What’s bugging us?

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Perhaps only 4 diseases matter?

- Go see your doctor
- I can sort it
- It doesn't matter
- Did I cause it?

- How often do we clean our frame stock?
- Other optical equipment?
- What’s likely to be on it if we don’t?
- What’s likely to be on it if we do?
- Does it matter?

What's normally present on human skin?

- Make up
- Perfumes
- Soap etc?
- Can cause skin reactions

- Skin medications?

- Potential pathogens?
- Normal skin flora
- Symbionts
- Commensals
- Transients
- Do we worry about it on our frame stock?

Symbionts

- Living together mutually beneficial
- e.g. Escherichia coli produce vitamins B12 & K in the gut
- Strain 0157:H7 can kill you

Commensals

- Living together without harm or benefit to either
- e.g. many of the organisms often thought of as pathogenic

Transients

- Come and go, but not normally residents.
- Anything from the entirely harmless to the seriously pathogenic

Definitions can become blurred

- What do you call a harmful bug that prevents invasion by a more harmful one?
- What about an opportunistic bug that usually is commensal?

Normal skin

How do they get there?

- In the air
- Direct contact between hosts
- Indirect contact between hosts
- Glasses
- Optical equipment

How do they stick on?

- Fibrillae - fine structures binding bacteria to “host” cells
- Fimbriae - hair-like cells that penetrate the “host” cell membrane (like roots)
- Adhesins - chemical bonds to molecules on surface of “host” cells/ substrate
- Fungi - adhesins (for relevant ones + myceliae)
- Protozoa - adhesins for both human and bacterial cells
- Arthropods – more obvious means…

Factors affecting normal skin flora

- pH
- Temperature
- Hydration
- Light
- Oxygen/ carbon dioxide

pH

- Typically skin is quite acidic - pH ca 5.0
- Acidity tends to limit growth of many “transient” pathogens
- Doesn’t have much effect on normal residents growth or density

- Temperature
- Human core temperature ca. 37 ° C
- Skin can be 20 ° cooler
- Many pathogens like it much cooler than the core temperature (about 25-30 ° C)
    - Dermophytes and fungi

Hydration

- Lower microbe populations on exposed areas
- So fewer on face and hands than under armpit

Light

•Principally u.v. - can kill some bugs

Oxygen/ carbon dioxide

- Skin occupied by both aerobes and anaerobes

•Many of skin's inhabitants can are "facultative"

- Can live under either set of conditions
  - But happiest under one

- How variable is it?
- Skin flora from birth
- Skin smoother
  - Stratum corneum weaker
  - Hair follicles and sebacious glands not fully developed
  - Heat regulation mechanisms a bit different
- Skin “sterile” until just before birth
  - pH 6-ish at birth, becomes normal 4-5 after ca. 4 days
- Susceptible to skin disease
  - Incomplete defence mechanisms
    - Including by “harmless” organisms
- By 6 weeks, very similar to adult skin flora

- Staphylococci
- Principally S.aureus & S.epidermidis
- S.aureus - principally in nasal passages - less common on skin
- S.aureus - well known pathogen
- S.epidermidis - may have defensive role in normal flora
    - Can be an opportunistic pathogen
        - Mostly newborn, elderly and intravenous drug users

Other “normal” staphylococci on skin

- S.capitis
- S. cohnii
- S.haemoliticus
- S.hominis
- S.simulans
- S.warneri
- S.xylosus

- In infections acquired whilst in hospital, coagulase negative staphylococci 3 times more frequent than coagulase positive.
  - ie NOT S.aureus!
- Opportunistic pathogens of compromised skin
  - Prefer anaerobic conditions & mucous membranes
  - Tend to be transients *on* skin
  - Common because of frequency in mucous membranes
  - But often causative agent in pus-filled skin infections

Pseudomonas: principally P.aeruginosa

•Relatively low incidence on most “normals”

- But up to 90%) in hospital patients and hospital staff (up to 30%)
- Opportunistic pathogen of compromised skin

Micrococcus: M.luteus, M.roseus, M.varians

•Normal resident

- More frequent on infants than adults
- Appears “harmless”

Acintobacter spp.

•Present in about 25% of normal population

- Opportunistic pathogens of compromised skin

Propionibacteria:

- Principally Propionibacterium acnes
- Very common in sebum-rich areas of skin
- Principal bacteria involved in “acne”

Fungi:

•Pityosporum (Malassezia) species (P.ovale, P.orbiculare,

P.pachydermatitis)

•Candida species

•“Yeasts”

•Very common, but Candida only transient on exposed skin

•When pathogenic, tend to affect stratum corneum alone (e.g. ringworm)

or be opportunistic pathogens of compromised skin

Arthropods etc

- Won’t get head lice of specs
  - I hope - but what about eggs?
- May get smaller bugs
  - Demodex?

Protozoa

- Trichomonas tenax (commensal- mostly mouth)
- Pentatrichomonas hominis (commensal, everywhere!)
- Acanthamoeba (transient, very common)
- +Lots of internal “commensals”

Helminths

- All parasitic.
- Transient on skin

Viruses

- Less information available
- Much harder to find out what is where and when
- both DNA & RNA viruses common
- Well known disease vector mechanism
- Some obvious and resident
  - eg papillovirus
- Some less obvious and transient
  - eg influenza, polio
- Some part of normal flora
  - This is the more mysterious bit!

What can we do?

•NHS Scotland specifically advises ensuring that “applications and devices” are not one of the contributing factors to the spread of infectious microorganisms

•Specifically, re-usable devices such as eye patches used with visual screeners should be decontaminated between use with a Medi-wipe or similar,

•Do optical practices do this?

•What is our frame stock if not a re-usable device?

C/L wearer | Readers | Constant use

Pads

Sides

Pilot 3 large colonies (C/L, wearer pads) bacillus spp. Others mostly commensal staphylococcus (? – not fully identified) (Tara Beattie, 2005)

More detailed investigation

- Not just frames
- Not many frames!
- Anything in contact with the face
- Concerned because GCU Eye Clinic has known MRSA +ve patients

Blood agar plates, cultured from swabs

Slit-lamp headrest

Trial frame nose-piece

Hard plastic occluder
(for perimetry)

Trial frame side

All coagulase negative staphylococci

Michell McGinn (2011)

Methods

•Approx. 2cm^2 of each surface swabbed

•Cell culture (blood agar) 37 ° C aseptically streaked and:

- Gram Stain
  - Positive or negative
- Catalase Test
  - eg Positive (pathogenic staphylococcus) or negative (nonpathogenic strep.)
- Modified oxidase test
  - Can oxidize some aromatic amines, eg, p -aminodimethylaniline, to form coloured end product
  - Differentiates Micrococcus from Staphylococcus

Methods

- Staphylococcus Latex Test
  - Positive or negative agglutination
- DNAse Test (Culture on DNAse agar)
  - DNAse positive or negative
    - Ability to produce exoenzyme: deoxyribonuclease (+ growth in medium)
- Oxacillin E-test
  - MRSA
- VITEK 2

Cultures grown on DNAse agar

The bottom culture has a ring

of clearing, meaning it is

DNAse positive

Oxacillin E-test. The MIC is where

the zone of clearing joins the

ellipse on the strip (doesn’t really

show up on slide!)

Samples	Where taken	No. of colonies	No.difft colony types	cfu/cm²
Slit lamp-joystick	Cubicle 3	4	2	2.5
Slit lamp-joystick	Cubicle 1	none	none	0
Slit lamp-joystick	Out of cubicles	3	3	2
Slit lamp-headpiece	Cubicle 3	>300	>6	150
Slit lamp-headpiece	Cubicle 1	none	none	0
Slit lamp-headpiece	Out of cubicles	none	none	0
Slit lamp-chin-dirty	Out of cubicles	none	none	0
Slit lamp-chin-clean	Out of cubicles	4	3	2
Slit lamp-hand piece	Out of cubicles	none	none	0
Trial frame-side	Cubicle 3	>143	>3	71.5
Trial frame-side	Cubicle 1	79	>4	39.5
Trial frame-nosepiece	Cubicle 3	>1600	>6	800

Samples	Where taken	No. of colonies	No.difft colony types	cfu/cm²
Trial frame-nosepiece	Cubicle 1	>476	>5	238
Occluder	Cubicle 3	>146	>4	73
Occluder	Cubicle 1	6	3	3.5
Safety glasses-side	Row 1	none	none	0
Safety glasses-nosepiece	Row 1	none	none	0
FYSH glasses-side	Row 13	none	none	0
FYSH glasses-nosepiece	Row 13	none	none	0
CK glasses-side	Row 13	1	1	0.5
CK glasses-nosepiece	Row 13	none	none	0
Retro glasses-side (unworn)	Row 7	none	none	0
Retro glasses-nosepiece (unworn)	Row 7	none	none	0
Pupilometer-blue	Desk	1	1	0.5
Pupilometer-silver	Desk	none	none	0

Samples	Colony phenotype	Organism identified	% probability
Slit lamp-joystick	1-2mm,hemolytic,white	*Staphylococcus lugdunensis*	99
Slit lamp-joystick	1-2mm,grey	*Staphylococcus epidermidis*	99
Slit lamp-headpiece	<1mm,white	*Staphylococcus capitis*	99
Slit lamp-headpiece	1-2mm,grey/white	*Staphylococcus capitis*	98
Trial Frame-side	2-3mm,hemolytic,white	*Staphylococcus simulans*	99
Trail Frame-nosepiece	<1mm,white	*Staphylococcus capitis*	99
Trail Frame-nosepiece	2-3mm,white	*Staphylococcus capitis*	96
Trail Frame-nosepiece	<1mm,grey/white	*Staphylococcus capitis*	99
Trail Frame-side	2-3mm,white	*Staphylococcus hominis*	unable to confirm subspecies
Occluder	1mm,grey/white	*Staphylococcus capitis*	99
Slit lamp-joystick	2-3mm,yellow/white	*Staphylococcus warneri*	95
Slit lamp-joystick	1-2mm,hemolytic,yellow	*Staphylococcus warneri/hominis*	Low discrimination
Slit lamp-chin-clean	1mm,white/grey	*Staphylococcus epidermidis*	99
Pupilometer	3-4mm,white	*Staphylococcus capitis*	99

NOT what expected…..

•eg Bifero, A.E. et al., 2006; Rajak, S.N. et al., 2006; Nwaugo, V.O. et al., 2008

- coagulase-positive Staphylococcus
- gram-negative bacillus
- methicillin-resistant Staphylococcus aureus
- (Aspergillus)
- (Penicillium)
- (Candida)
- (Microsporium)

… but we were only looking for bacteria