



## Nature's Einsteins

HONEY BEES ARE THE GENEROUS EINSTEINS OF THE INSECT WORLD, WRITES REESE HALTER, WITH MARVELLOUS BRAINS AND HUMAN-LIKE BEHAVIOURS.

When we think of bees, mostly it's honeybees and in Australia, native bees, but there are some 20,000 species around the globe and all are breathtaking pollinators. Their splendid array of products and services are life sustaining not just for us, but also the planet. Beyond their extraordinary gifts and medicines, these indefatigable buzzing workers provide clues to advance our understanding of brain science through their own sophisticated physiology.

Pollinators, including bees, hoverflies, bats and a host of other creatures, facilitate a whopping 75 per cent of the food crops necessary to feed 7.7 billion humans. Almost 2000 native Australian bee species assist the European domesticated honeybees in pollinating our crops. Each year globally, according to the Food and Agriculture Organization (FAO) of the United Nations, the pollinators account for as much as US\$577 billion in commerce. From apples to coffee and scrumptious chocolate bars or pastries, bees are the key.

We also owe a debt of gratitude to approximately 1.7 trillion honeybees globally that provide about 20 million kilos of beeswax and 1.6 billion kilos of honey and medicines.

### Medicinal marvels

Honey is a proven antiseptic, renowned for its antibacterial properties, which is why some modern bandage companies line their products with diluted traces of honey. It also contains vitamins, such as B2 (riboflavin), B6 and C, as well as pantothenic acid and niacin. The goodness of honey also includes essential minerals: calcium, phosphorus, potassium, iron, copper, manganese, magnesium and sulfur. Some of these minerals in the specific concentrations found in honey amazingly mimic the concentration of blood serum.

Several years ago, scientists observed honeybees biting parasites but not killing them. It turns out that bee bites contain chemicals that stun pests, making it easier to eject



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these bloodsuckers from the colony. It was thought that these 'stun' chemicals may have an important role in human medicine as an effective anaesthetic offering an alternative to lidocaine, which some patients are allergic to.

Honeybees also make glue for their hives from tree resin, mixing it with their own enzymes. This pungent glue is called propolis, and it contains strong antiviral, anti-inflammatory, antifungal, antibacterial and cancer-fighting compounds. Propolis contains effective secondary plant metabolites that scavenge the human body to rid it of free radicals, helping keep us healthy. Not only will propolis help heal a sore throat, it effectively treats the herpes simplex virus. There is a widely available propolis-based ointment that treats all stages of a cold sore from the initial prickle, or blisters, through to healing the lesions. The astounding strength of propolis and a compound it produces, caffeic acid phenethyl ester, has been shown to halt the growth of prostate cancer in mice. Propolis clearly shows promise as a co-treatment for humans.<sup>[1]</sup>

### Brainy bees

The complexity of both honey and propolis is only surpassed by the amazing honeybee brain, which possesses a memory for time. These little mathematicians can add, subtract, count to five and be trained to return at regular feeding intervals.<sup>[2]</sup> Honeybees also vote. These golden Einstein's can even recognise an individual human face.

Honeybees and people share genetic similarities. Some thrill-seeking honeybees, just like people, are drawn to adventure. There are more than 1000 genetic differences

ABOVE: BEEHIVES CONTAIN A WHOLE LOT OF GOODNESS, FROM THE HONEY THEY PRODUCE TO AN ANTI-BACTERIAL COMPOUND CALLED PROPOLIS MADE FROM TREE RESIN.

that affect a bee's likelihood of being a thrill seeker. Some honeybee brain neurons are responsible for giving distinct personalities, according to Professor Gene Robinson of the University of Illinois at Urbana-Champaign.

Getting a good night's rest is not just important for people – without it, bees may forget activities that should be automatic. Worker honeybees require an eight-hour rest in order to perform optimally, seven days a week, from sun-up to sundown. If they don't get good sleep they can get disorientated when out foraging and even lose their way.

The worker bees probably need better pay and conditions, as after 800 kilometres of flying and visiting one million flowers or so, their wings wear out and they die! All within about six weeks.

### Fast learners

Honeybees have such remarkable brains that the Queensland Brain Institute, at the University of Queensland, devotes an entire program to understanding them. Scientists have made some stunning discoveries – among them that bees learn just like we do. They are top-down learners, meaning that they respond rather than react.

Honeybees, like people, learn while they are asleep and some UK scientists concede they may even dream! It has also been found that a bee can see both an individual tree and the forest at the same time. That's an astonishing feat, which a human eye cannot duplicate.



Consider that honeybees have about 1 million neurons in their brain cortex. Compare that to elephants with approximately 11 billion, orcas about 10.5 billion and humans between 11.5 and 16 billion. An individual honeybee brain has a number of different types of neurons with similar traits to those of an elephant, orca and human – all species with complex brains that live in complex societies.

### We need bees

Bees pollinate more than 330,000 flowering plant species, or, about 85 per cent of the plant kingdom; they must be protected at all costs. That means bolstering Australia's frontline detection to prevent entry of the deadly varroa mite, which is decimating honeybees on all other continents. Currently, Australia supplies queen honeybees' free-of-varroa to the rest of the world.

Meanwhile, widespread use of a class of insecticides known as neonicotinoids, or neonics, has wreaked havoc with the bees and many, many other insects around the globe. At two dozen parts per billion, neonics cause bees to lose their minds and shake to death, eerily similar to human symptoms of Alzheimer's and Parkinson's diseases. In June last year, French beekeepers held a symbolic funeral in Paris protesting the use of pesticides.


Climate change is also having significant effects. Higher temperatures with longer lasting heatwaves are deadly for both plants and bees as evidenced by the honey drought of 2013-14 across Australia. Its yet another compelling reason to switch from fossil fuels to a zero-combustion economy *poste haste*.

### Reigniting our connection

Today, as bees strike trouble globally, those in tune are coming to their rescue, fostering a relationship that has been going on for centuries. Throughout the ages, people and honeybees have shared an inseparable bond, deeper than many may imagine.

In ancient mythology, bees were considered sacred insects that could connect the natural world with the afterlife. There is also the traditional custom, most common in the 19th century, of "telling the bees", where important events in a beekeeper's life had to be communicated to the bees, whether marriage, births or deaths. For the latter, black cloth was sometimes draped over the hives. There is a lovely story about this in the online publication *Jstor Daily*,<sup>(3)</sup> which quotes New England Quaker writer John Greenleaf Whittier's 1858 poem 'Telling the Bees'.

In 1976, US paper *The Gadsden Times*<sup>(4)</sup> ran an intriguing story that tells of two instances where bees had attended their beekeeper's funeral – arriving for the service and then leaving once their beekeeper had been buried.

With the help of science we are learning more and more about these extraordinary creatures, and so potentially more about ourselves. But it seems humans are naturally being drawn again to their wonders. It's a growing beekeeping and bee-nurturing revolution that everyone can be a part of. 



TOP: A PAINTING ENTITLED 'THE BEE FRIEND' BY HANS THOMAS (1863/1864).  
BOTTOM: THE 20,000 SPECIES OF BEES AROUND THE GLOBE ARE AMAZING POLLINATORS.

### References

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