Robert Barthen and Igor Felschau presenting the review:

THE SKIN MICROBIOME

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SKIN

- Physical barrier of 1.8 m²
- Interface with outside environment
- It is cool, acidic and desiccated
- Selects for specific microorganisms
- Composed of different layers
- Provides various invaginations and appendages
INVAGINATIONS AND APPENDAGES

- E.g. sweat or sebaceous glands
- Create special habitats
DIFFERENT HABITATS ON SKIN

- Host factors (age, sex and location)
- Environmental factors (occupation, clothing, antibiotic use and hygienic products)
- Habitat defines microbial community
INHABITANTS OF HUMAN SKIN

- Bacteria
- Fungi
- Viruses
- Mites
Composition of skin microbiota is more dependent on body site than on the individual.
ANALYSIS OF SKIN MICROBIOTA

- Culture based methods
- 16s rRNA analysis
- Whole-genome shotgun metagenomic sequencing
Fungi

- *Malassezia* spp. make up 53 – 80% of total skin fungal population
- Remainder remains unclear
  - *Candida* spp. rarely found, can cause infections
  - Species of *Debaryomyces* and *Cryptococcus* found by culture based analysis, but has not been conformed by molecular analysis
Mites

- *Demodex spp.* are considered part of the skin microflora
- Associated to skin disorders like facial itching and chronic blepharitis
- Molecular methods to specify *Demodex* mites do not exist
Viruses and Archaea

- Methods for isolation and identifying viruses from skin are just being developed

- Archaea have not been identified on the skin, either by culture or by molecular methods
Skin is also an immunological barrier

- Keratinocytes sample the MOs on the skin by pattern recognition receptors (PRRs)
- PRRs recognize pathogen-associated molecular patterns (PAMPs)
  - PAMPs can be flagellin, nucleic acids, lipo-polysaccharides and other attributes of bacterial or fungal cell walls
By activation of PRRs the keratinocytes initiate the immune response

Antimicrobial peptides, cytokines and chemokines can be released

Skin can distinguish between harmless and harmful MOs

Commensal MOs can be involved in the immune answer by triggering receptors
SKIN DISEASES

- Three ways how specific organisms can be involved in skin diseases
SKIN DISEASES

Skin disorders with a correlation to microbiota e.g. acne

- Commensal skin bacterium *Propionibacterium acnes* destroys tissue of the pilosebaceous unit by lipases and proteases
SKIN DISEASES

Disorder with an unidentified microbial component.

- Commensal skin organisms invade and become pathogenic upon breach of the skin barrier.
- E.g. burn wounds commonly become infected with *S. pyogenes*, *Enterococcus spp* or *Pseudomonas aeruginosa*
SKIN DISEASES

Invasive skin commensal that causes infection

- Normally commensal organisms can become virulent when they invade other sites
- E.g. *S. epidermis* forms biofilms on catheters or other medical devices, which protect them from the host immune system and antibiotics
Several dominant organisms of the skin microbiota are known, but little is understood about the rare or transient organisms.

Also it is not completely clear if the indigenous organisms provide some benefit to the host and whether they are truly symbiotic or commensal.