
Utilization of methylglyoxal in Manuka honey to reduce S. aureus colonisation in the nasal vestibule
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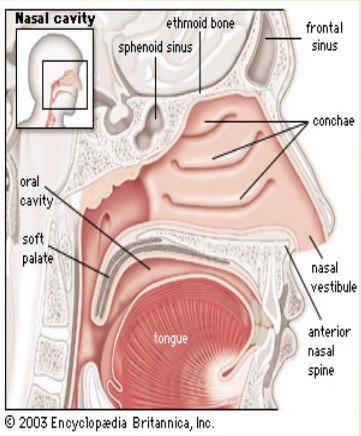
Introduction

- Preventing infection/ bacteraemia by *Staphylococcus aureus*/MRSA
- Nasal carriage and infection
- Honey, methylglyoxal, and Manuka Cyclopower™
- Results of study so far and "building beyond"



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Nasal Carriage and Infection

- Link initially identified in 1931 by Danbolt (Wertheim et al., 2005)
- A sample of papers since then:
  - Tulloch (1954) – nasal carriage and skin lesions
  - White (1963) – correlation between carriage volume and infection
  - Solberg (1965) – nasal carriage and dispersal to hands/environment
  - von Eiff, Becker, Machka, Stammer, & Peters, (2001) – nasal carriage and bacteremia
  - Stenehjem and Rimland (2013) – nasal carriage risk factor for MRSA infection

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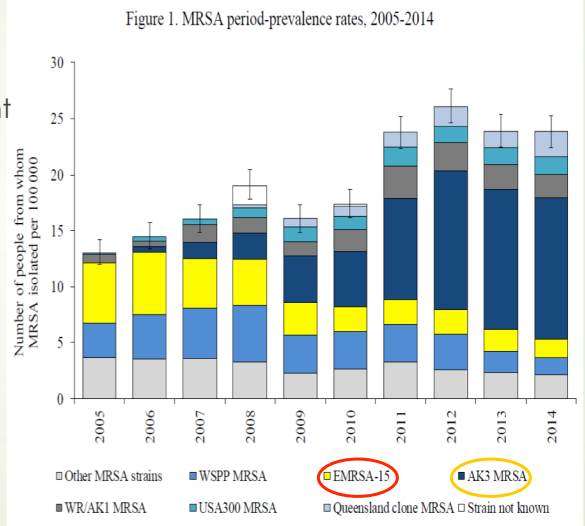
MRSA

- Similar infections
- Resistance to treatment (Heffernan, Bakker, Dyet, & Williamson, 2015).
- Fusidic acid 21.8% & Mupirocin 8.7% (14.2% 1999) (Heffernan, Bakker, Woodhouse, Dyet, & Williamson, 2015)



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Infection with *S. aureus*

- What does this really mean to you?
- Boils, 'school sores', impetigo, carbuncles, purulent pimple?
- Morbidity?
- Mortality?

https://classconnection.s3.amazonaws.com/781/flashcards/517781/jpg/faruncle1305035917619.jpg

http://howshealth.com/wp-content/uploads/2013/02/Carbuncle-back-of-neck.jpg

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Pre-antibiotic era Consequences

(Skinner & Keefer, 1941)

Case 47.—A boy aged 8 was well until six days before death, when he became acutely ill with high, irregular fever and pain in the groin. There were no localized signs of infection, but a culture of the blood was positive for staphylococci. Death occurred two days after admission to the hospital (fig. 3).

Necropsy showed miliary abscesses of the myocardium, spleen and pancreas, without any other lesions.

Case 13.—In a man aged 46, who had a carbuncle on the back of the neck, a chill suddenly developed, with a high, remittent fever and signs of bronchopneumonia and stupor. The course of his illness was one of progressive failure, with death occurring six days after the onset of the infection.

Necropsy showed a carbuncle of the neck and multiple abscesses of the brain, liver and kidneys.

Case 44.—In a boy aged 14 the signs of acute osteomyelitis of the right tibia developed, with high, remittent fever and bacteremia. Foci of osteomyelitis subsequently developed in the humerus and metatarsal bones, and the blood stream was cleared of bacteria. The foci of osteomyelitis were drained, and the patient recovered after an illness of three hundred and twenty-eight days (fig. 5).

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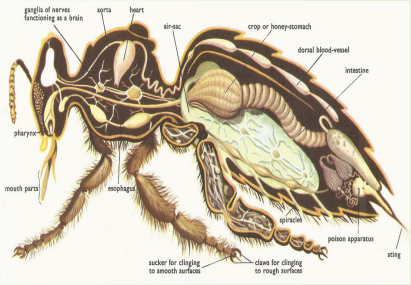
Honey – what is it?

- Nectar from plants (usually floral).
  - 25mg nectar in crop/honey stomach
  - Gland secretion – enzymes
  - Transfer to house bee → honeycomb
  - Sucrose to fructose and glucose
  - Evaporation of water
  - Honey in 1-3 days.

(Ball, 2007)



http://www.daviddarling.info/encyclopedia/B/bee.html

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Honey - history

- pre Christian, Bible, Koran (Zumla & Lulat, 1989; Molan, 1992).
- van Ketel (1892) – first scientific reference to lack of growth on agar plates.
- Sackett (1919) – honey as a carrier of intestinal disease, growth inhibited, so unlikely to be a carrier.
- Dold, Du, and Dziao, (1937) – identify 'inhibine' = hydrogen peroxide.

http://www.aloelf.com/wp-content/uploads/2010/06/bees-egypt-heiroglyphs.jpg

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Honey - activity

- Osmotic effect
- Acidity (pH 3.9)
- Hydrogen peroxide
- Bee defensin-1
- Methylglyoxal – Slow conversion, within manuka honey, of dihydroxyacetone in the nectar of Manuka (*L. scoparium*).

http://images.wisegeek.com/manuka-bush.jpg

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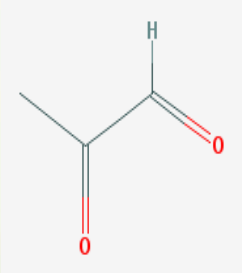
Methylglyoxal (MGO)

- Non–peroxide activity of Manuka identified as methylglyoxal, by Adams et al., (2008).
- Appears to inhibit/affect DNA, RNA, and protein synthesis (Krymkiewicz, Dieguez, Rekarte, & Zwaig, 1971).
- MGO aka UMF component of Manuka honeys.



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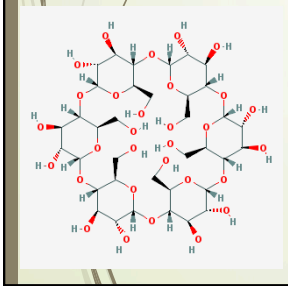
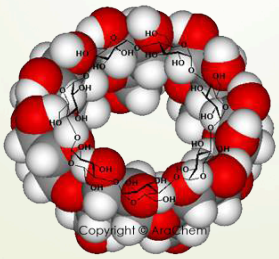
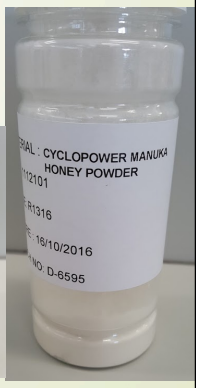
Manuka Cyclopower™ (MCP)

- MGO can be readily degraded, stabilising possible
- Manuka honey mixed with α-cyclodextrin (45%/55%), forms an off white powder.
- α-cyclodextrine molecule contains the MGO in the hydrophobic centre (Swift, Chepulis, Uy, & Radcliff, 2014).







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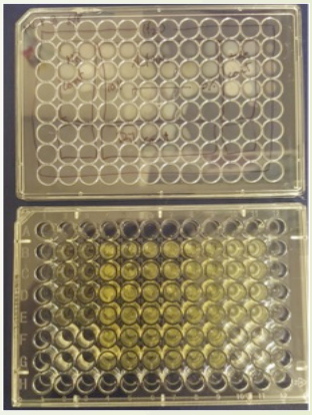
Experiment – Overall aim

- To identify if Manuka cyclopower™ could be made into a cream for use in the nasal vestibule/anterior nares
- To compare a sample of Manuka cyclopower™ with the source honey.



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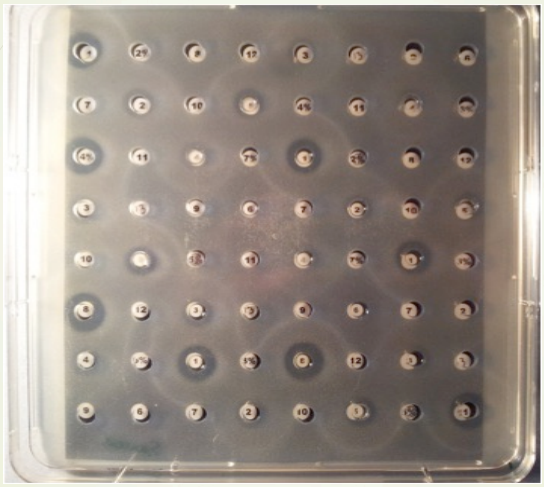
Exp 1 – Zones of Inhibition



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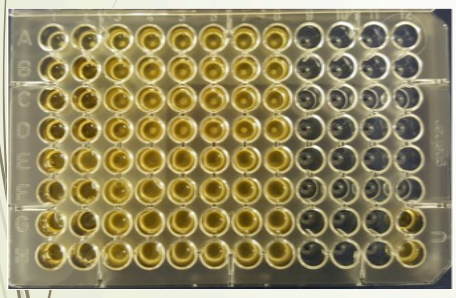
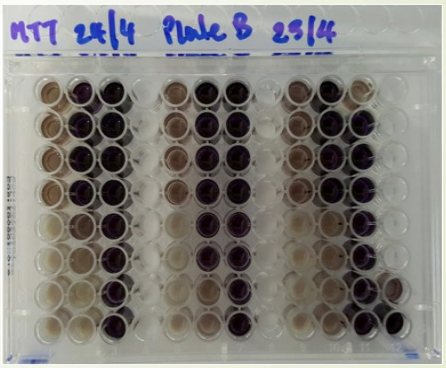
Experiment – MTT assay





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Growth Inhibition - Spectrophotometry

- Before and after incubation readings

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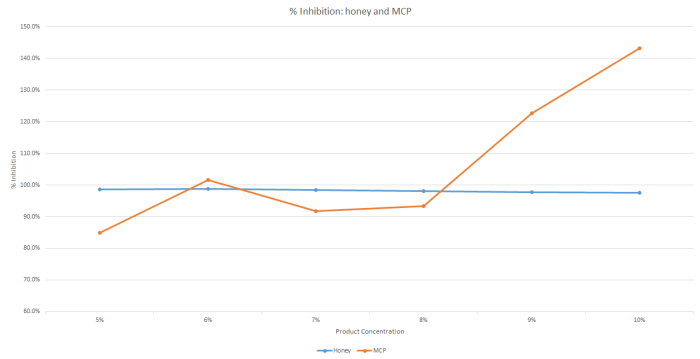
Growth Inhibition - Spectrophotometry



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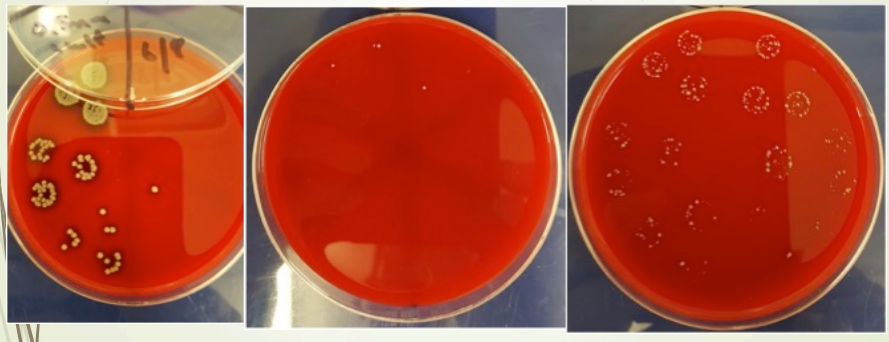
Bacterial Inhibition– Plating – Initial findings

Source culture 10^6/ml (n=12)

10% Manuka Cyclopower™ 10^2/ml (n=9)

10% Manuka honey 10^6/ml (n=11)



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Where to next?

- Consolidate/Repeat Data
- Further *invitro/invivo* work. Animal studies
  - What activity on mucous membranes?
  - Possible additional topical options?
- Clinical trial
- Other roles for MCP

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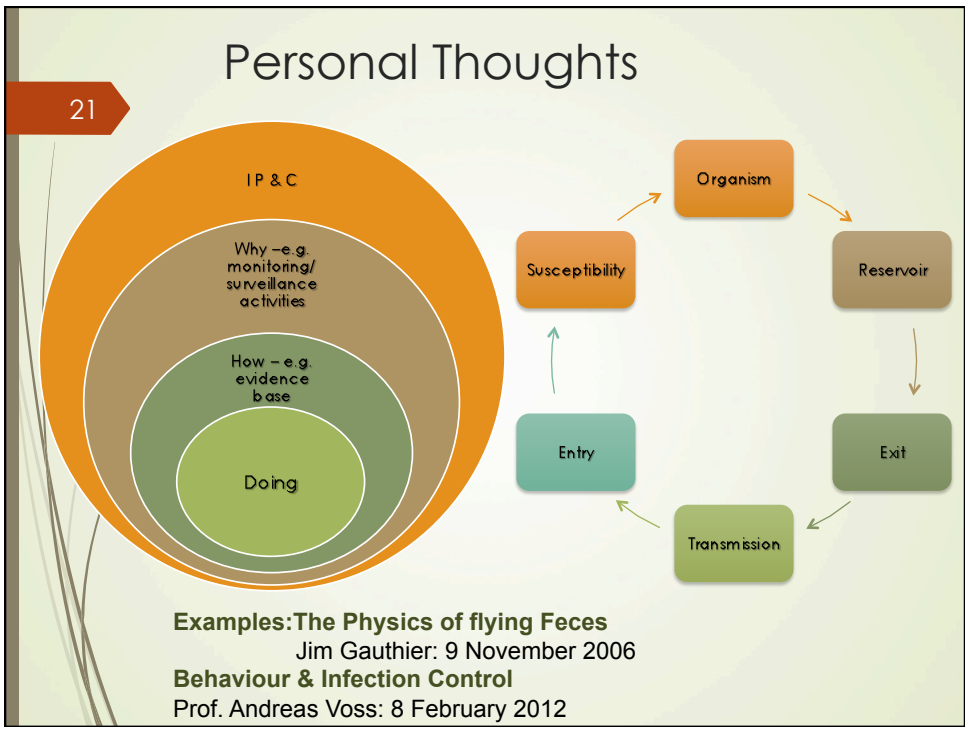
So where does this leave IPC?

- "Infection control refers to a range of practices and procedures designed to minimise the risk of spreading infections, especially in hospitals and health care facilities"

  (Controller and Auditor-General, 2003)

- What and How we Do


Personal Thoughts
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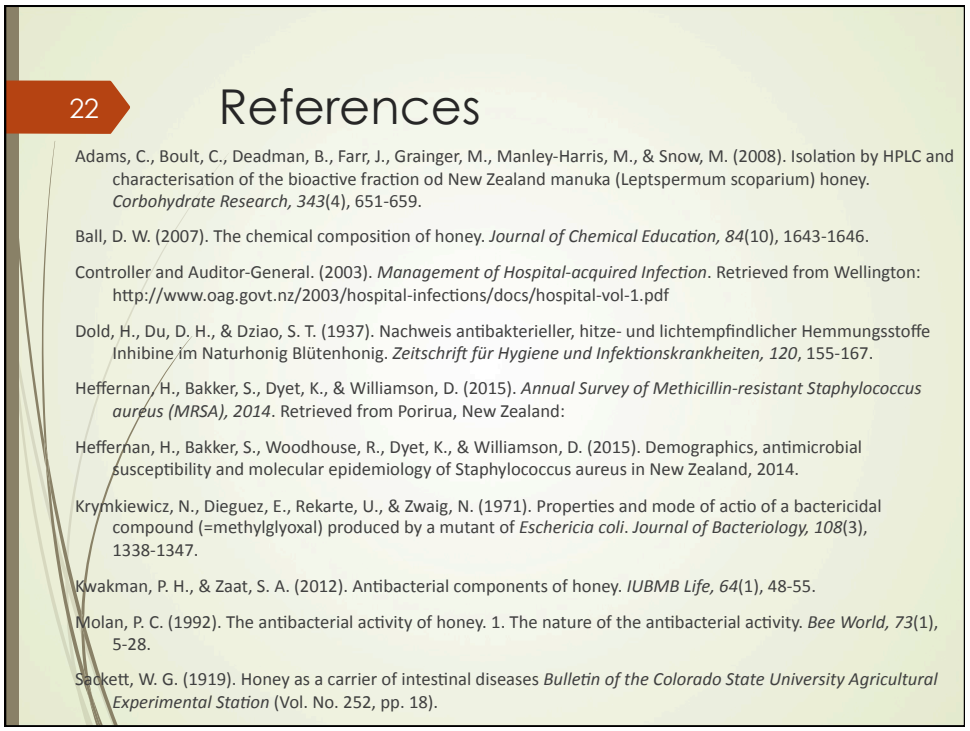
I P & C
Why – e.g. monitoring/ surveillance activities
How – e.g. evidence base
Doing
Organism
Reservoir
Exit
Transmission
Entry
Susceptibility
Examples:The Physics of flying Feces
Jim Gauthier: 9 November 2006
Behaviour & Infection Control
Prof. Andreas Voss: 8 February 2012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