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AUSTRALIA'S COMPLIMENTARY WAITING ROOM MAGAZINE FOR THE WHOLE FAMILY
HONEY,
I killed those super-bugs

Dr Shona Blair and Dr Nural Cokcetin are scientists who have been investigating the medicinal properties of honey for years. They are fascinated by bees and their sweet honey and how they are so important for our wellbeing.
Honey is much more than just a sweet toast-topper - it literally saves lives and limbs. This is because honey kills super-bugs and other germs that are causing life-threatening infections in hospitals and in the community, even ones like the deadly Golden Staph.

Super-bugs are germs that cause infections that are notoriously difficult to treat because they have become resistant to the usual antibiotic medications that used to kill them. In some cases the infection can progress to complications like gangrene and may lead to amputation or even death. Honey has medicinal properties that kill super-bugs and eradicate these life-threatening infections, even when conventional medications have failed.

But it’s not just any old honey. It is all about the flowers that bees visit to collect nectar that they turn into delicious, and potentially life-saving, honey. One of the most famous examples of a powerful medicinal honey is manuka (Leptospermum scoparium) from New Zealand.

Professor Peter Molan (New Zealand) discovered the unusual activity of manuka honey in the 1980s and he showed that it was effective against a wide range of different infection-causing germs. Since Professor Molan’s discovery, and all of the research he and other scientists have conducted on New Zealand’s manuka since, the demand and price of this honey have grown considerably.

However, although Australia is home to the largest diversity of Leptospermum plants in the world (we have more than 80 species compared to NZ’s one!), Australia’s medicinal honey research and industry is in its infancy compared to New Zealand’s.

The quest to find more liquid gold

We already know that a handful of Australian Leptospermum honeys have similar levels of antimicrobial (that is, germ-killing) activity to NZ manuka, but many of the other 80 plus Australian varieties have not been tested. So our research team is running a nationwide study looking for more sources of this honey, sometimes referred to as “jelly bush” or “Australian manuka”.

We want to identify which trees make the most therapeutically active honey and where they are located in Australia, as well as find more sources of this honey and understand more about its medicinal properties.

We are asking beekeepers with access to Leptospermum honeys from anywhere in the country to provide samples to include in our research project.
Why the scientific interest in medicinal honey?

Honey has been used as a medicine throughout the history of the human race. Conditions traditionally treated with honey range from diseases of the gut and respiratory systems to burns, bites, wounds and eye infections.

In many different cultures honey has been especially persistent as a wound dressing. This is undoubtedly because it shows significant antimicrobial, or germ-killing, activity.

Although it was used extensively throughout the history of medicine, honey largely fell from favour from the 1940s, with the advent of highly active antibiotic medications. After the introduction of these incredibly important and life-saving drugs, modern western medicine largely dismissed medicinal honey as a “worthless but harmless substance”.

However, one of the scariest threats to human health right now is the huge increase of antibiotic-resistant bacteria (or antibiotic-resistant germs). Some germs that cause serious infections are becoming resistant to most available antibiotics. A few terrifying types are now resistant to all of the antibiotics we currently have.

But, one of the most exciting things about the antimicrobial activity of honey is that it works against a very wide range of germs that cause infections, and it is just as effective against antibiotic-resistant ones as it is against those that are still sensitive to these drugs. So, it is far from “worthless”!

Not just any honey

Aristotle prescribed honey for a variety of conditions. However, it was not just any old honey for any old thing. He specified the region and season for the collection of medicinal honey. In fact, many of the ancient peoples who used honey medicinally, prescribed honeys collected from specific locations, seasons or flowers for specific medical conditions. What Aristotle and many other ancient peoples appreciated is that the floral source of a honey will affect the level of its antimicrobial activity (although it is unlikely that they would have phrased it that way themselves!).

A common modern misconception is that honey is a standard product. However, the aroma, taste and colour, as well as the antimicrobial activity of honey will vary greatly, depending on which flowers the bees visit to collect the nectar they turn into honey.

All honeys possess some level of antimicrobial activity, but some are up to 100 times more effective than others!

How does medicinal honey work?

Honey is an incredibly complex substance, with well over 100 components including many different simple and complex sugars, amino acids and other substances. The European honey bee (Apis mellifera) is the one most commonly employed by people for honey production, which usually comes from the nectar of flowers.

As a consequence of the many different types of flowering plants that can be used to produce honey, there is a huge difference in honeys and their germ-killing ability.

Certain honeys have powerful activity against the germs that cause infections, even against super-bugs like Golden Staph. This antimicrobial activity is due to four main factors:

• High sugar content (about 80%) - All of the sugar molecules in honey bind so tightly to any water molecules present that the water is not available for the germs to use, so the honey is too “dry” for them to grow.
  - But even when honey becomes diluted it is more powerful than just equivalent sugar solutions.

• Acidity (low pH) - The typical pH ranges from 3.2 to 4.5, which is too low for the growth of most germs that cause infection

• Hydrogen peroxide - When bees are making honey they add a variety of other substances, including hydrogen peroxide, which is a powerful germ-killer.

• Phenolic compounds - These are a type of antioxidant that is present in honey and can help to prevent the growth of germs.

• Enzymes - Honey contains a variety of enzymes that can help to break down the sugars and other substances in the honey, which can help to kill germs.

These factors work together to make honey a powerful natural antibiotic.
of things to the nectar, and one of these is an enzyme called glucose oxidase.
- When honey is mixed with water this enzyme produces hydrogen peroxide (like bleach), and this is toxic to germs.
- This is the main factor responsible for the antimicrobial effect in most honeys with significant activity.
- But the level varies greatly from honey to honey – jarrah honey from Western Australia is an example of a honey with very high levels of antimicrobial activity due to hydrogen peroxide production.

**Floral factors**
- Some honeys have exceptional antimicrobial activity that is not due to hydrogen peroxide – the most famous example is certain *Leptospermum* honeys from New Zealand and Australia (a.k.a. manuka or jelly bush).
- Even once the hydrogen peroxide is neutralised, significant activity remains, so this type of activity was dubbed “non-peroxide activity” (NPA).
- Although the special properties of manuka were discovered in the 1980s it wasn’t until 2008 that scientists found that methylglyoxyl (MGO) is responsible for much of the unusual activity of manuka honey.
- It has since been established that MGO comes from a naturally occurring compound in the nectar of flowers of some *Leptospermum* species native to New Zealand and Australia.

**Honey kills super-bugs**
Medicinal honey is a very powerful wound dressing because it promotes wound healing, and it kills super-bugs.
Many different types of germs are sensitive to the antimicrobial activity of honey, just a few examples include:
- Methicillin-resistant *Staphylococcus aureus* - a.k.a. MRSA or Golden Staph.
- *Pseudomonas* species - many of these cause very nasty infections, particularly in burns patients.

**Honey and wound healing**
Wound healing is a complicated process that is not completely understood, and it is a balance between creating an environment for new healthy tissues to grow and heal, while trying not to create one that enables germs to grow and cause infections.

Infections slow down healing, cause more pain and scarring, and can become life threatening. However, our repairing tissues and germs both do best in warm, moist environments.

Unlike other topical wound dressings, honey helps to maintain a moist environment for our cells to regenerate, while also killing the bacteria that could lead to infection.

There are numerous reports of the successful use of honey in modern medicine, and these include the treatment of:
- Super-bug infected wounds, like Golden Staph infections
- Burns
- Infected surgical wounds
- Leg ulcers and pressure sores
- Traumatic injuries and chronic wounds
- Meningococcal lesions
- Side effects from radiotherapy

Honey has various properties that help wounds to heal, and these include:
- Maintaining a moist environment (which is essential for good healing)
- Promoting healthy tissue regrowth
- Anti-inflammatory activity
- Scar reduction
- Preventing bandages and other dressings from sticking to wound beds
- Reduction of wound smell
- Powerful antimicrobial activity – while being non-toxic to human cells.

**So which honey should I buy...?**
This depends on why you want the honey. If it is for general daily use as a food or tonic, there is no need to buy the more active (and also rarer and therefore more expensive) types.

However, if honey is to be used as a wound dressing, it should be one with a high level of antimicrobial activity, and it should be sterile. The best way to ensure this is to check that it is honey specifically for wound care, and that the wound care
product either has a CE mark or it is registered with the Australian Therapeutic Goods Administration as a wound-care product (there will be an AUST L number visible on the packaging). You can ask your chemist to order registered honey-based wound care products.

**What do the different ‘ratings’ used on medicinal honey mean?**

Since the discovery that manuka and some other honeys have significant medicinal properties there have been a number of systems used to describe and rate the antimicrobial activity. There is currently a confusing array of labels and terminology on different honeys, like UMF® (Unique Manuka Factor), NPA (Non-Peroxide Activity), MGO or MG (Methylglyoxal), and Active + or TA (Total Activity).

Unfortunately, this can be very confusing for people, but hopefully understanding what the different numbers mean will help.

**The NPA or UMF®**

The NPA or UMF® ratings are used to describe the unique type of antimicrobial activity exhibited by certain *Leptospermum* honeys (a.k.a. manuka or jelly bush) from New Zealand and Australia. The lab tests used to generate these ratings are called “bioassays” because they test the honey directly against a biological organism (in this case, a germ related to Golden Staph). Although the NPA and UMF® numbers are generated by the same type of lab tests and the ratings are equivalent to each other, the “Unique Manuka Factor” (UMF®) is a trademark registered by the UMF Honey Association. UMF® is only available for use under license by producers of manuka honey from New Zealand. Some other active *Leptospermum* honeys from New Zealand and Australia (with similar antimicrobial properties to New Zealand manuka) are sold with the NPA ratings. So NPA and UMF® are directly comparable, and are equivalent of each other when tested by an appropriate laboratory.

**Methylglyoxal - MGO (or MG)**

Since it was discovered that methylglyoxal (MGO) is responsible for much of the unique activity in manuka honey, a number of products on the market are labelled with a MGO (or MG) concentration. This is a direct measure of the amount of MGO in the honey and it is expressed as parts per million (ppm) or mg/kg. The numbers for this type of labelling are usually much higher than the NPA/UMF® ratings – although this doesn’t necessarily mean the honeys are more active.

There is a relationship between MGO concentration and the NPA/UMF® of a honey. However, it is important to remember that the numbers are derived from completely different types of tests, so they are not easily compared. Consumers should be aware that as the MGO scale is a completely different one, a “higher” MGO might not be as active as a honey with a “lower” NPA/UMF® rating.

As a rough guide:
- NPA/UMF® 5+ = MGO 83+
- NPA/UMF® 10+ = MGO 263+
- NPA/UMF® 15+ = MGO 514+
- NPA/UMF® 20+ = MGO 829+

But as there is more to the story of the medicinal activity of honey than the amount of MGO, just measuring this does not necessarily give the full picture of its medicinal potential.

**Total Activity**

Total activity generally refers to the activity of a honey in its entirety. That is, it includes all of the peroxide activity and any non-peroxide activity that might be present (but usually total activity honeys don’t have much of the unusual activity we see in the manuka-type honeys). And the tests that are used to generate these numbers are similar bioassays to those used for NPA/UMF® ratings.

**Is raw better?**

You often see the term “raw” used to describe honey, and although this isn’t an official term it is generally used to imply that the honey has not been heated or
filtered. There are sometimes claims that raw honey is “more nutritious” or “better for you”. However, in terms of eating Australian honey, its micronutrient profile is not overly affected by normal commercial processing.

“Supermarket” honey has usually undergone some heating during filtration and packaging. Minimally-processed honey is generally more active than processed varieties because heat (and long-term exposure to light in clear jars) can destroy the enzyme responsible for the production of hydrogen peroxide—the main factor behind the antimicrobial properties of most honeys. So, medicinal honeys for wound care products are usually processed slightly differently to honeys that are for eating.

Something to keep in mind – you might hear lots of people saying “raw” honey is best and “supermarket” honey is lower quality. This might be the case in some other countries, but in Australia we have strict food laws and our “supermarket” honey is of a very high quality - so long as it is Australian - always check the small print of the label and make sure that it is indeed 100% Australian.

Why the buzz for bees?
We know we need bees for honey and other hive products like beeswax and propolis (a.k.a. bee glue). However, bees play an even more important role in keeping us healthy, because of their essential part in feeding us all. They are crucial due to the pollination services they provide.

It is staggering to think that there are around 100 crop species that provide 90% of the world’s food, and bees pollinate over 70 of these. It has been estimated that one in every three mouthfuls of food consumed globally is dependent on the pollination services of bees. In Australia almost two thirds of our agricultural output benefits from honey bee pollination! Many fruits, vegetables, nuts and seeds need bees. Imagine your diet without them...

Despite their essential role in healthy food production, honey bee populations are declining in many places around the world, and they face serious, ongoing and complex threats.

Nectar and pollen are essential food for bees, and poor nutrition can be extremely detrimental to their health. In Australia 70-80% of the honey produced (and the pollen collected by bees for feeding their young) comes from native species. So access to native flowering plants is essential to maintain healthy honey bee populations (and beekeeping businesses).