

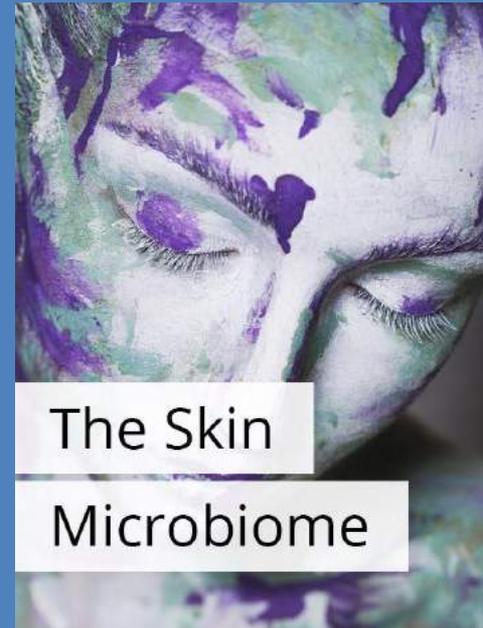
Gut-Skin-Brain Axis

Evidence Connecting Gut and Skin Microbiome

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SKIN-GUT-Brain AXIS



BEAUTY FROM WITHIN

The Gut Microbiome behind beauty

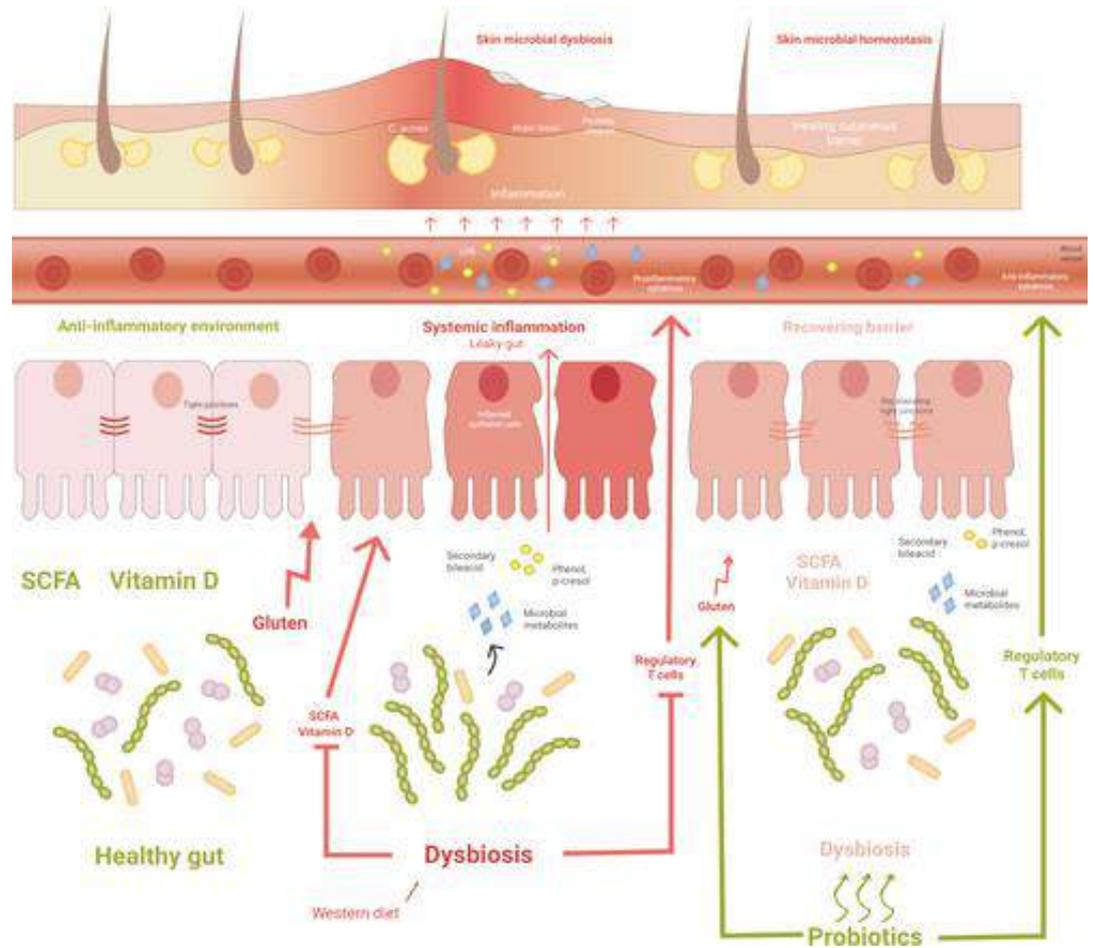
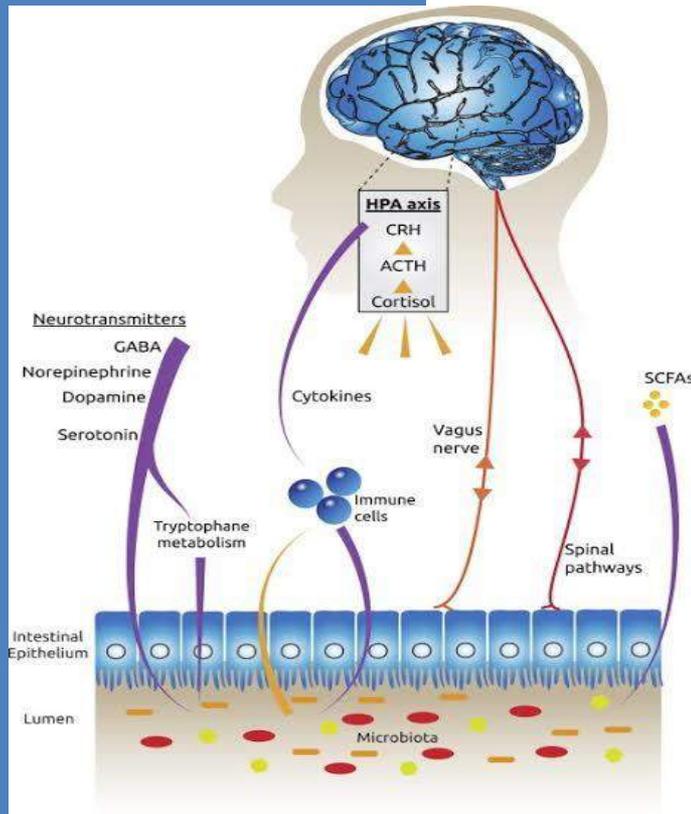
What is beauty?

- ❑ Beauty doesn't only come in through the eyes, it is also felt, meaning, it comes in from all of our senses
- ❑ Expectations/Anticipation → Reward (dopamine)
- ❑ **A number of key neurotransmitters including dopamine, serotonin, noreadrenalin and adrenalin are produced by the gut microbiota**
- ❑ **Meaning the gut produces these chemicals to make us feel good – self esteem, self-confidence**
- ❑ Does beauty therefore lie within?

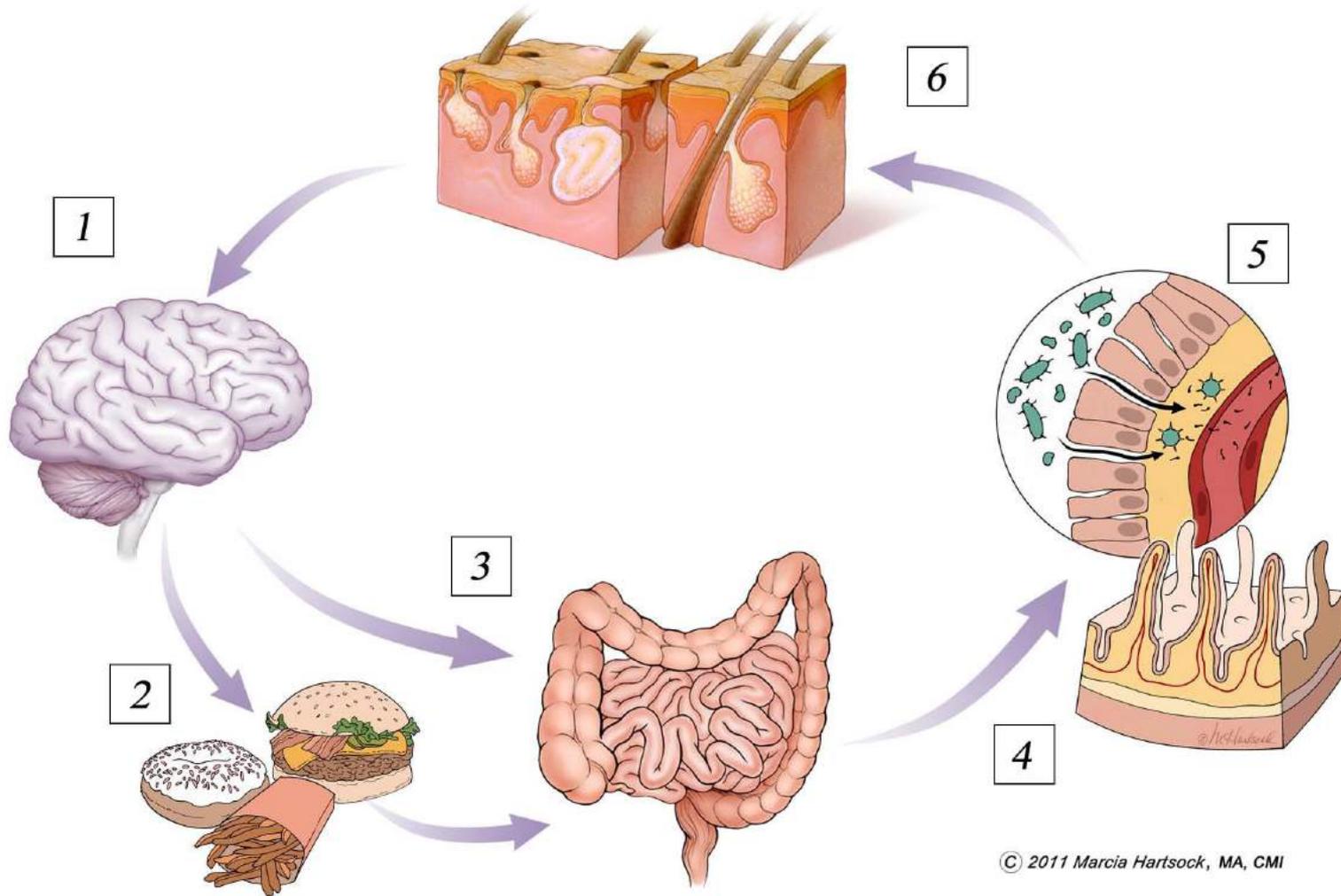


The gut-brain-skin axis is all connected

BIOHM



Potential Pathways of the Gut-Brain-Skin Axis in Acne





Medications Can Contribute to Dysbiosis

Broad spectrum antibiotics

Antibiotic means *antibacterial*, and these medications wipe out bacteria— not just the pathogenic bacteria causing your illness, but many of the good guys as well

Antifungals

Antifungals can be just as disruptive as antibiotics because they remove fungi that could be contributing to healthy microbiome balance

Certain other medications

Talk to your doctor before stopping any prescribed medication, but you should know that the following kinds of medications could be contributing to microbiome imbalance:

- Acid-reducing drugs
- Non-steroidal anti-inflammatory drugs (NSAIDs)
- Hormone-manipulating drugs
- Corticosteroids
- Diabetes drugs
- Antipsychotics and anticancer/chemotherapy drugs

Personal care products can disrupt microbiome balance, including:

- Mouthwash, shampoo, skin cream, soap
- Anything toxic that goes into or onto your body is a potential microbiome disruptor

Impact of antibiotics on long-term physiology through microbiota changes

- The gut microbiota has been shown to influence the development of the host's immune system in addition to being implicated in adipose, muscle, and bone tissue growth.
- New evidence indicate that the gut microbiota may impact stem-like cell populations suggesting a new way in which the gut microbiota may be regulating tissue development.
- Antibiotics alter the gut microbiota, which may change the course of these developmental pathways, leading to variations in long-term physiology.

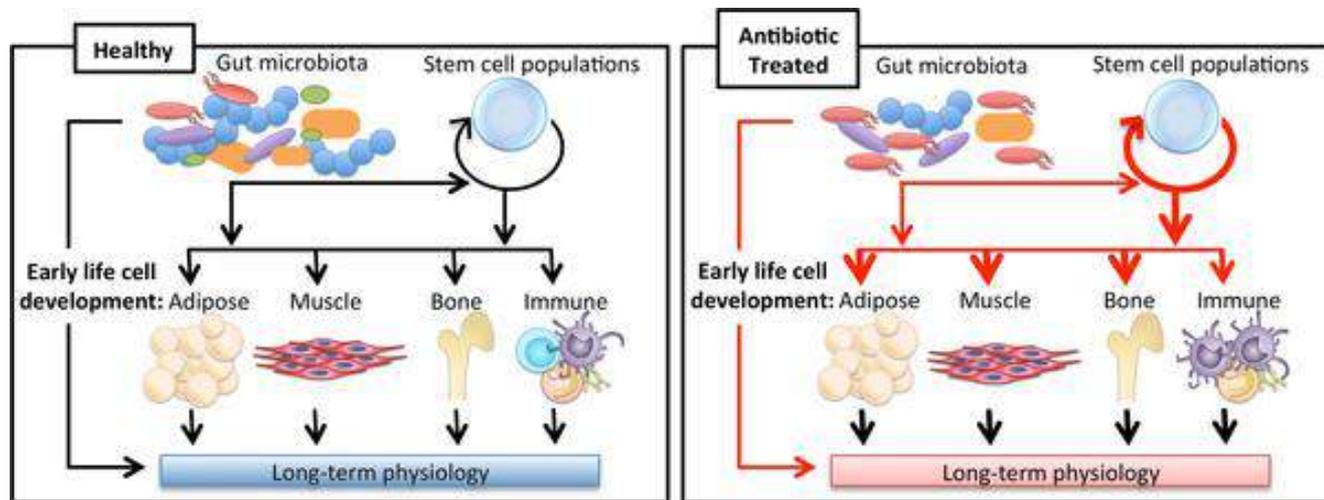
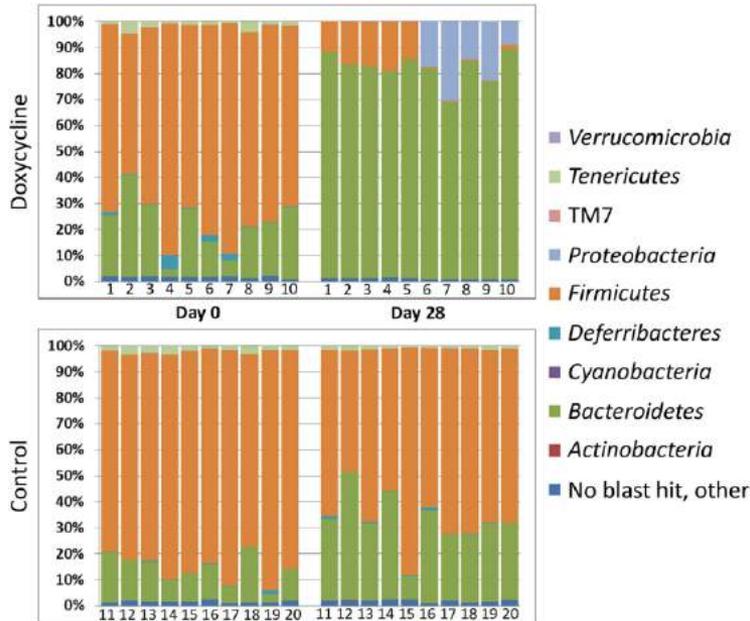


Figure. Impact of antibiotics on long-term physiology through microbiota changes



Effect of Broad Spectrum Antibiotics on Gut and Skin Microbiome



Doxycycline, a broad-spectrum antibiotic, induces dysbiosis in female C57BL/6NCrI mice relative abundance at the phylum level.

- Bar charts showing the bacterial composition of the same control and doxycycline-treated mice on days 0 and 28
- Each bar represents an individual animal (DOX animals numbered 1–10, control animals numbered 11–20)



Minocycline, A Broad Spectrum Antibiotic

Causes microbial dysbiosis in the skin and gastrointestinal tract of acne patients

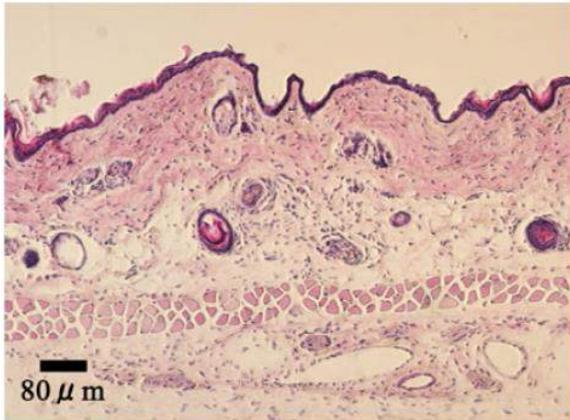
- Just as with the intestinal microbiome, skin microbiota is also impacted by the use of broad-spectrum oral antibiotics
- A study by Thompson *et. al.* investigating the effect of minocycline showed that this **drug taken orally not only affected the gut microbiome but also the skin microbial community**
- Post treatment, the **gut microbiota** of acne patients was significantly depleted in probiotic species including: *Lactobacillus salivarius*, *Bifidobacterium adolescentis*, *Bifidobacterium pseudolongum*, and *Bifidobacterium breve* (P values $<0,042$)
- While the **skin bacterial community** of these patients was:
 - Enriched with *Leuconostoc mesenteroides*, a gram-positive, non-motile, vancomycin-resistant pathogen ($P=0.028$), and
 - Depleted in *Staphylococcus epidermidis* ($P=0.009$), a skin probiotic bacterium, that inhibits *C. acnes* growth, and affect the inflammatory process

Can Oral Probiotics Help:

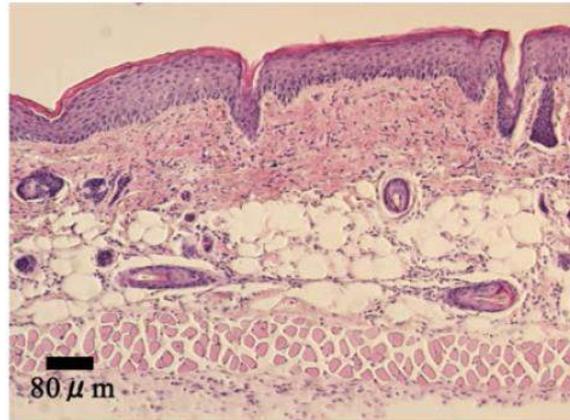
Photo-protective effects of *Bifidobacterium breve*

- Examined whether oral administration of live *Bifidobacterium breve* (BBY), a typical probiotic strain, could exert photo-protective effects in hairless mouse skin
- BBY cell suspension was orally administered to mice for 9 and 14 days.
- Mice were irradiated with UV light daily for the last 4 consecutive days.
- 24 hours after the final irradiation, skin elasticity, appearance, elastase activity and interleukin (IL)-1b levels were evaluated in dorsal skin.

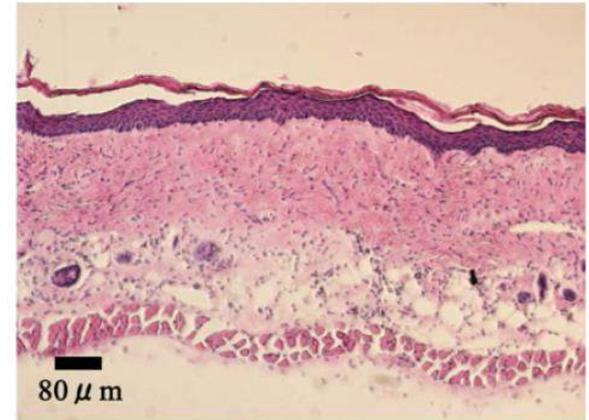
Histology of ultraviolet (UV)-irradiated hairless mouse skin, visualized using hematoxylin–eosin (H&E) staining



UV-/S



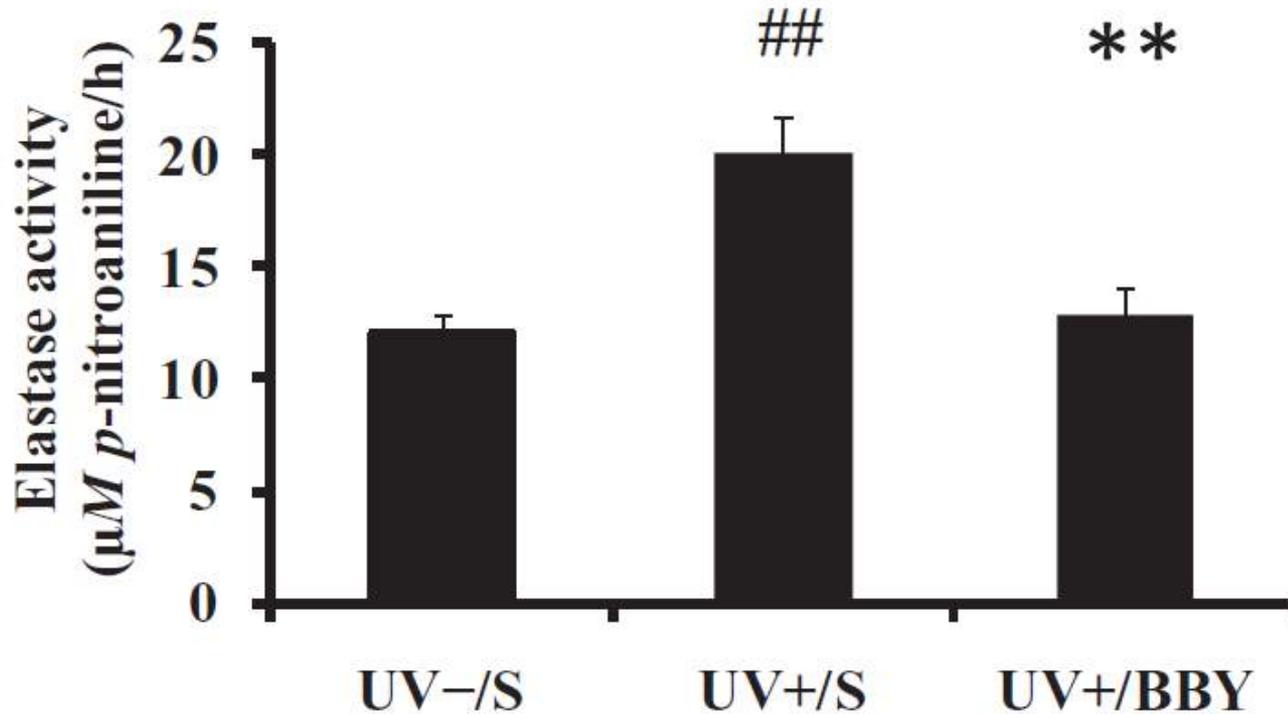
UV+/S



UV+/BBY

- Epidermal thickness was increased in the UV+/S group with epidermal hyper-proliferation and hypertrophy.
- Histological changes were suppressed in the UV+/BBY group.

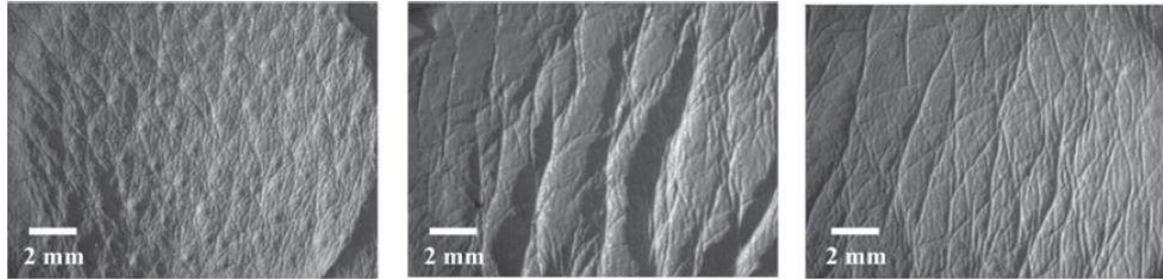
Effect of oral administration of BBY cells on elastase activity in the skin of ultraviolet (UV)-irradiated hairless mice.



- Elastase activity was higher in the UV+/S group than in the UV-/S group ($P < 0.01$)
- But lower in the UV+/BBY group than in the UV+/S group ($P < 0.01$)

Effect of oral administration of BBY cells on skin surface features of UV-irradiated hairless mice.

(a)

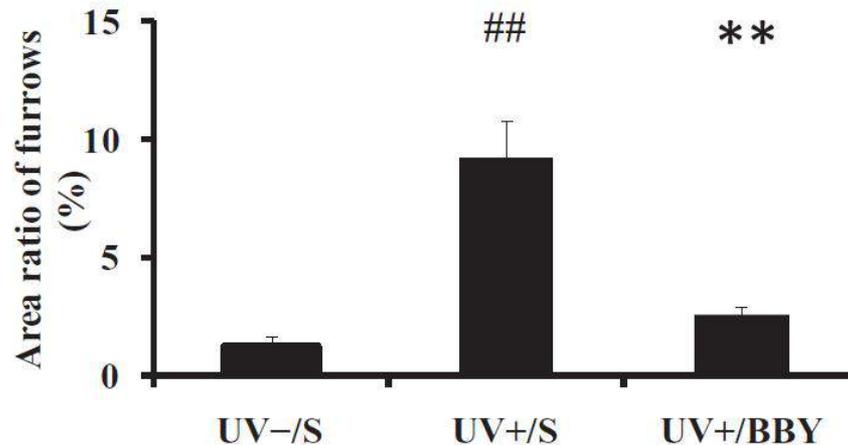


UV-/S

UV+/S

UV+/BBY

(b)



- Photomicrograph of representative replica. (b) Area ratio of furrows calculated by image analysis.
- ##, $P < 0.01$ comparing UV+/S group with UV-/S group; **, $P < 0.01$ comparing UV+/BBY group with UV+/S group. BBY, *Bifidobacterium breve*; S, saline.

Photo-protective effects of *Bifidobacterium breve*:

Results

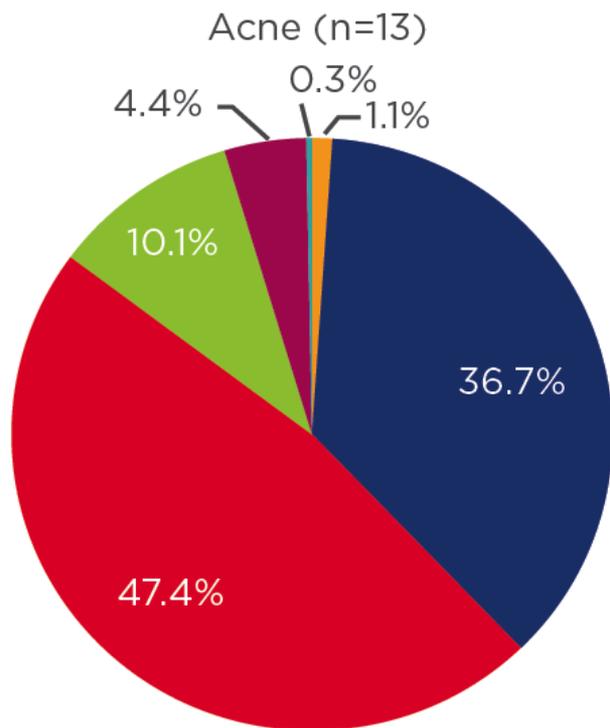
- BBY significantly prevented UV-induced deleterious changes in skin elasticity and appearance.
- BBY suppressed the increases in both elastase activity and IL-1b levels in the skin.
- **Conclusion:** Oral administration of probiotic BBY has the potential to prevent UV-induced skin damage, **supporting the hypothesis that probiotics are beneficial not only to the intestine but also to the skin**

Probiotics and the Gut-Brain-Skin Axis

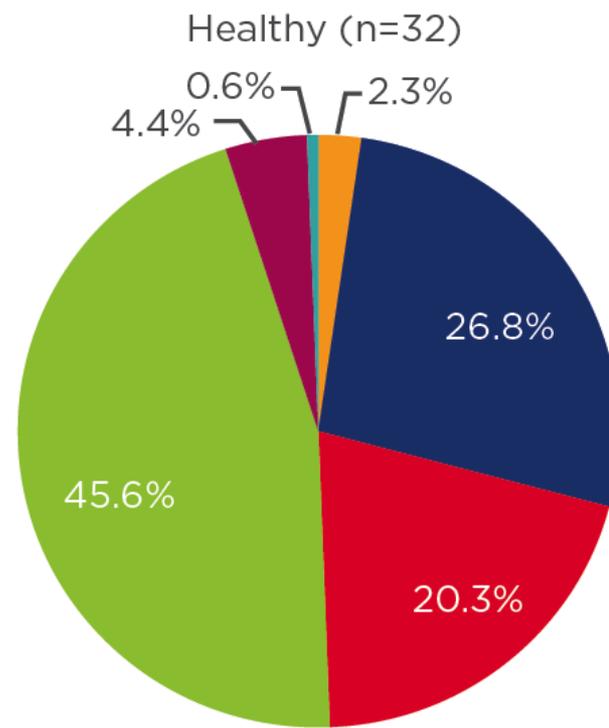
- Over 70 years ago Stokes and Pillsbury first proposed a gastrointestinal mechanism for the overlap between depression, anxiety and skin conditions
- Emotional states might alter the normal intestinal microflora, increase intestinal permeability and contribute to systemic inflammation.
- **Among the remedies advocated by Stokes and Pillsbury were *Lactobacillus acidophilus* cultures**
- Many aspects of this gut-brain-skin unifying theory have recently been validated.
- The ability of the gut microbiota and oral probiotics to influence systemic inflammation, oxidative stress, and tissue lipid content may have important implications in skin health

- **Stokes, Pillsbury: The effect on the skin of emotional and nervous states: theoretical and practical consideration of a gastrointestinal mechanism. Arch Dermatol Syphilol 1930, 22:962-93.**
- **Bowe and Logan Gut Pathogens 2011, 3:1**

Alteration in the Skin Microbiome in Patients with Acne



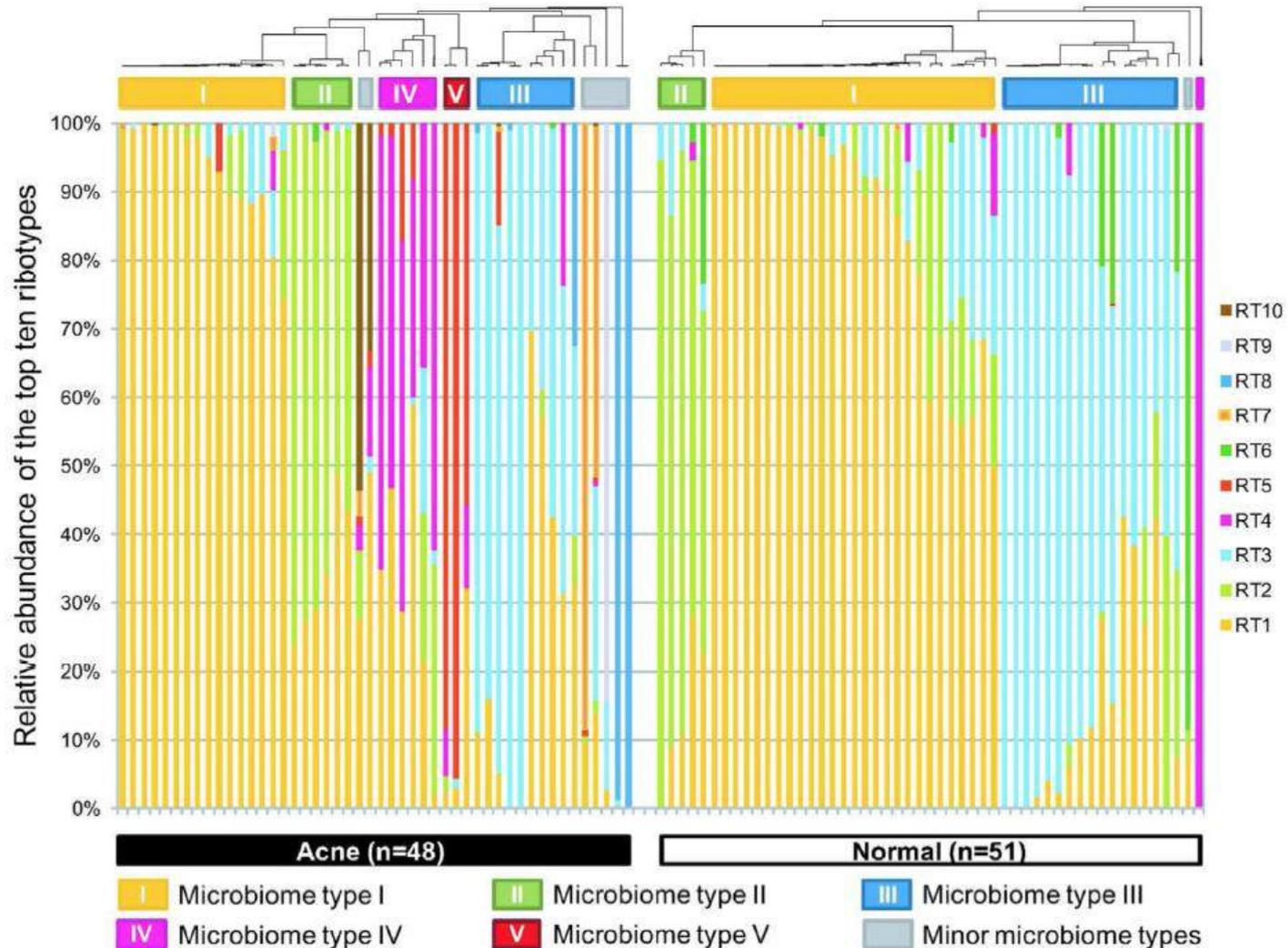
Clear skin: Cheeks and forehead



Clear skin: Cheeks



A Distinct Pattern of *P. acnes* Strains is Associated with Acne



Clinical Evidence in support of oral probiotics in Acne

- The first clinical case reports on the potential value of *Lactobacillus* probiotics was published in 1961.
- Siver followed 300 patients who were administered a commercially available probiotic (a mixture of *L. acidophilus* and *L. bulgaricus*).
- **Protocol:** Probiotic supplementation for 8 days followed by two-week wash out then re-introduction for an additional eight days.
- **Results:** 80 % of those with acne had some degree of clinical improvement,
- The intervention was most valuable in cases of inflammatory acne.
- **Conclusion:** Demonstrates interactions of skin manifestations of acne vulgaris and of metabolic processes of the intestinal tract’.

Take Home Message: Beauty from Within

- Gut-Skin-Brain axis plays a central role in microbiome dysbiosis
- Dysbiosis in gut microbiome can impact skin health
- Rebalancing and maintain microbiome gut balance is critical to maintain healthy skin
- Probiotics are beneficial not only to the intestine but also to the skin



“The Wild-Type”