Infant Skin Barrier Maturation and Infant Skin Microbiome

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The Human Skin – Our Outside Organ is Our Largest

- Rapid growth in skin surface area over the first years of life[1]
- Baby ~ 3-5 square feet[1]
- Adult ~ 20 Square feet [2]

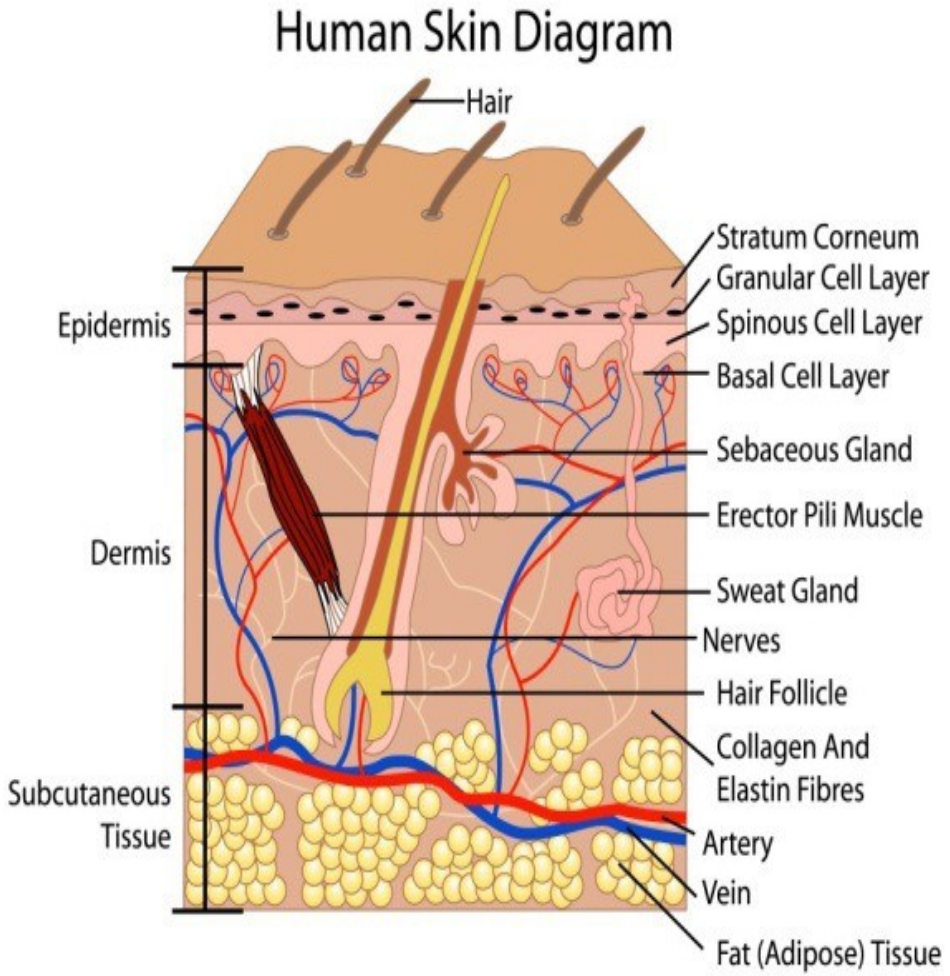
At birth, skin surface area grows at a rate of 75 cm^2/week

Surface area growth rate decreases to about 10 cm^2/week by 1 year

1. Walters et al. Skin Pharmacol Physiol 2016;29:111–118. 2. U.S. NCHS National Health and Nutrition Examination Survey (2011-2014).

Skin Function

- Natural **protective barrier** from
  - Physical injury
  - Pathogenic microbes
  - Chemical agents
  - Extreme temperatures
- Starts process for making **Vitamin D** to help body absorb calcium and maintain phosphorous for healthy bones
- **Sensory perception**: temperature, pressure, touch, pain
- **Temperature regulation** of the body
- Helps to **restrict fluid** and water **loss**



1. Irving V. *J Wound Care* 2001, 10:253-6. 2. Nikolovski J et al. *J Invest Dermatol* 2008, 128:1728-36. 3.https://www.health.harvard.edu/staying-healthy/time-for-more-vitamin-d

Babies' Skin is Different: Structure, Composition, Function

Structure	Composition	Function
▪ Stratum corneum and epidermal thickness[1] ▪ Corneocyte size[1] ▪ Surface roughness ▪ Elasticity	▪ Water content[2] ▪ Natural moisturizing factor (NMF)[2] ▪ Melanin[3] ▪ Lipid content and organization	▪ Water handling properties[2] ▪ Barrier function[2] ▪ Skin reactivity ▪ Cell proliferation[1]

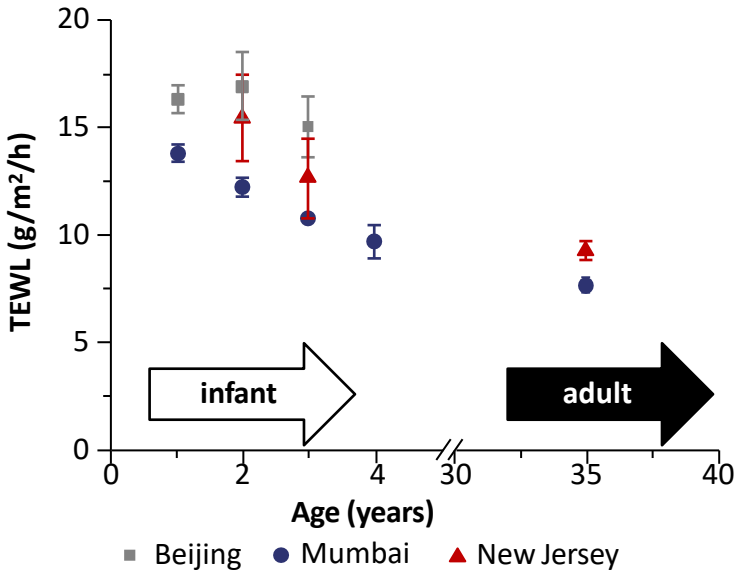
1. Stamatas G, et al. *Pediatr Dermatol. 2010;27(2):125-31.* 2. Nikolovski J, et al. *J Invest Dermatol.* 2008;128:1728-1735. 3. Mack M, et al. *J Invest Dermatol.* 2009;129(S1):S143

Across Geographic Regions & Skin Type, Infant Skin Barrier Differs from Adult

- TEWL is higher in infants compared to adults in three populations studied
- TEWL on exposed skin (dorsal forearm) approaches adult-like values faster than unexposed skin (upper inner arm)

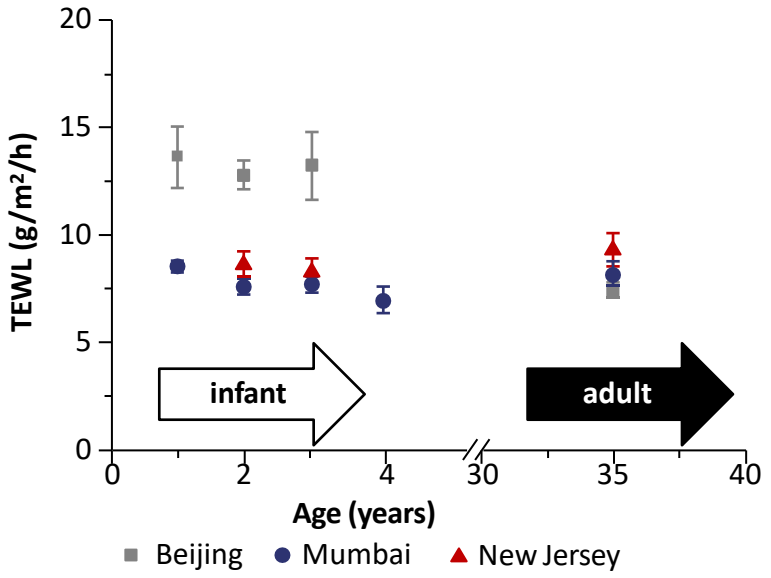
Transepidermal Water Loss

Upper Inner Arm



Unexposed skin

Dorsal Forearm



Exposed skin

1. Mack MC, et al. *Pediatr Dermatol. 2016;33(3):275-82*

Babies' Skin is Uniquely Different; Still Developing

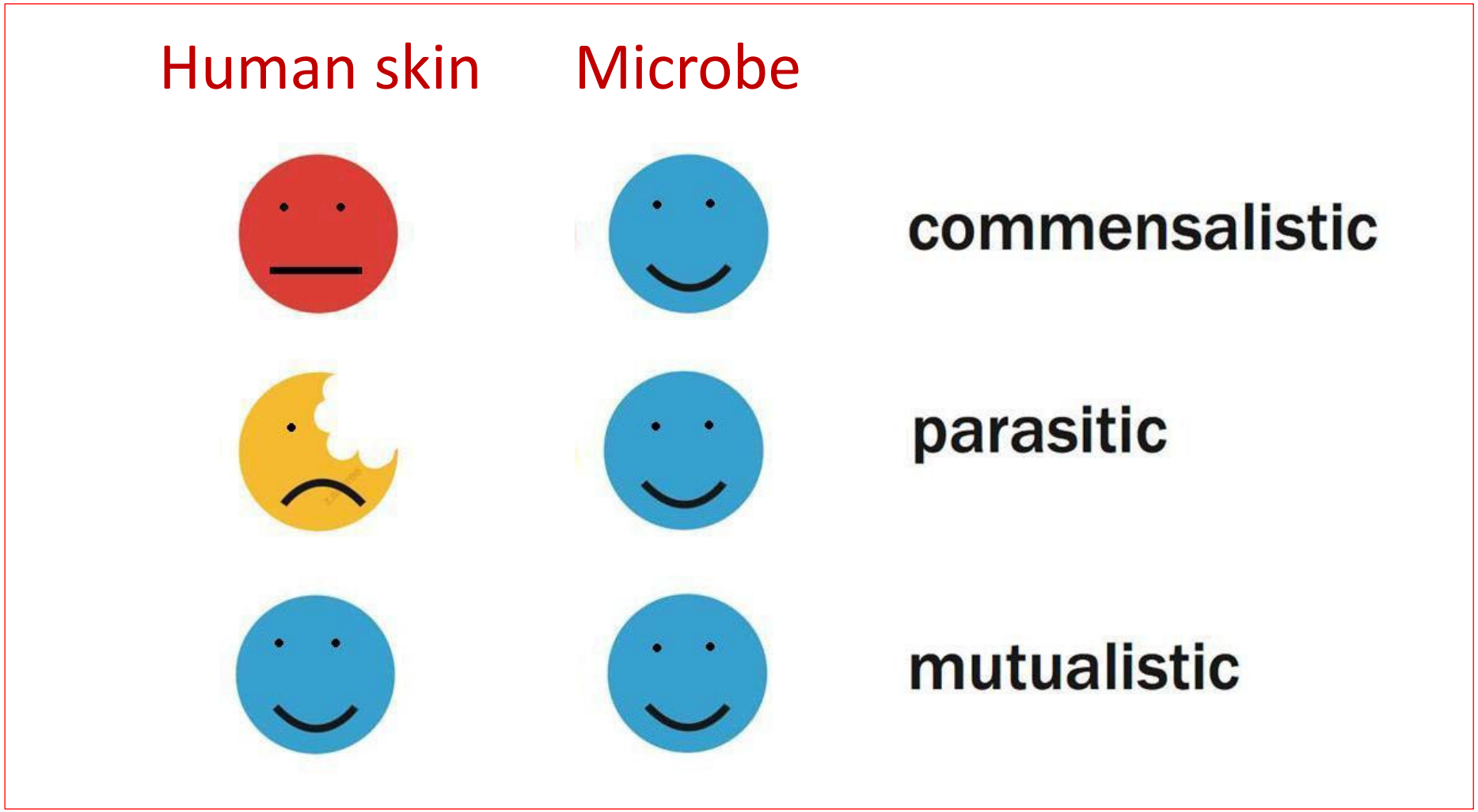
Baby's Skin is Still Developing	Implications for Products
• Thinner[1] • Absorbs and loses water more quickly[2] • Less natural moisturizing factor • Melanin developing • Developing immune system[3]	• Need mild products with less potential to alter skin barrier function; less potential to irritate; lower potential for allergy • Need mild cleansers, moisturizers, and sunscreens designed for baby's developing skin

1. Stamatas, G et al. *Pediatric Dermatology* 2010;27(2):125-31. 2. Nikolovski J, et al. *J Invest Dermatol.* 2008;128:1728-1736. 3. Larson A *Current Opinion Pediatrics* 2006;17:481-485.

Key Learnings – Part 1

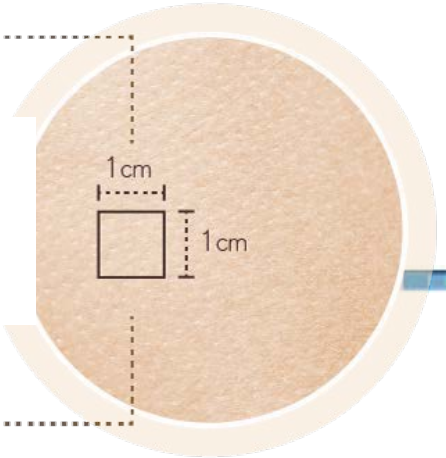
1. Infant skin is different from adult skin in structure and composition and *continues to develop* over the first years of life
2. These differences lead to functional differences in skin barrier properties with implications for care and protection
3. Ensure baby skin care routines support infant's developing skin and that products are mild and specially formulated for baby's unique needs (cleansers, moisturizers, etc.)

Skin-microbe Relationships

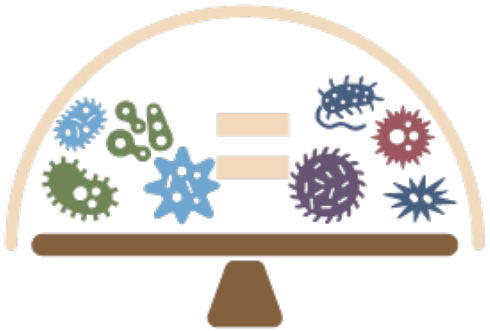


The Skin Microbiome

1 BILLION BACTERIA
inhabit a typical **square centimeter** of skin[2]



A diverse community of microorganisms coexisting at the skin surface.[1]

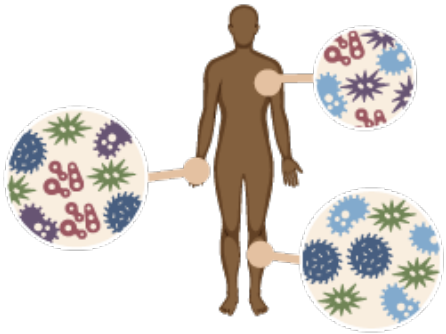


A Balanced Microbiome

The skin microbiome is a habitat of billions of beneficial and harmful bacteria. An imbalance of these bacteria can lead to a variety of skin conditions including acne, eczema, rosacea and ageing.[1]

pH Balance

The skin microbiome prefers a relatively acidic environment (pH around 5.0) which also inhibits growth of pathogens.[1]



Bacterial Diversity Differs by Body Zone

Differences in skin temperature, texture, thickness, humidity and chemistry help determine which kinds of microbes live where on the skin.[1]

1. EA Grice, JA Segre, *Nat Rev Microbiol* 2011: 9(4), 244-53.
2. EA Grice, HH Kong, G Renaud, AC Young, et al. *Genome Res* 2008: 18(7), 1043-50.

Skin Microbiome at Birth

In utero skin is in a sterile environment

The skin of vaginally-born babies is colonized by microbes from the mother's vagina[1]

The skin of C-section babies is colonized by microbes from the mother's skin[1]

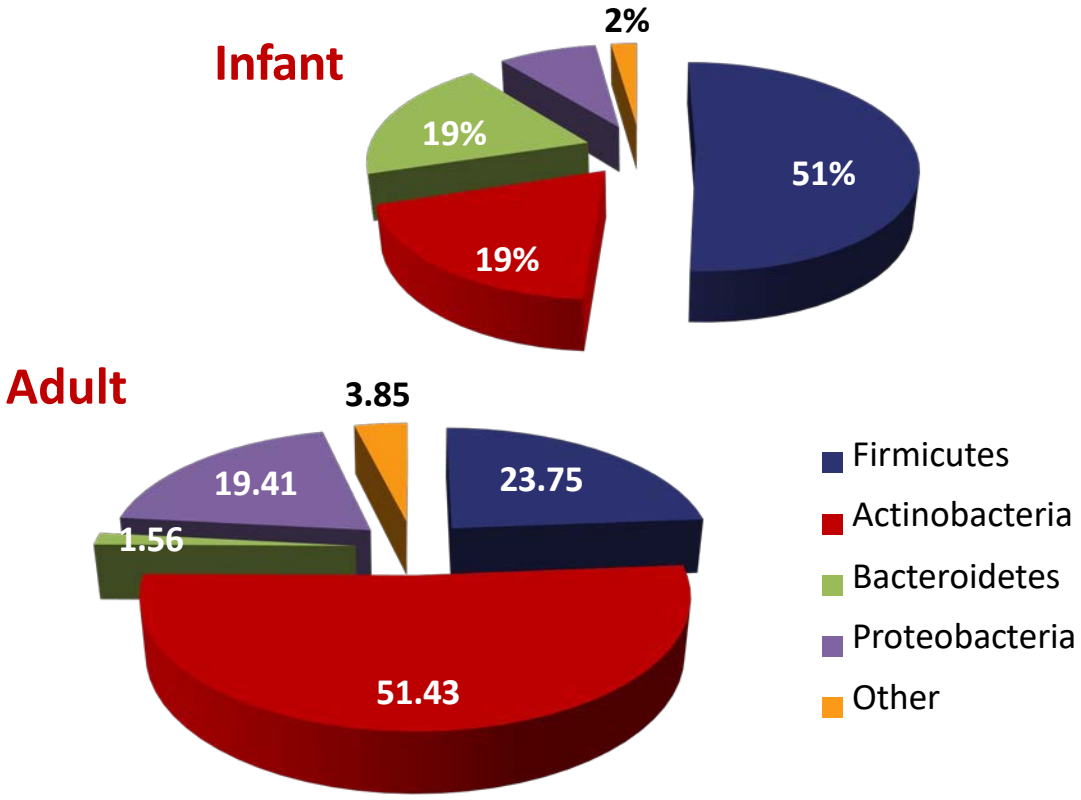
Baby skin microbiome community is dynamic and becomes more diverse as the baby grows[2]

Skin contacts between mother and child (breast-feeding, kangaroo care, wash, massage, etc.) is an opportunity for exchange of microbiome[2]

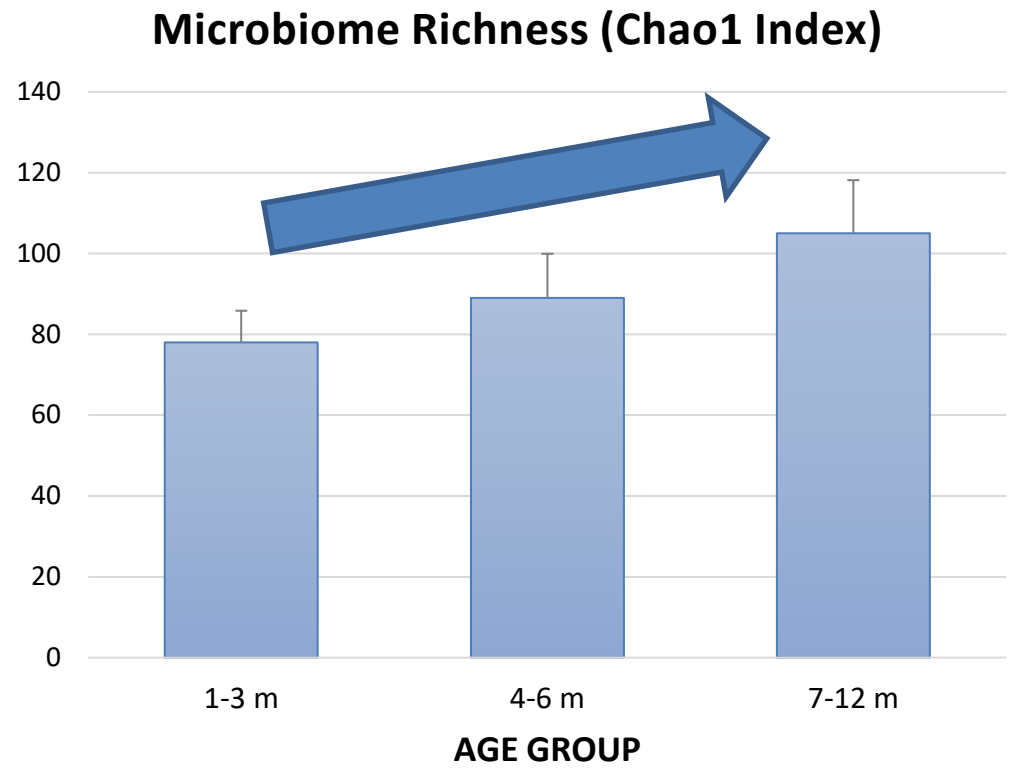
[1] MG Dominguez-Bello, EK Costello, M Contreras, M Nargris, G Hidalgo, N Fierer, R Knight, *PNAS* 107(26), 11971-5, 2010
[2] KA Capone, SE Dowd, GN Stamatas, J Nikolovski, *J Invest Dermatol* 2011: 131, 2026-2032
[3] G Gaitanis, G Tsiouri, P Spyridonos, T Stefos, GN Stamatas, A Velegraki, ID Bassukas, *Pediatr Dermatol* 36, 460-465, 2019

Baby Skin Microbiome Differs from Adult and Evolves with Baby Age

Infant Skin Microbiome differs from that of Adult



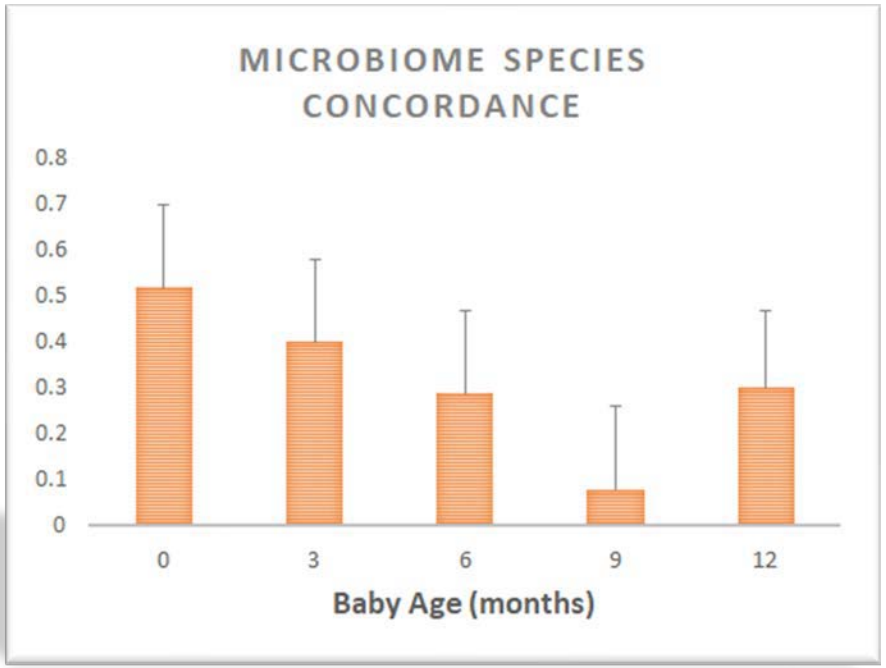
Microbiome richness increases over the first year of life



KA Capone, SE Dowd, GN Stamatas, J Nikolovski, *J Invest Dermatol* 2011: 131, 2026-2032

Concordance with Mother's Skin Microbiome

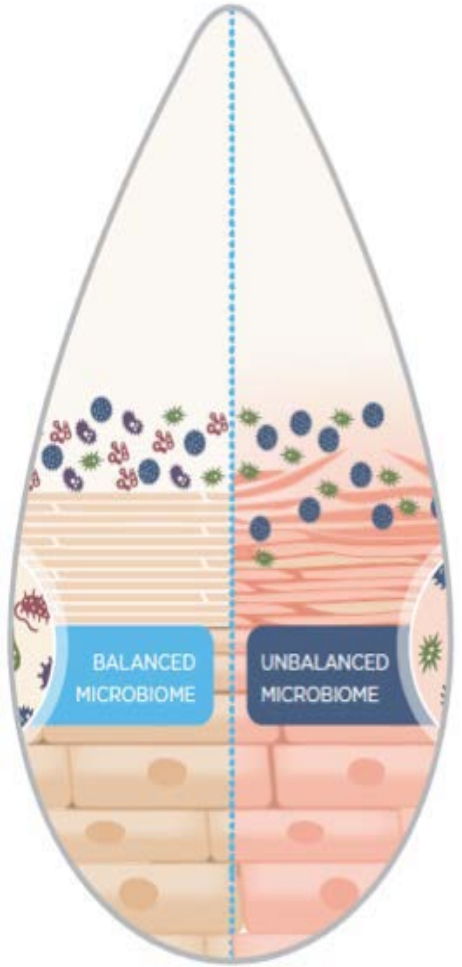
Skin microbe concordance between the mother-infant dyad is particularly high early in life



G Gaitanis, G Tsiouri, P Spyridonos, T Stefos, GN Stamatas, A Velegraki, ID Bassukas, *Pediatr Dermatol* 36, 460-465, 2019

The Skin Microbiome in Disease - Importance of Diversity

- The diversity of microbes within a given area of the body can be defined as the number and abundance of distinct types of organisms
- Diversity has been linked to several human diseases
  - *C. difficile* colitis – lack of diversity, monocolonization in colon with *C. difficile*
  - Obesity and inflammatory bowel disease - low diversity in the gut
  - Bacterial vaginosis – high diversity in the vagina
  - Atopic dermatitis (AD) lesions – increase in *S. aureus* and low diversity
  - Lesions of acne vulgaris patients – lower diversity, and certain strains of Propionibacterium acnes
  - Changes in relative abundance – lesional areas of psoriasis
- New research suggests that a diseased state may be achieved by the absence of commensal bacteria and not simply the presence of a pathogen



Key Learnings – part 2

1. The skin and its microbiome continue to mature and develop long after birth, playing an important role as a first line of defense
2. Skin care routines should strive to maintain the integrity of the skin barrier *and also* to support the skin microbiome
3. In a clinical study, adding an application of lotion after bath, using mild products specifically formulated for baby's skin, was shown to accelerate increase in skin microbial richness

Asante Sana

Niyabonga

Takk

Obrigada

Děkuji

Arigato

شكرًا

Dankie

Bedankt

Thank You !

Danke

Tack

Xie xie

Gracias

Merci

Ευχαριστώ

e dupe

Terima Kasih

Obrigado