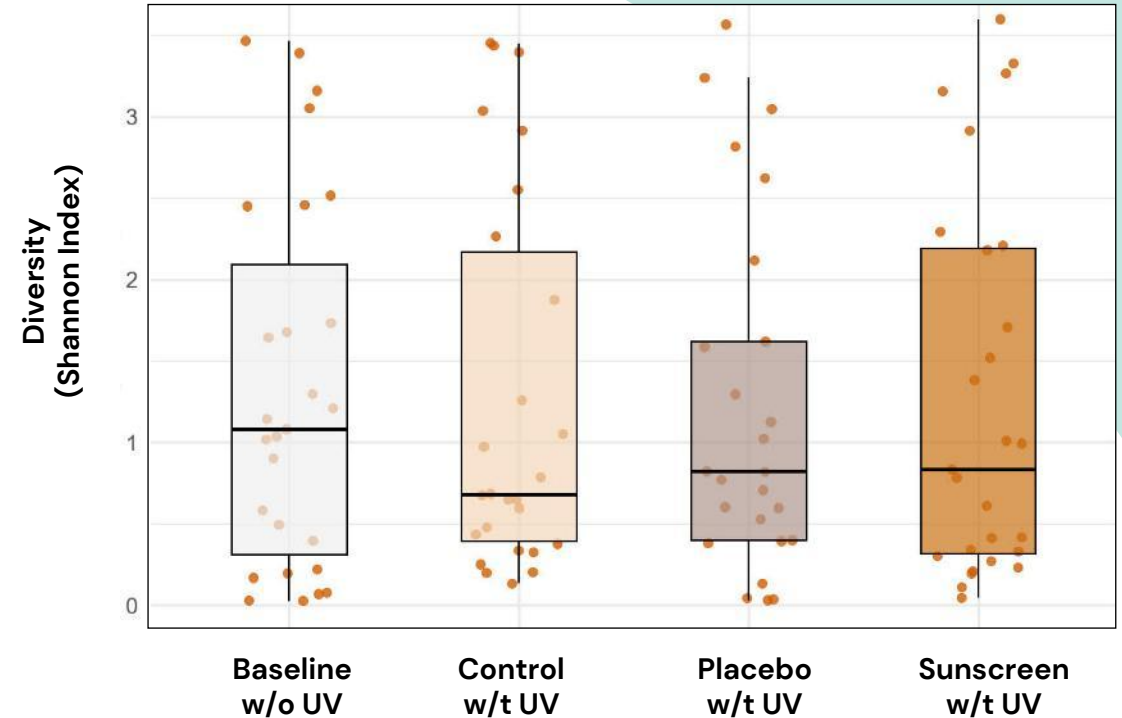
1. effects on general microbiome biodiversity

Skin microbiome biodiversity is key to maintain barrier integrity, regulate immune responses, and prevent the overgrowth of pathogenic species. A diverse microbial community strengthens skin resilience and overall health.

Key findings:

1. **The skin microbiome biodiversity remains stable** under low (suberythral) repeated UV exposure.
2. **An SPF 50 sunscreen helps maintain the skin's natural microbiome balance, supporting the original composition.**

An SPF 50 Sunscreen preserves the overall skin microbiome biodiversity and resilience.



Shannon Index: the quantitative measure for richness and evenness of microbiome composition. Differences n.s. between conditions.

- Median value of total counts
Refers to 1 subject data

Breaking it down:

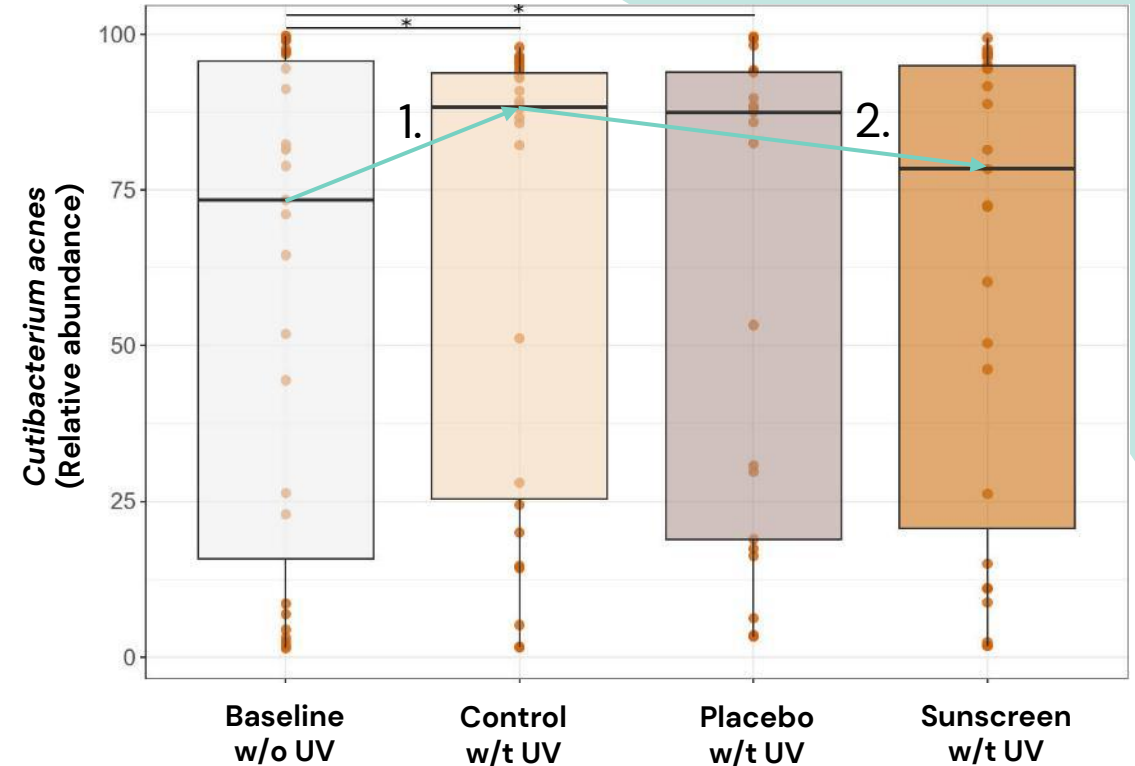
2. influences on *C. acnes* population

UV exposure can trigger an overgrowth of *C. acnes*, accelerating acne formation. Conversely, reducing *C. acnes* levels helps minimize the overall risk and supports clearer, healthier-looking skin.

Key findings:

1. *C. acnes* can be triggered significantly with low-level repeated UV exposure.
2. An SPF 50 sunscreen prevents such trend helping prevent the risk of getting acne, better than without.

An SPF 50 Sunscreen prevents UV-induced overproduction of *C. acnes*.



Relative abundance: the percent composition of an organism of a particular kind relative to the total number of organisms in the area

— Median value of total counts

● Refers to 1 subject data

* Significance $p < 0.05$

Breaking it down:

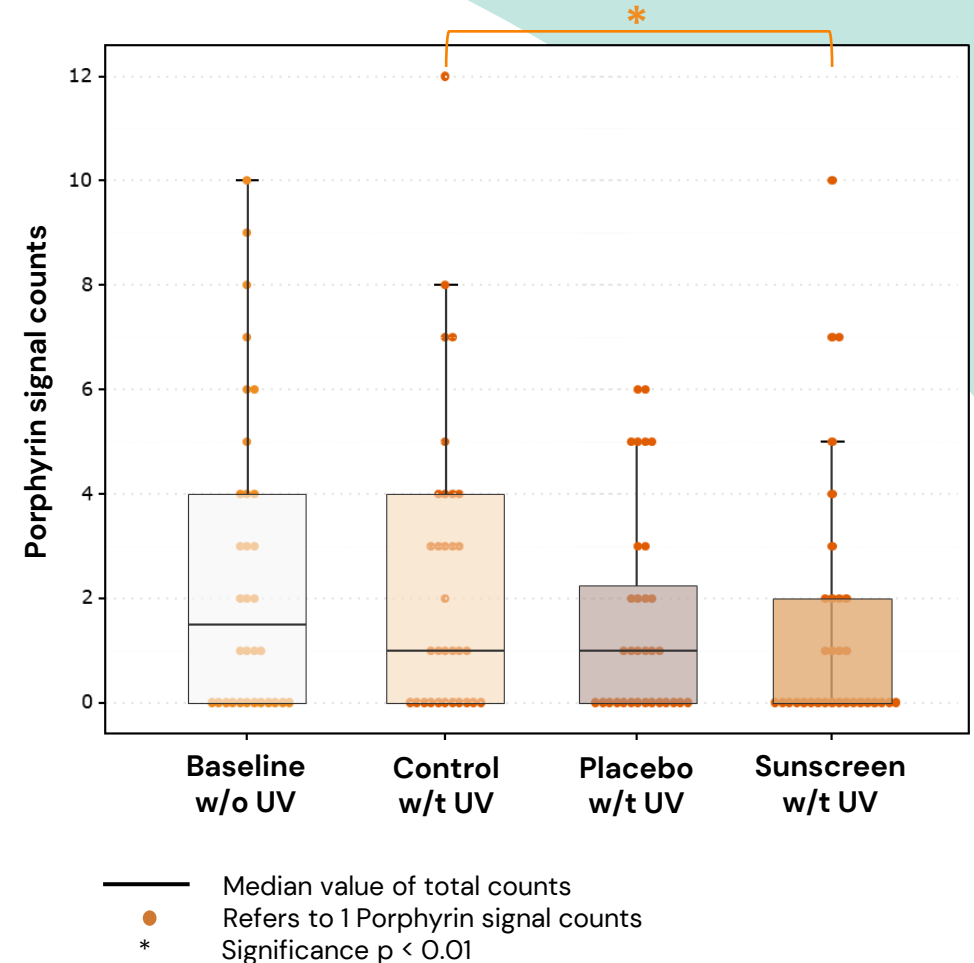
3. decoding porphyrins

Porphyrins are metabolic byproducts produced by pathogenic strains of *C. acnes* and are closely linked to acne-prone skin, particularly in sebaceous glands. These strains have a high pro-inflammatory potential compared to non-pathogenic strains of *C. acnes*.

Key findings:

1. An SPF 50 sunscreen helps limit porphyrin overproduction by keeping UV-induced *C. acnes* in check.
2. And it significantly reduces porphyrin signal counts compared to controls, outperforming placebo.

An SPF 50 Sunscreen helps reduce porphyrin significantly, outperforming than without.



For acne-prone skin, daily SPF 50 is a smart and proactive habit because...

The latest clinical study by dsm-firmenich proves that daily SPF 50 sunscreen can:

1. Preserve and maintain the overall microbiome balance.
2. Keep *C. acnes* overpopulation in check.
3. Lower acne risk by reducing porphyrins counts, more effectively than without.



*“Be gentle with your microbiome –
it is here to stay and protect your skin.”*

Dr. Rolf Schütz

Leading Scientist for **Sunny Skin Microbiome Studies**
Lead Study Director Photoprotection, Beauty and Care



- 20+ years of R&D experience in the cosmetic ingredient industry.
- Holds a PhD in organic chemistry from the University of Bern and completed postdoctoral studies in genetic engineering at Stanford.
- Specializes in connecting chemistry and skin biology for claim substantiation in Sun and Skin Care, particularly in photobiology.
- Led product launches in anti-aging, pollution, epigenetics and blue light.
- Conducted all clinical studies for US registration of bemotrizinol.
- Prolific (co-)author and patent filer, and a member of the Swiss SCC.

Schuetz R. et al., IJCS, 2023

From Sterile Thinking to Symbiotic Beauty: Advancing the Science of the Skin Microbiome

The skin microbiome has been a major focus in cosmetics for more than a decade. While we now understand much more about its role in skin health, there is still a great deal to uncover.

At dsm-firmenich, we continue to push the frontier by building up the knowledge 35 years ago – advancing research, refining methodologies, and deepening our understanding of the causal links between the microbiome and skin health through inter-omics technologies and beyond.

Our discoveries open new possibilities, strengthening our leadership in shaping the future of skin microbiome science.

2020

Clinical study to evaluate the impacting of cleansing on skin microbiome.

**Sfriso R. and Claypool J.,
Microorganisms, 2020**

2022

The pioneering clinical exploratory study to understand the interaction among UV exposure, sunscreen and skin microbiome.

**Schuetz R. et al., IJCS,
2023**

2024

The pioneering clinical study to directly link menopause status to changes in skin microbiome composition.

**M. Pagac et al.,
Front Aging, 2024**

2025

A novel study approach with 3D visualization framework to predict facial-skin microbial distributions more efficiently without losing accuracy.

IFSCC 2025 Top 10 Poster

The Sunny Skin Microbiome 2.0

Deep dive into the science
and results

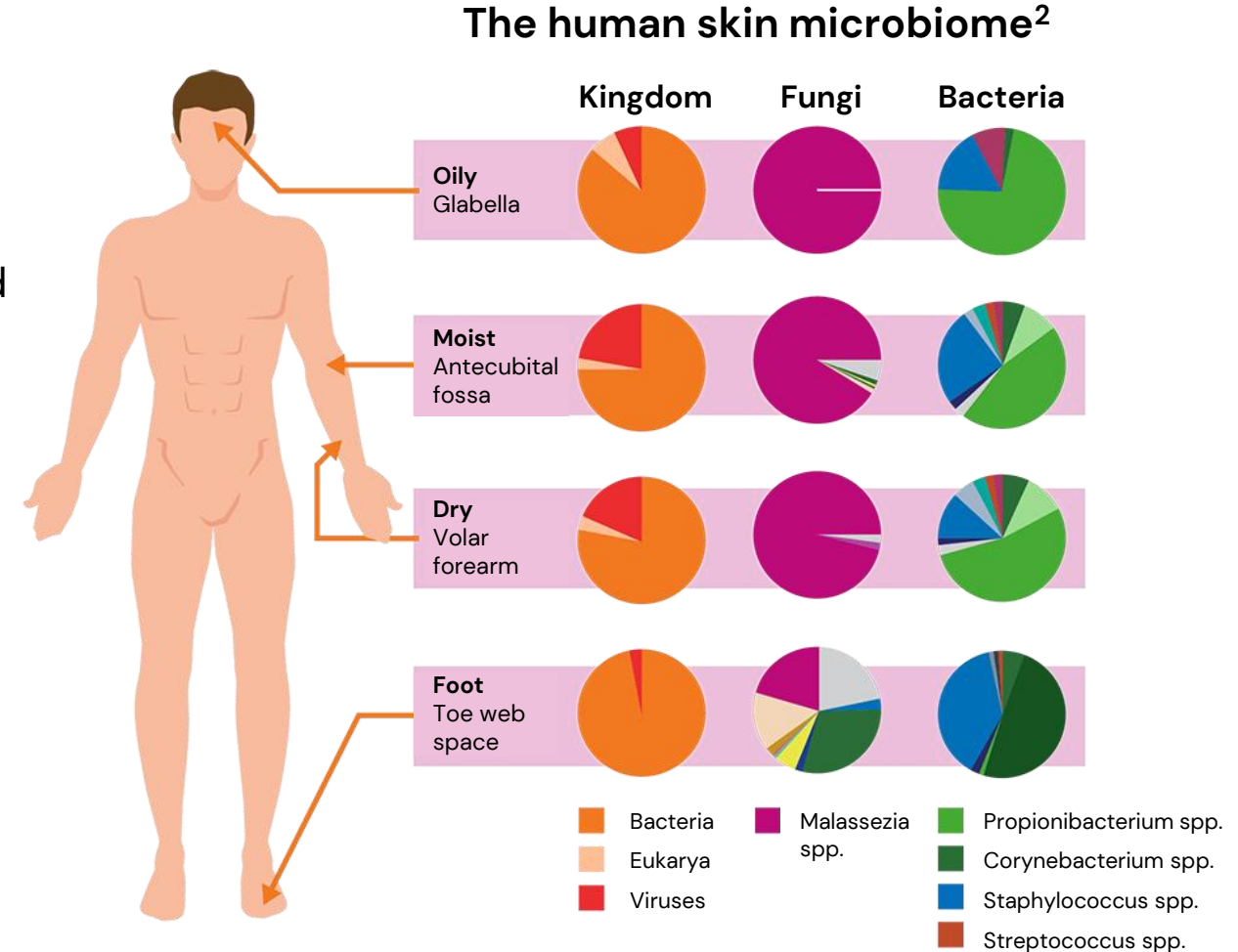
Dr. Rolf Schütz

Leading Scientist for **Sunny Skin Microbiome Studies**
Lead Study Director Photoprotection, Beauty and Care

Micro(biome), but MEGA-important!

What is the Skin Microbiome and its role?

- The Skin Microbiome is the **community of all microorganisms present on skin** (bacteria, fungi, viruses, etc.) and its interactions¹.
- It has an **important role** in the skin health, wellbeing, and protection of the human body.
- **Bacteria** are the most abundant microorganisms in the skin and differ depending on the body sites (moist, dry or oily skin conditions).
- **Intra-/inter-individual and temporal diversity** is observed depending on internal and external factors
- Microorganisms may have **symbiotic or pathogenic interactions** with one another or with the skin cells (e.g., *Cutibacterium acnes*)

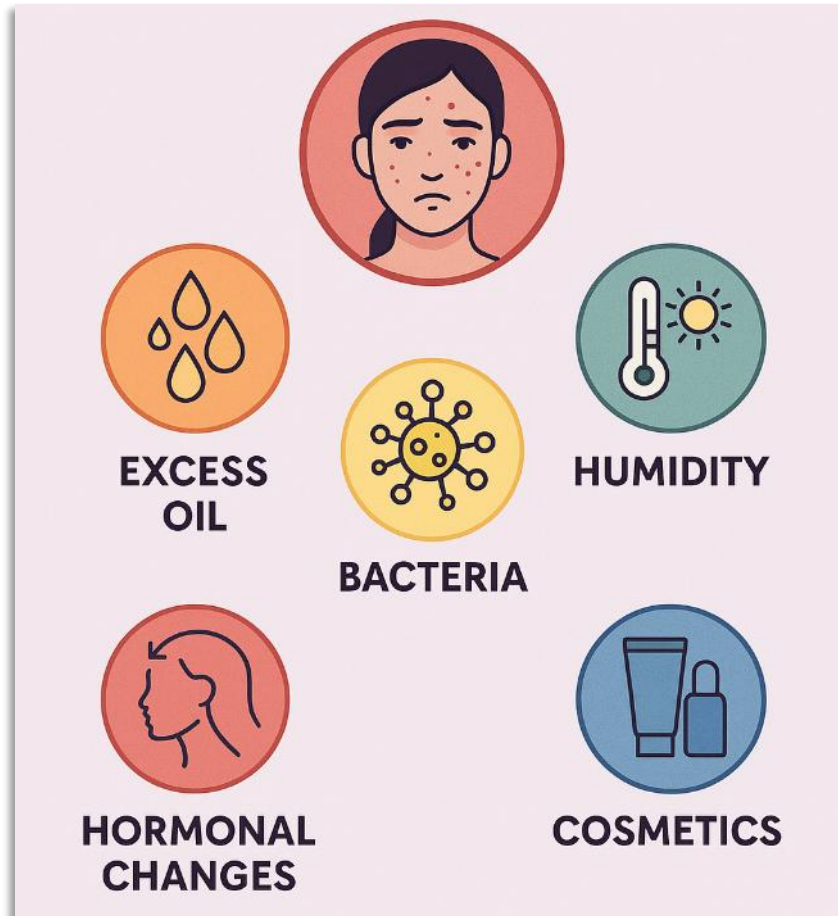


Important: quantity AND quality of microbiome

Factors triggering acne-prone skin

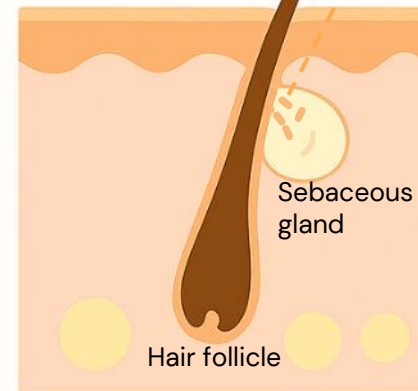
From factors...

...to skin deep formation of acne



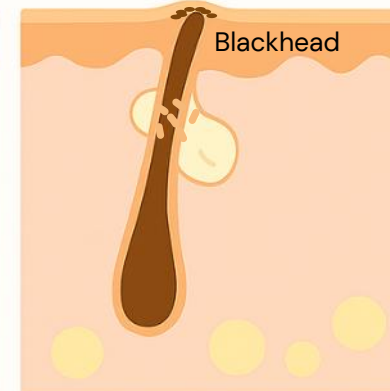
Cutibacterium acnes is an abundant bacteria of sebum-rich skin microbiome and can trigger acne formation¹⁻⁴

1) Healthy pore



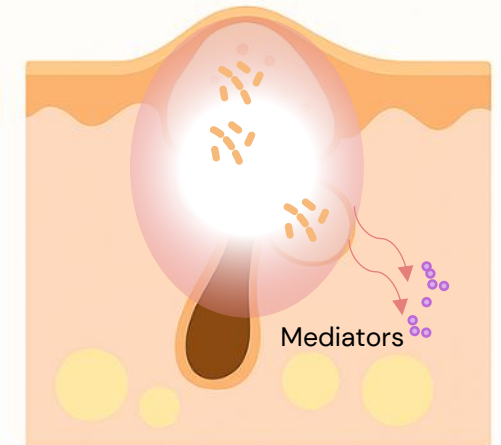
Sebum secretion↑
Androgen-dependent
Genetic influence

2) Clogged Pore (Comedon)



Occlusion,
Hyperkeratinization
Bacterial (*C. acnes*)
colonialization of
duct

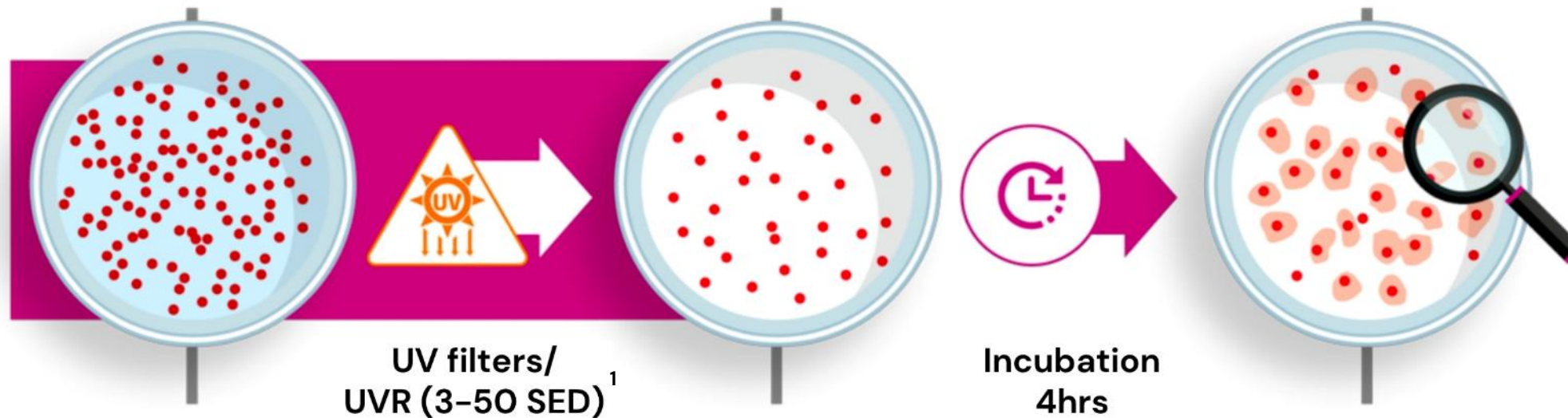
3) Inflamed pore



Bacteria spreading
Dermal inflammation by
release of bacterial
mediators (e.g. SC-FA)
and ruptured comedones

In vitro Bacterial Survival UV-Model

To understand impact of UV filters at the microbial level, we tested UV filter combinations against three key skin bacteria on acne-prone skin



Test Formulations

- Solubilized UV filters and combinations calibrated to predicted in vitro SPF 6 and SPF 24, respectively
- Non-irradiated and irradiated controls with vehicle (oil solvents) treatment

Microbial strain (Reference²)

Cutibacterium acnes (ATCC 11827): most abundant bacteria in sebaceous skin, opportunistic pathogen

Lactobacillus crispatus (CIP 103604): key species supporting skin barrier, pH, microbiome stability.

Staphylococcus epidermidis (ATCC 12228): skin commensal supporting homeostasis, barrier integrity.

Analysis

- Colony forming units (CFU) or dye staining
- Survival ratio (%) vs. non-irradiated control
- Protection ratio (%) vs. irradiated control

1. SED= Standard Erythema Dose: 1 SED unit = 10 mJ/cm²; 2. CIP (Institut Pasteur Collection, France); ATCC (American type culture collection)

In Vitro Study results – comprehensive overview

Study Series	Sample	UV filters		Wt-%*	Protection* (Survival**) [%]		
		Abbrev.	Trade Name		<i>C. acnes</i>	<i>L. crispatus</i>	<i>S. epidermidis</i>
I	1.1	BMDBM	PARSOL® 1789	5	-70 (20)	+100 (25)	+59 (63)
	1.2	EHS	PARSOL® EHS	10	-30 (46)	+59 (20)	+100 (79)
	1.3	OC	PARSOL® 340	5	-15 (56)	+300 (50)	+59 (63)
	1.4	ZnO Tecs	PARSOL® ZX	3	+13 (74)	+152 (31)	+26 (50)
	1.5	BEMT	PARSOL® Shield	2.3	+13 (74)	+59 (20)	+100 (79)
	1.6	EHT	PARSOL® EHT	2.3	+40 (92)	+100 (25)	+59 (63)
	1.7	TiO ₂ /SiO ₂ /D	PARSOL® TX	3	+23 (81)	+59 (20)	+26 (50)
	1.8	OC/EHS/ BEMT/BMDBM	PARSOL® 340/EHS/Shield/1789	7/4/2/4.5	+25 (82)	+152 (31)	+59 (63)
	1.9	EHT/BEMT/ BMDDBM	PARSOL® EHT/Shield/1789	3/3/3	-13 (58)	+152 (31)	+26 (50)
	1.10	OC/EHS/EHT	PARSOL® 340/EHS/EHT	10/5/5	-65 (23)	+152 (31)	-21 (31)
	Control	Vehicle					
II	2.1	DHHB					
	2.2	MBBT					
	2.3	PBSA					
	2.4	PS-15					
	2.5	OMC					
	2.6	PS-15/OMC	PARSOL® SLX/MCX	3/1.7	+13 (30)	+152 (79)	+404 (79)
	2.7	BEMT/ZnO	PARSOL® Shield/ZX	5/15	+100 (54)	+59 (50)	-88 (2)
	2.8	BEMT/EHT/DHHB	PARSOL® Shield/EHT/DHHB	2.5/3.5/4.5	+31 (35)	+152 (79)	+534 (100)
	Control	Vehicle	n.d.	n.d.	0 (27)	0 (32)	0 (16)

Specific UV filters protected beneficial skin bacteria such as *Lactobacillus crispatus* and reduced the proliferation of opportunistic pathogen *Cutibacterium acnes*

Evaluation Criteria

- *Cutibacterium acnes*
→ Keep in check but not to kill
- *Lactobacillus crispatus*
→ Protect and promote
- *Staphylococcus epidermidis*
→ Protect and promote

BMCDBM Butyl Methoxydibenzoylmethane
 BEMT Bis-Ethylhexyloxyphenol Methoxyphenyl Triazine
 DHHB Diethylamino Hydroxybenzoyl Hexyl Benzoate
 EHS Ethylhexyl Salicylate
 EHT Ethylhexyl Triazone
 OC Octocrylene
 OMC Ethylhexyl methoxycinnamate
 PBSA Phenylbenzimidazole Sulfonic Acid
 PS-15 Polysilicone-15
 MBBT Methylene Bis-Benzotriazolyl Tetramethylbutylphenol
 ZnO Tecs Zinc Oxide, Triethoxycaprylsilane

*Survival ratio (%) vs. non-irradiated control; **Protection ratio (%) vs. irradiated control

Clinical Study Test Design

Placebo-controlled study for acne-prone Asian skin

TEST PRODUCTS:

- **SUNSCREEN:** Asian SPF 50 formulation (PARSOL® 1798, Shield, EHT, EHS, SLX, HS)
- **PLACEBO:** chassis without UV filters

STUDY POPULATION:

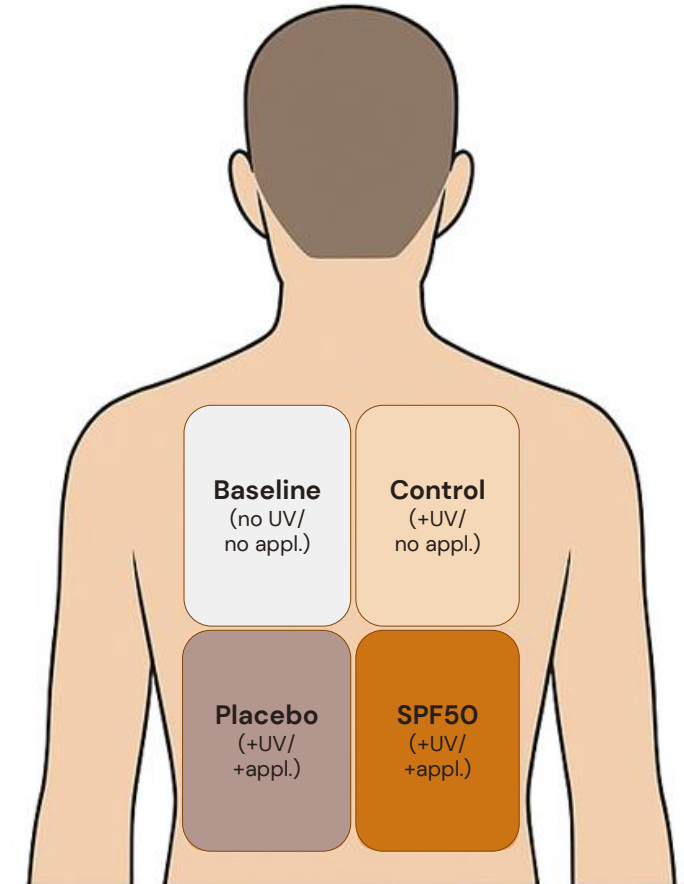
- **Min. 30 participants** between 25 and 45 years of age (start n= 33)
- **Asian skin**, type II-III (MED determination)
- **Acne-prone skin**, manifesting acne on back and/or face

OVERALL STUDY DESIGN:

- **Wash-out phase:** gentle Crème lavante (La Roche Posay Effaclar H IsoBiome), 1x/day, 7 days
- **Standardized application:** Test products to be applied on upper mid **back**, 2 mg/cm² on 2.5 cm x 10 cm dedicated zones (Z1 to Z4, right)
- **Exposure: cumulative 2 MED** (Minimal Erythema Dose) UVA/B from solar simulator, 4 x 0.5 MED per day on D0-D3
- **Time Points: D0** (Baseline), **D1, D2, D3** (2-hour post-exposure, microbiome), **D4** (lipids/porphyrins)
- **Swabbing/Tape Stripping:** 132 samples from 32 participants

SKIN MICROBIOME and BIOPHYSICAL PARAMETERS:

- Targeted analysis: **Long-read 16S rRNA gene sequencing** and **Single Locus Sequence typing (SLST)**
- **Lipid analysis** (Sebutape/D-Squame tape; LC/ESI-MS/MS), **Porphyrin analysis** (VISIOPOR device), **Photos** (DSLR camera)



Conditions used for microbiome swabbing and lipid tape stripping.

Participant Demographics

Demographics (n=32, completed)

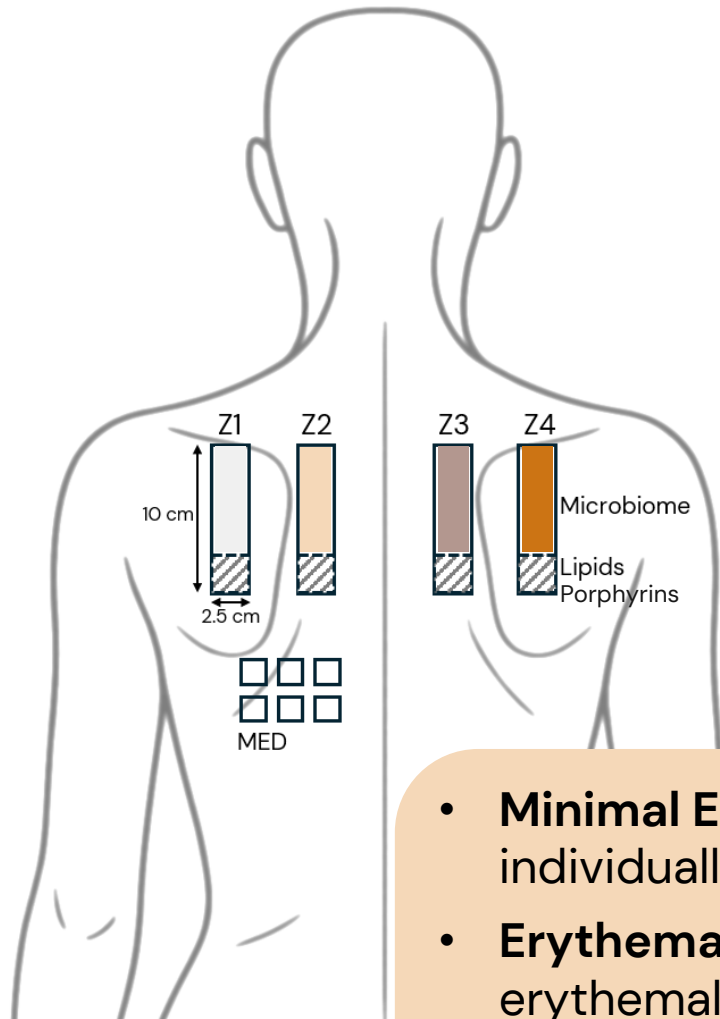
Age range	18–46 years (mean 29±1)
Sex Distribution	Female: 59% (19)/Male: 41% (13)
Ethnicity	Chinese (69%), mixed Asian (31%)
Acne-prone Skin	100% (face or/and back)
Skin type (Fitzpatrick)	III (66%), II (25%), IV (9%)
Skin Tone range	20.9–52.3 ITA° (mean 36.6±1.2 intermediate)

Key Observations

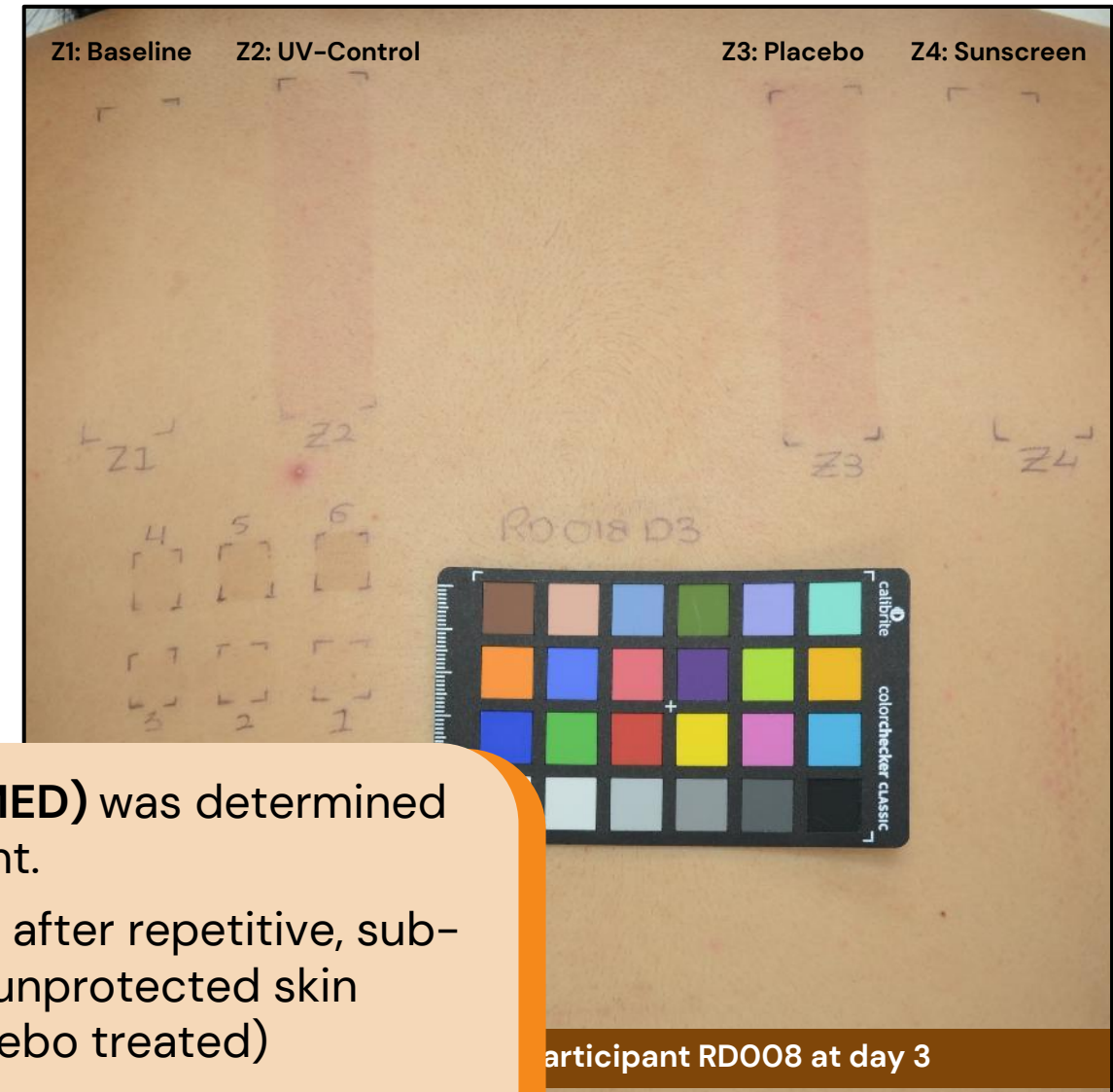
- All participants successfully completed the study without early termination.
- The demographics ensure good representation of the acne-prone Asian cohort relevant to the study.
- No observed or reported AE's in the study



Test Zones and Participant Photo



Dedicated test zones (Z1-Z4) included lipid tape stripping. Condition per subject to minimize local bias. Determination were used on 6 separate

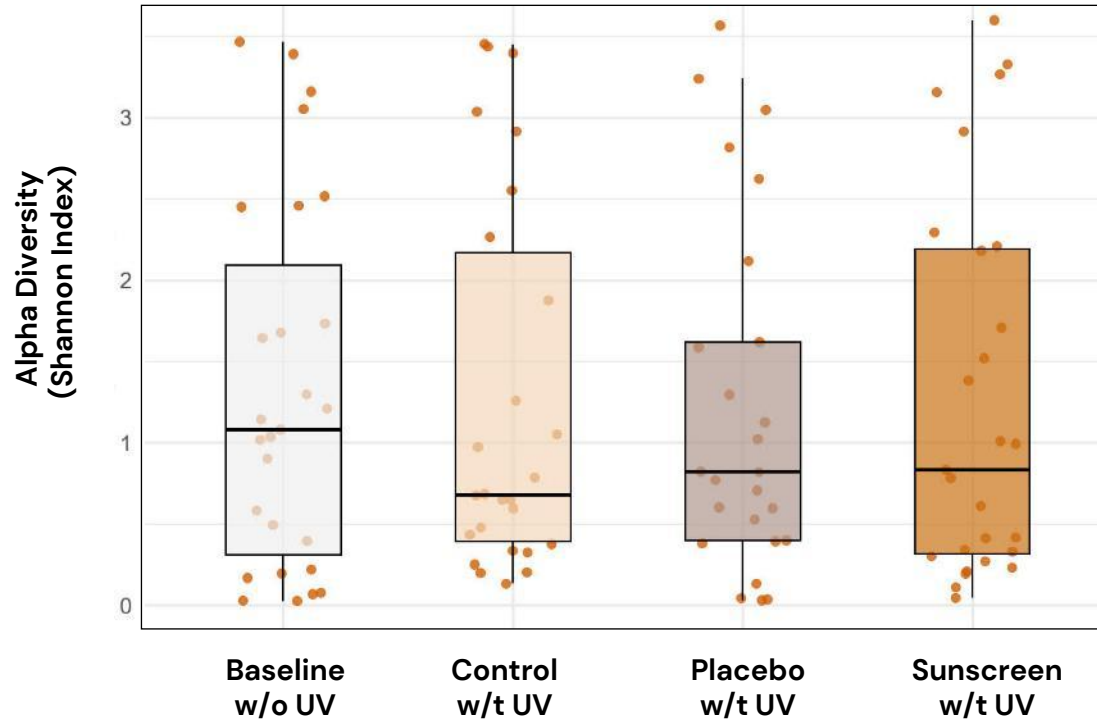


participant RD008 at day 3

- **Minimal Erythema Dose (MED)** was determined individually before treatment.
- **Erythema** can be observed after repetitive, sub-erythral UV exposure on unprotected skin (irradiated control and placebo treated)
- **SPF 50 Sunscreen** provided effective photoprotection

Microbiome Analysis (1)

Microbiome diversity is stable by treatment and repeated sub-erythral UV exposure*



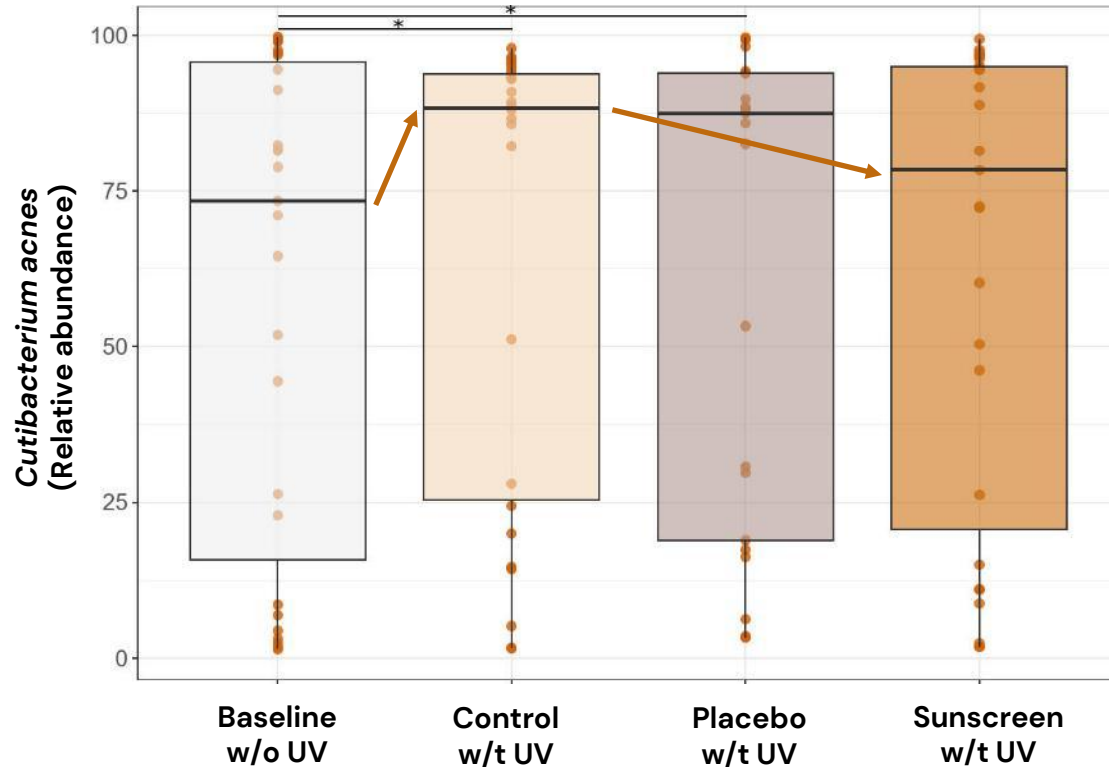
***Shannon Index:** the quantitative measure for richness and evenness of microbiome composition. Differences between conditions non-significant.

- Median value of total counts
- Refers to single subject data

- **Repeated low intensity** exposure to UV has a **low (non-significant) impact** on overall skin microbiome community (alpha diversity)
- **Sunscreen treatment** keeps the resident skin microbiome intact (*in vivo* evidence!)
- **Proper sunscreen use keeps UV exposure low**, helping protect your skin without noticeably affecting its natural microbiome

Microbiome Analysis (2)

Significant upregulation of *Cutibacterium acnes* population by repeated UV irradiation can be prevented by SPF 50 sunscreen



Relative abundance: the percent composition of an organism of a particular kind relative to the total number of organisms in the area

— Median value of total counts

● Refers to 1 subject data

* Significance $p < 0.05$, linear mixed model

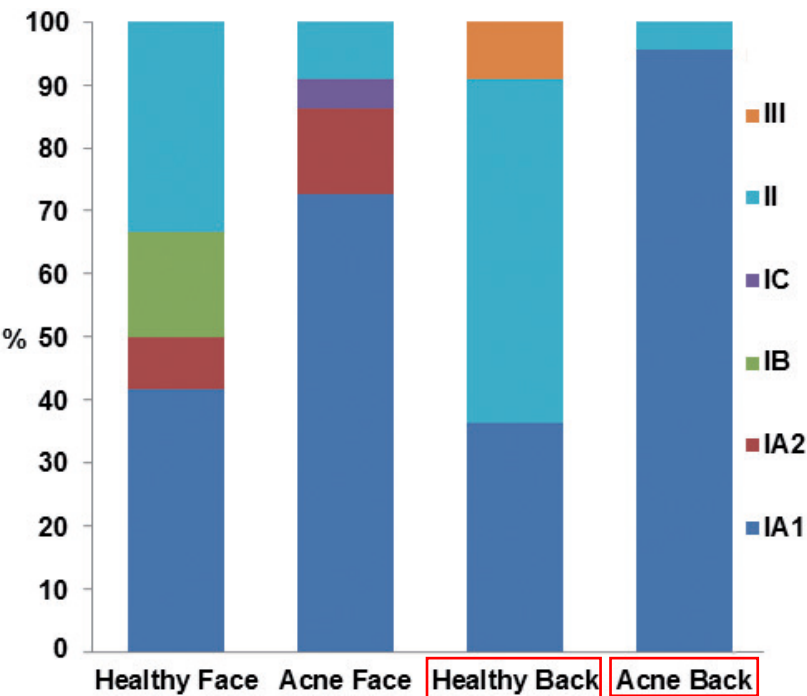
- **Significant increase of *C. acnes* population with UV exposure**
- Similar increase of *C. acnes* abundance by placebo treatment
- **SPF50 sunscreen treatment decreased overpopulation** in the direction of baseline
- Sub-erythral UV irradiation resulted in significant overpopulation of *C. acnes* that can be controlled by SPF50 treatment

C. acnes subspecies and the correlation with healthy and acneic skin

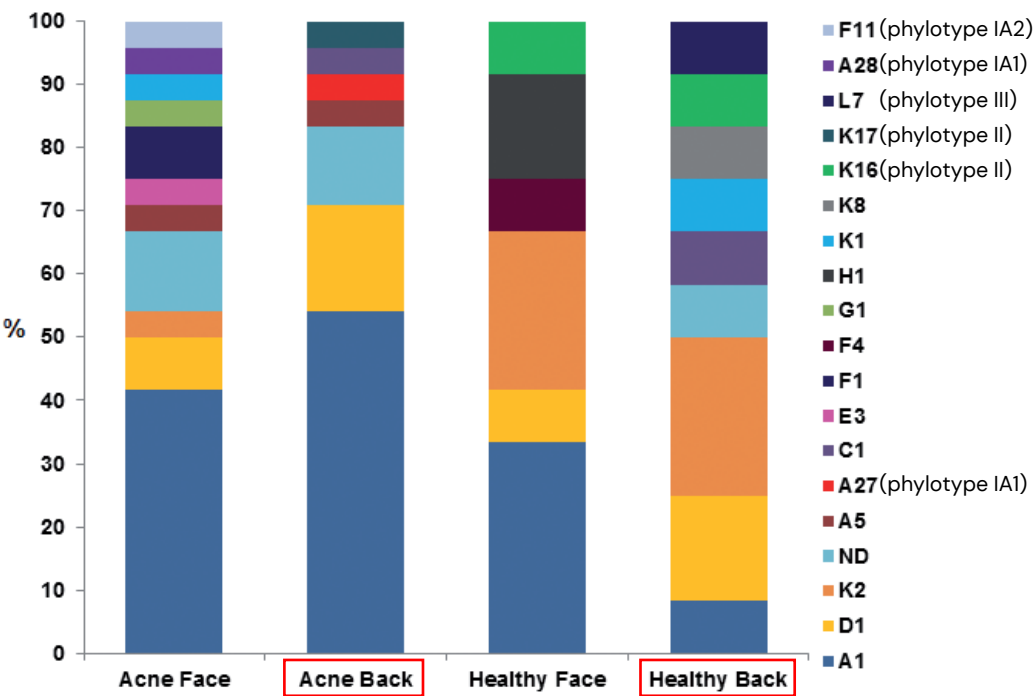
Phylotypes: *C. acnes* is grouped into three phylotypes I-III. Type I is further subdivided by whole-genome sequencing into the major type I clade encompassing **IA1, IA2, IB, IC, II and III**.

A clinical study by looking into 36 **healthy and acne** participants, **IA1 phylotypes** are identified as predominantly in **acne lesions**, whereas **phylotypes II and III** mostly present in **healthy skin***.

By additional molecular typing methods, a higher diversity of SLST-types associated with known phylotypes (IA1 and II) with **new SLST-types** was noted:



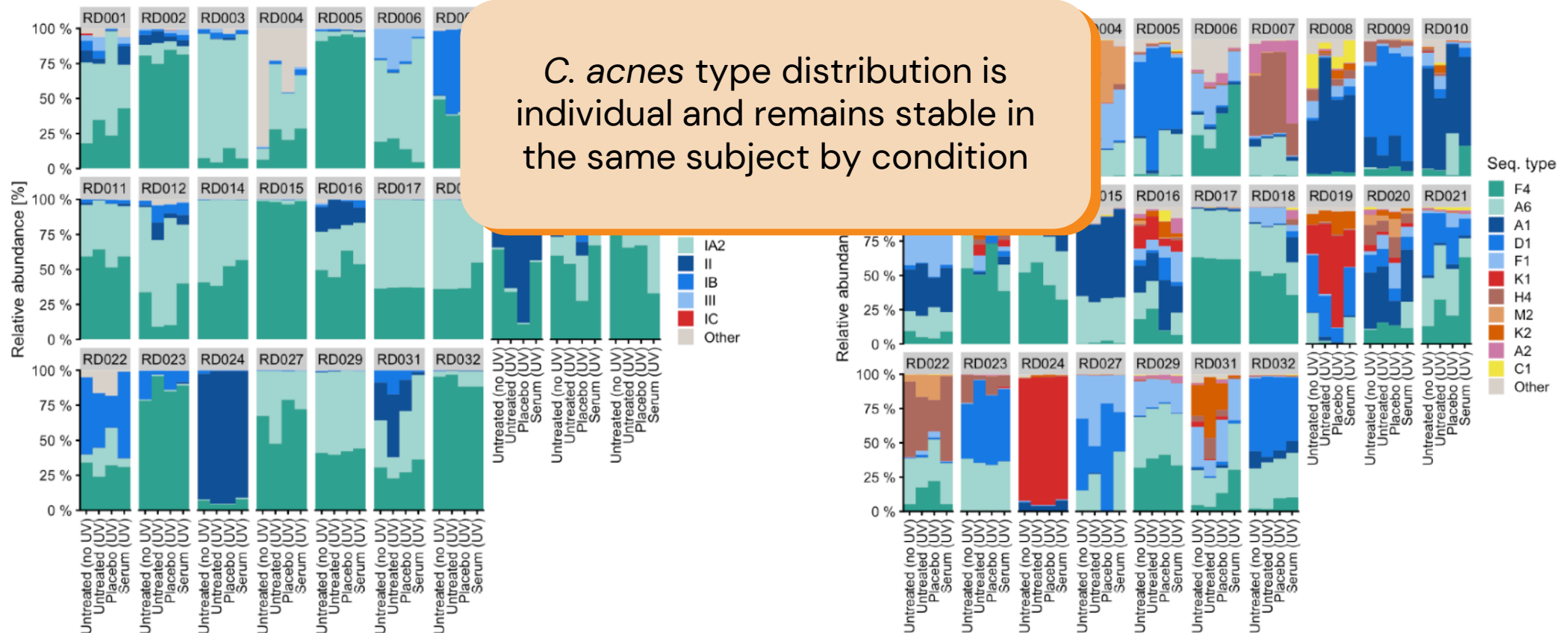
Cutibacterium acnes phylotype distribution on 2 sites on healthy volunteers and acne patients (n = 12 and n = 24, respectively). Categories "Healthy" and "Acne" represent the percentages of phylotypes found on the back and the face, respectively.



Cutibacterium acnes single-locus sequence typing (SLST) type distribution according to 2 body sites on healthy volunteers and patients with acne (n = 12 and n = 24, respectively). Categories "Healthy" and "Acne" represent the percentages of the different SLST types found on back and on face in either the healthy group or the acne group. "ND" category represents the other species found instead of *C. acnes*, where typing was not possible.

Microbiome Analysis (3)

Is there any shift towards healthy or acneic strains?



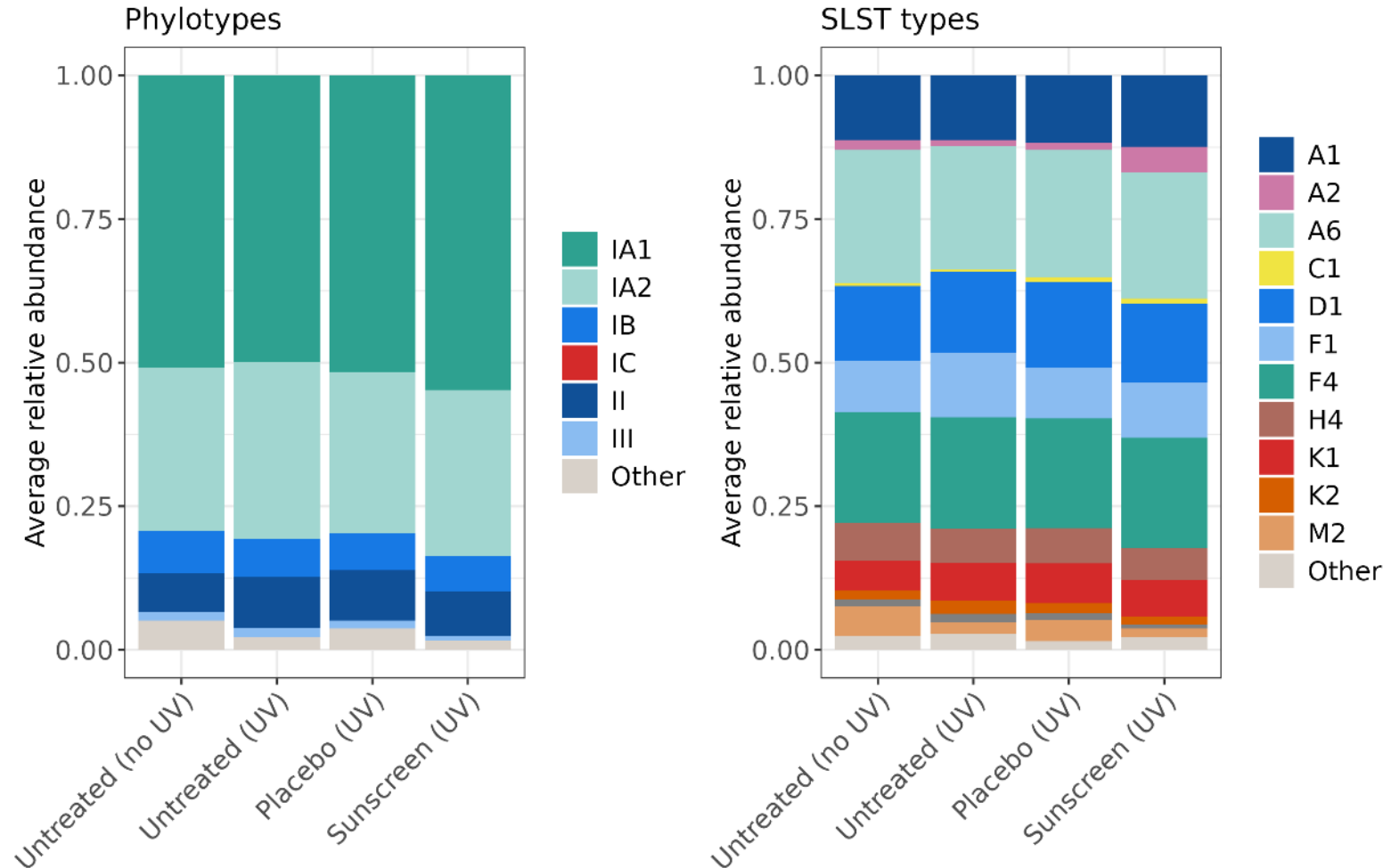
Cutibacterium acnes sequence type profiles using traditional classification grouped into **phylotypes** (IA1, IA2, IB, IC, II, III). ASVs not annotated to a known clade are pooled into 'Other'. Plots are faceted by subject, with the x-axis denoting treatment.

Cutibacterium acnes sequence type profiles. The 11 most abundant sequence types are highlighted.

Microbiome Analysis (3)

Conclusion: *C. acnes* strain composition is very similar to baseline after SPF 50 treatment

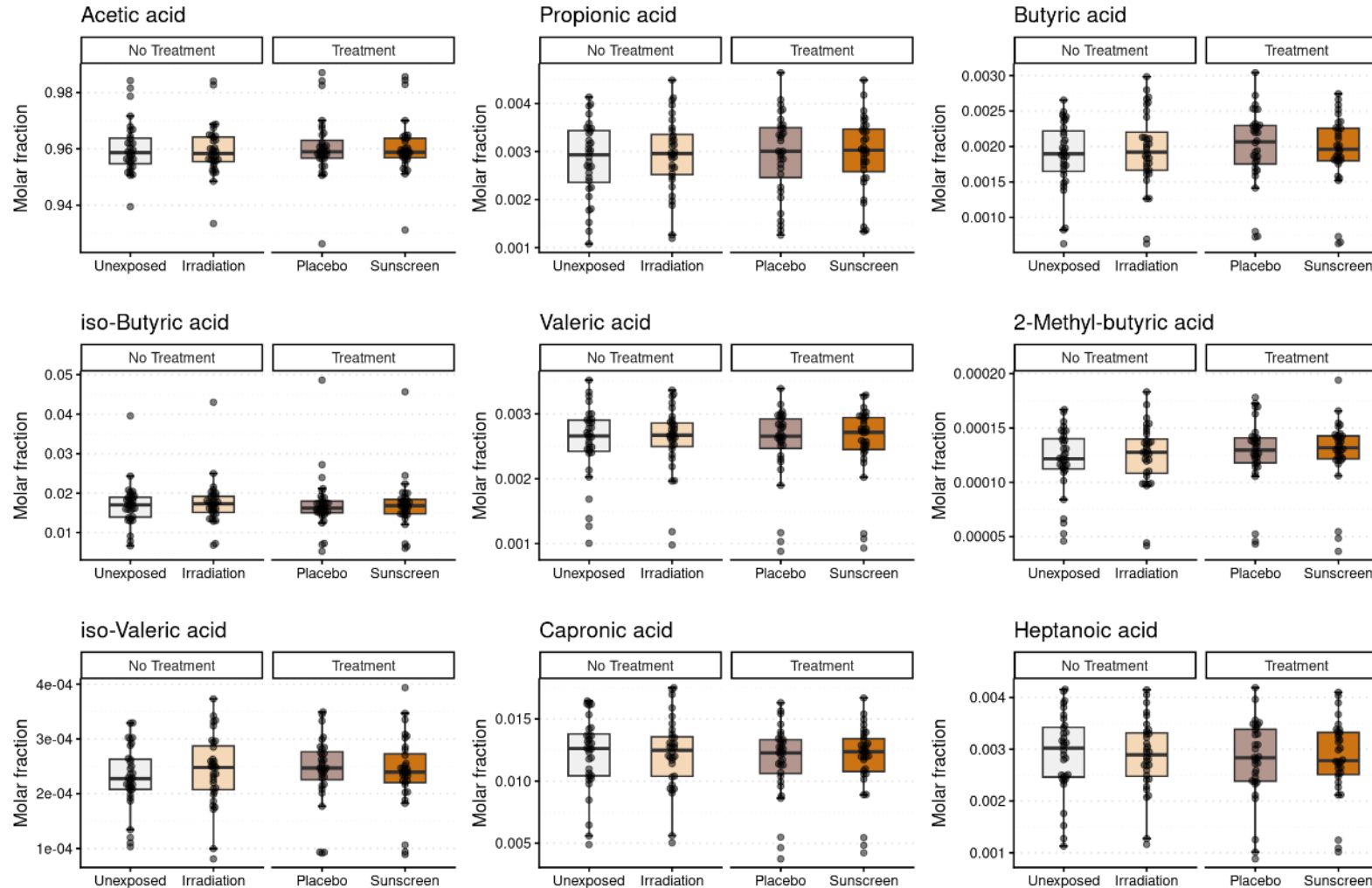
Classification:



- All conditions show **high consistency** for strain types in both classifications (phylotype/SLST).
- *Cutibacterium acnes* strains are stable per person and largely **unaffected by UV or treatment**
- **SPF50 treatment** preserves the original *C. acnes* strain patterns
- No shift towards more **acneic strain** types detected

Lipid Analysis

All 9 short-chain fatty acid (SC-FA) degradation products (of *C. acnes*) are unaffected by UV and sunscreens

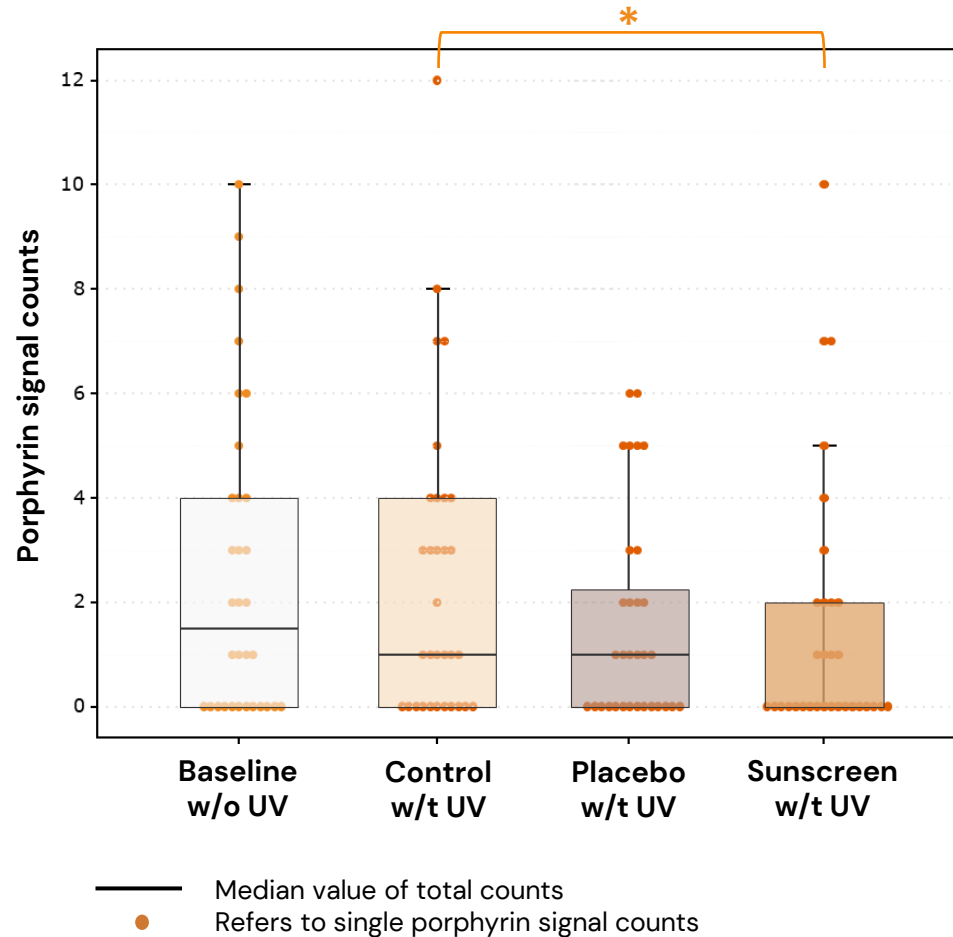


- Essentially **no significant differences** between the conditions
- Acetic acid by far most abundant
- **Sunscreen treatment keeps the resident skin microbiome and lipid metabolites intact**

**Further study is ongoing about FFA and sebum*

Porphyrin Analysis

SPF 50 Sunscreen Treatment shows less Phorphyrin as Biomarker for *C. acnes* Activity



Acne-associated *C. acnes* strains produce more porphyrins than non-acneic strains, activating inflammation process (Muñoz-Planillo et al., 2013)

Porphyrins in skin pores were significantly reduced in counts and intensity by SPF 50 sunscreen vs controls, pointing towards mitigation of *C. acnes* activity (and abundance)

Daily application of an SPF 50 sunscreen provides measurable, science-backed protection for acne-prone skin – actively mitigating UV-induced microbiome disturbances.

The latest clinical study by dsm-firmenich demonstrates that an SPF 50 sunscreen not only preserves the structural integrity of the skin microbiome but also prevents key biological shifts associated with increased acne risk:

1. **Stabilizes overall skin microbiome diversity:** SPF 50 preserves diversity (Shannon indices) under repeated sub-erythral UV exposure, indicating no disruption of the native microbial community.
2. **Prevents UV-induced *Cutibacterium acnes* overgrowth:** UV irradiation significantly increased *C. acnes* abundance in untreated and placebo zones, whereas SPF 50 maintained levels close to baseline, reducing the key acne-associated microbial shift.
3. **Preserves *C. acnes* strain-level and lipid metabolite composition:** Novel SLST analysis confirmed that SPF 50 maintains the individual's original *C. acnes* phylotype profile, supporting the native strain state as well as the short-chain fatty acids.
4. **Reduces porphyrins, biomarkers of (pathogenic) *C. acnes* activity:** Sunscreen-treated sites showed substantially lower porphyrin signals versus UV-exposed controls, reflecting decreased metabolic activity of acne-associated strains.

This study provides the **first in-vivo evidence** that a daily-use **high-SPF** sunscreen positioning SPF 50 as **a proactive, microbiome-compatible strategy for managing acne-prone skin.**

MyProBiome

My sunscreen to protect the skin and microbiome, professionally.

Science-backed insights

Latest clinical study by dsm-firmenich confirms that wearing an SPF 50 sunscreen helps mitigate the potential of UV-induced acne while maintain an undisturbed skin microbiome.

From insights to innovation

Our research highlights the importance of daily sunscreens as the essential first step in effective skin protection. Building on this evidence, we designed three SPF 50 formulations that fit naturally into everyday routine.

Our formulation philosophy

- Broad-spectrum defense
- Lightweight textures: light touch without extra burden for the skin, ideal for daily wear
- Simplified yet potent targeted bioactives that elevate essential skin benefits
- Microbiome-supportive: developed to help in keeping the skin microbiome healthy and balanced



MyProBiome

Hydrating Sun Cream SPF 50

Hydration is one of the skin's most essential needs. This watery yet dry-touch formula provides intense moisture, promoting a fresh, dewy-looking complexion contributed by two complementary hyaluronic acids.



Formulated for **daily application**



Film-forming technology by **PARSOL® SLX** for an even UV protection



Dual hyaluronic acids to attract and retain moisture



Certified **Microbiome-Friendly***

KEY INGREDIENTS

UV FILTERS

PARSOL® DHHB | DIETHYLAMINO HYDROXYBENZOYL HEXYL BENZOATE

PARSOL® Shield | BIS-ETHYLHEXYLOXYPHENOL METHOXYPHENYL TRIAZINE

PARSOL® EHT | ETHYLHEXYL TRIAZONE

PARSOL® SLX | POLYSILICONE-15

PARSOL® MCX | ETHYLHEXYL METHOXYCINNAMATE

PARSOL® EHS | ETHYLHEXYL SALICYLATE

SKIN ACTIVE

HYALLURONIC ACID-BT | SODIUM HYALURONATE

HYA-ACT™ M | SODIUM HYALURONATE

FRAGRANCE

BIOME GENTLE BLOOM



TOP apple-pear-green

HEART rose-white flowers-muguet

FOND musk-oak-vetiver



An **Eco Class B** formulation by **Sunscreen Optimizer™**



This certified formulation maintains the balance of the skin

Products are for experimental use only and are not for sale.
dsm-firmenich is not responsible for final products claims

MyProBiome

Lightening Sun Cream SPF 50

Healthy-looking skin begins with a natural, radiant glow. This formula helps promote a more even skin tone by preventing – and visibly reducing – pigmentation triggered by UV and visible light.



Formulated for **daily application**



Film-forming technology by **PARSOL® SLX** for an even UV protection



Vitamin B3 to prevent skin from hyper-pigmentation and encourage an even skin tone even under UV stress



Certified **Microbiome-Friendly***

KEY INGREDIENTS

UV FILTERS

PARSOL® DHHB | DIETHYLAMINO HYDROXYBENZOYL HEXYL BENZOATE

PARSOL® Shield | BIS-ETHYLHEXYLOXYPHENOL METHOXYPHENYL TRIAZINE

PARSOL® EHT | ETHYLHEXYL TRIAZONE

PARSOL® SLX | POLYSILICONE-15

PARSOL® TX | TITANIUM DIOXIDE, SILICA, DIMETHICONE

PARSOL® HS | PHENYLBENZIMIDAZOLE SULFONIC ACID

SKIN ACTIVE

NIACINAMIDE PC | NIACINAMIDE

Mixed Tocopherols 95 | TOCOPHEROL

FRAGRANCE

BIOME GENTLE BLOOM



TOP apple-pear-green

HEART rose-white flowers-muguet

FOND musk-oak-vetiver



An **Eco Class A** formulation by **Sunscreen Optimizer™**



Products are for experimental use only and are not for sale.
dsm-firmenich is not responsible for final products claims

MyProBiome

Resilience Sun Cream SPF 50+

Tired-looking skin, meet your match. Daily UV and visible light can take their toll on the skin, but with two broad-spectrum filters and the potent dipeptide SYN-UP®, this formula helps skin to bounce back and stay resilient against everyday stressors.



Formulated for **daily application**



Broad spectrum protection thanks to PARSOL® Max & PARSOL® SHIELD



Patented **dipeptide SYN-UP®** enabling skin longevity by fighting against UV induced stressor – plasmin.



Certified **Microbiome-Friendly***

KEY INGREDIENTS

UV FILTERS

PARSOL® 1789 | BUTYL METHOXYDIBENZOYLMETHANE

PARSOL® Shield | BIS-ETHYLHEXYLOXYPHENOL METHOXYPHENYL TRIAZINE

PARSOL® MAX | METHYLENE BIS-BENZOTRIAZOLYL TETRAMETHYLBUTYLPHENOL, AQUA, DECYL GLUCOSIDE, PROPYLENE GLYCOL, XANTHAN GUM

PARSOL® EHT | ETHYLHEXYL TRIAZONE

PARSOL® HS | PHENYLBENZIMIDAZOLE SULFONIC ACID

SKIN ACTIVE

SYN-UP® | AMIDINO BENZYL BENZYL SULFONYL D-SERYL HOMOPHENYLALANINAMIDE ACETATE, GLYCERIN, AQUA, CITRIC ACID, SODIUM HYDROXIDE |

HYA-ACT™ M | SODIUM HYALURONATE

FRAGRANCE

BIOME GENTLE GLOW



TOP bergamot-orange blossom-lactonic fruits

HEART tiare-white flowers-ylang

FOND musk-sandalwood-tonka



An **Eco Class A** formulation by **Sunscreen Optimizer™**



Products are for experimental use only and are not for sale.
dsm-firmenich is not responsible for final products claims

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We bring progress to life

The Sunny Skin Microbiome 1.0 Overview

In 2023 dsm-firmenich conducted the 1st exploratory study on Skin Microbiome & UV exposure that showed an active benefit of sunscreen application.

Pioneering studies investigate the impact of erythematous UV exposure on the skin microbiome and determine the protective effect of an SPF 20 sunscreen versus placebo on the UV-exposed skin microbiome

Conclusion:

UV protection of microbiome by UV filters can result in more resilient cutaneous defense.

- Specific UV-filters or combinations protect beneficial skin bacteria such as *Lactobacillus crispatus* and reduce the proliferation of opportunistic pathogens such as *Cutibacterium acnes* *in vitro*.
- An SPF 20 sunscreen supports the abundance of *Lactobacillus crispatus*, a key player for UV-irradiated skin microbiome *in vivo*.



Microbiome Strains Recap

Cutibacterium acnes

- *C. acnes* is the most prevalent bacteria on oily skin, anaerobic and lipophilic commensal
- The majority of strains are commensal and non-pathogenic, help to maintain low pH by releasing free fatty acids, blocking pathogens (acts as skin sentinel).
- Only few strains are known to be pathogenic related to acne.

Lactobacillus crispatus

- *L. crispatus* has a key function in vaginal microflora (but also present in skin) and is commonly used in probiotic treatment.
- It preserves the balance of microbe populations, prevents skin pathogens and infections.
- *L. crispatus* is a component of the innate immune response, protecting the microbiome and skin by fostering skin's self defense and the symbiosis of microbiome.

Staphylococcus epidermidis

- A lipophilic commensal bacteria, typically part of healthy human skin microbiome, acts as sentinel of skin microbiota (protects and prevents microbial disequilibrium by fighting pathogens)
- Helps to prevent acne and limits inflammation (production of bacteriocin – antimicrobial peptide)

Test Formulations

PLACEBO
SU E 102683 14

SUNSCREEN SPF 50
SU E 102683 15

INGREDIENTS		% w/w	
A	PARSOL® EHS (ETHYLHEXYL SALICYLATE)	–	5
	PARSOL® EHT (ETHYLHEXYL TRIAZONE)	–	3
	PARSOL® SLX (POLYSILICONE-15)	–	3
	PARSOL® 1789 (BUTYL METHOXYDIBENZOYLMETHANE)	–	4
	PARSOL® Shield (BIS-ETHYLHEXYLOXYPHENOL METHOXYPHENYL TRIAZINE)	–	2.8
	C12-15 ALKYL BENZOATE	10	4
	DIBUTYL ADIPATE	13	12
	SOLVIENCE™ DCC (DICAPRYLYL CARBONATE, TOCOPHEROL)	20	6
	STEARYL ALCOHOL	2	2
	AMPHISOL® K (POTASSIUM CETYL PHOSPHATE)	2	2
	TOCOPHERYL ACETATE	0.5	0.5
	VALVANCE® Touch 210 (SILICA)	2	2
B	CAPRYLYL GLYCOL	0.2	0.2
	ETHYLHEXYLGLYCERIN	0.2	0.2
	AQUA	24.41	24.55
C	ACRYLATES/C10-30 ALKYL ACRYLATE CROSSPOLMER	0.2	0.2
	SODIUM POLYPHOSPHATE	0.1	0.1
	XANTHAN GUM	0.15	0.15
D	PENTYLENE GLYCOL	2	2
	PROPANEDIOL	3	3
	AQUA	20	20
	PARSOL® HS (PHENYLBENZIMIDAZOLE SULFONIC ACID)	–	2
	TROMETHAMINE	0.24	1.3

SUNSCREEN SPF 50

- *in silico* SPF 46 (expected to achieve SPF 50)
- *in silico* in vitro UVA-PF 17.6
- *in silico* UVA/SPF 0.35 (0.33)

By dsm-firmenich Sunscreen Optimizer™
(www.sunscreen-optimizer.com)

Microbiome-Friendly Certified PARSOL® UV Filters



PARSOL® 1789	Face/Body Leave on
PARSOL® Shield	Face/Body Leave on
PARSOL® EHT	Face/Body Leave on
PARSOL® SLX	Face/Body Leave on, Scalp Leave on
PARSOL® DHHB	Face/Body Leave on
PARSOL® HS	Face/Body Leave on
PARSOL® MAX	Face/Body Leave on

*Logo usage for final formulation to be requested by customer at MyMicrobiome
**www.microbiome-friendly.com a Worldwide leading and only registered certification mark for Microbiome-friendly cosmetics and care products

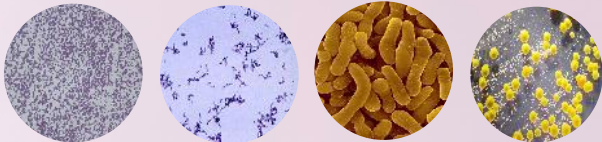
The dsm-firmenich expertise

Strong credentials in bacterial research & extensive capabilities

35 YEARS
OF EXPERTISE
in bacterial
understanding

Several patents in the field of bacteria
Microbiological labs in San Diego & China

Leading to
Identification of the
4 MOST COMMON SKIN BACTERIA,
representing **>90% OF THE SKIN MICROBIOME**



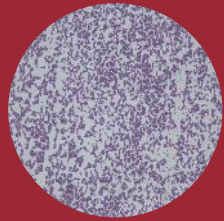
dsm-firmenich 

Targeted healthy bacteria for skin balance

Comprehensive skin microbiome knowledge

dsm-firmenich has identified the
4 most common skin bacteria,
Representing more than **90% of the skin microbiome**

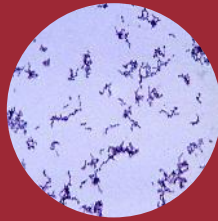
S. epidermidis



Supports skin barrier & immune balance

The most abundant in the **SKIN MICROFLORA**

C. acnes



Controls skin pH and microbial balance

(strain dependent)
Most abundant in the
SEBACEOUS GLAND-RICH SITES
(forehead, upper trunk)

C. tuberculossteiaricum



Colonization resistance
(deters pathogen colonization)

Major component of bacteria that
colonize
a **VARIETY OF SKIN ENVIRONMENTS**
(dry, moist, and sebaceous regions)

M. luteus



Environmental protection & oxidative stress defense

Most abundant in the **REGIONS OF THE HEAD, LEGS, AND ARMS.**

- Skin microbiome includes prokaryotic and eukaryotic unicellular organisms, as well as viruses. **Bacteria are however the most abundant**
- dsm-firmenich's scientists studied relevant bacterial species
- **These microorganisms' role in skin health and disease are beyond "good" or "bad", it is all about balance.**
- For microbiome-gentle applications, the aim is to minimize the impact of our fragrances on bacterial populations naturally present on skin

Byrd, A., Belkaid, Y. & Segre, J. The human skin microbiome. Nat Rev Microbiol 16, 143–155 (2018). <https://doi.org/10.1038/nrmicro.2017.157>

The dsm-firmenich solution

Preserving the balance of the skin microbiome

skinpositive™ biome

dsm-firmenich fragrance design model to create
microbiome-gentle fragrances with 100% confidence

> **900 fragrance ingredients assessed**

Allowing perfumers to create fragrances that help **keep the natural balance of the skin microbiome** while **delighting consumers**

Minimizing impact on **4 main commensal skin bacteria**
representing more than 90% of the skin microbiome
Comprehensive & accurate **in-vitro validation**

Now available for 3 beauty categories :



BIOME GENTLE BLOOM

Our *fragrance design manager* notes:

Biome-gentle scent for suncare cream

A lush green bouquet where creamy white blossoms and rosy petals intertwine with juicy apple and pear. This blooming bouquet unfolding into a sophisticated base of soft woods and white musk.

Claims substantiation

90% Biodegradable

Vegan

Clean label 83



TOP

APPLE – PEAR – GREEN

HEART

ROSE – WHITE FLOWERS –
MUGUET

FOND

MUSK – OAK – MOSS –
VETIVER

BIOME GENTLE GLOW

Our *fragrance design manager* notes:

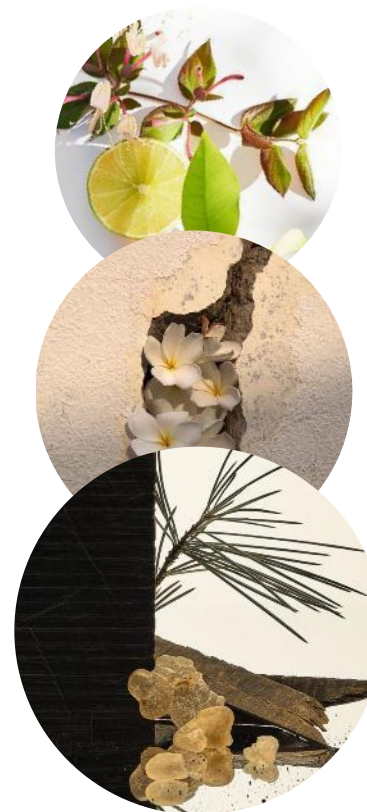
Biome-gentle scent for suncare cream

A glowing solar bouquet of tiare flowers, ylang and orange blossom enveloped by delicate creamy touches of fruits. The warm base of musk, sandalwood and tonka helps recreate the sensation of summer sunshine.

Claims substantiation

99.5% Biodegradable, Vegan, Clean label 83

emotiwaves® Designed with a scientifically proven technology that activates happy and joyful feelings.



TOP

BERGAMOT – ORANGE
BLOSSOM – LACTONIC
FRUITS

HEART

TIARE – WHITE FLOWERS –
YLANG

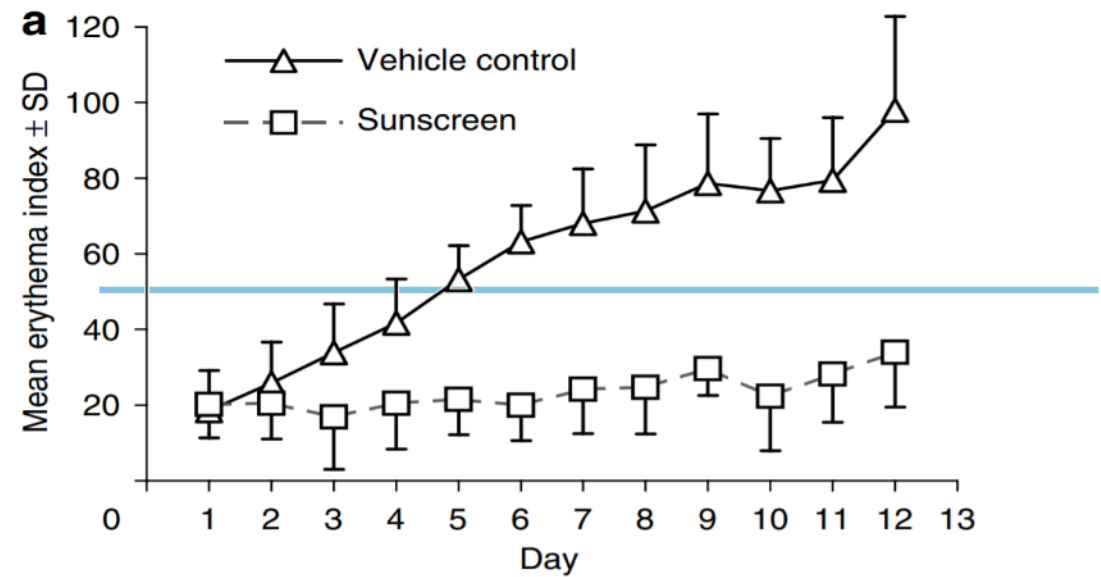
FOND

MUSK – SANDALWOOD –
TONKA

Low doses of UV radiation accumulate over time

Repeated low doses of UV radiation accumulate overtime and lead to sunburn, which can be prevented by the use of sunscreen.

Daily, low doses of UV radiation (sub-erythral SSR) cause significant clinical, cellular, and molecular damage in skin types I/II.



Erythema Index ~50 =
Level at which
erythema (redness)
can be preceived with
the naked eye

Study by dsm-firmenich

Study description

Objective

- To investigate the effects of sub-erythral UV radiation

Participants and Methods

- Six volunteers with skin type I or II
- 1x / day application of formulation at 2 different sites in lower back
 - Control (no UV filters)
 - Sunscreen (SPF ~7.5)
- 11 consecutive days of 0.6 MED Solar Simulated Radiation (SSR)
- Quantitative daily assessment of skin reflectance for red light expressed as erythral index

Reference

Young et al. Journal of Investigative Dermatology (2007) 127, 975–978.

Targeted Skin Microbiome Analysis Methods

Long-read 16S rRNA sequencing

Long-read 16S rRNA sequencing captures the entire ~1500 bp 16S rRNA gene, including all nine hypervariable regions (V1–V9), allowing much more accurate bacterial identification than short-read methods, which sequence only small fragments (usually 150–300 bp). Long-read platforms such as PacBio and Oxford Nanopore generate continuous, full-length reads, eliminating the need for computational reconstruction and enabling scientists to distinguish closely related species and sub-species that short-read data often merge together.

Why it matters:

Because skin microbiomes contain many bacteria with extremely similar 16S regions, short-read sequencing often lacks the resolution to separate them, leading to incomplete or ambiguous taxonomic profiles. Full-length long-read sequencing provides a much sharper picture of microbial diversity, revealing species-level shifts linked to health, inflammation, or dysbiosis and offering deeper insights into microbial behavior on skin and wounds.

Zhang H. *et al.*, ASM Journeys, 2024

Paisleigh Smythe, Holly Wilkinson, British Journal of Dermatology, 2024

Single Locus Sequence Typing (SLST)

A high-resolution method that sequences one carefully selected, highly variable genetic region to distinguish strains within a bacterial species—providing finer discrimination than broad markers like the 16S rRNA gene. Because it captures small but meaningful genetic differences, SLST helps researchers map strain-level diversity with strong accuracy while remaining far more scalable and cost-efficient than whole-genome sequencing.

Why it matters:

Strain-level differences often determine whether bacteria behave as harmless commensals or contribute to dysbiosis, inflammation, or disease. SLST offers a practical and reproducible way to uncover these functional differences, making it particularly valuable in fields such as dermatology, where different *C. acnes* strains play distinct roles in healthy vs. acne-prone skin.

Paetzold B. *et al.* Microbiome, 2019

Glossary

Key definitions

Relative abundance: The percent composition of an organism of a particular kind relative to the total number of organisms in the area

Richness: The total number of species in a microbiome

Evenness: How well represented each species is relative to others (relative abundance)

Diversity: How many different species are present in a microbiome and to what extend (richness + evenness)

Shannon Index: A popular metric used in ecology and estimates species diversity. The index considers the number of species living in a habitat (richness) and their relative abundance (evenness).