

**Apis-UK Issue No.46 November 2006**

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**EDITORIAL** [Back to top](#)

This month's issue takes several looks at evolutionary trends, and as usual I can only sit back and marvel at how nature has managed it all. We look at the oldest 'bee' on record, that has been sitting in its little capsule of amber for around 100 million years and we can just see the beginnings of the bee as we know it in this wasp like creature. Now, the honey bee has evolved into a very sophisticated and much specialised creature, able to carry out all of the amazing things that we all know it can do. We also look at the evolution of the compound eye which in itself is a marvellous piece of engineering; the evolution of social behaviour; the evolution of the bee brain and we look at the story of the arms race in the hive that has all of the trappings of a human spy story in its viciousness and skulduggery. Even our quote of the month gets involved with a view of how similar are bees and humans in our organisation.

In another look at an alternative member of the hymenoptera, we again investigate an ant and this time a truly great specimen that has displaced a type of shrimp as a world record holder. About a year ago we reported on gliding ants and I thought that this was spectacular, but the trap jaw ant featured in the article below beats even that.

The article on the ability of trees to change in response to climate change is worrying, even though it appears that they are hardier than we initially thought. It seems more and more likely that climate change is gathering pace as we sit and that both in our daily lives, our hobbies such as beekeeping and in our pockets we are going to see huge changes and not all of them good.

Have you ever linked pollen to good angling? Probably not, but in certain circumstances it can be a godsend. We investigate, and we also look at how we can use dirt in our fight against hay fever, and we ask, are French bees in trouble? Are they the A380 of the bee world? Some think that it is the end for them; others that they may well survive the current assault on their well being, and thrive. Perhaps only time will tell.

In this issue we move onto a subject about which I know very little. If you are one for having your body hairs brutally ripped out in a barbaric rite called hot wax depilation, (if you are, don't worry, you are still allowed to read this newsletter), then you may be in for a treat and an idea to save on the horrendous cost of such treatment. The recipe shows you how to make the stuff that does it so that you can do it virtually for free. Why pay when you don't need to? (Unless of course that's all part of the excitement!). And we can read the last in the truly fascinating series of articles by Ian Rumsey. Thanks for all the work Ian, the series has opened many of our eyes.

And all this in a month when the science editor of a major UK daily newspaper writing on the sequencing of the full genetic code of the honey bee's genome says:

*'She has a biological clock to tell the time of day, uses a sophisticated navigation system to locate food miles away and can produce the sweetest natural substance on earth simply by chewing up pollen grains.'*

I didn't realise that! Actually, the rest of the article was quite good, but it is amazing how many non beekeepers think that honey is produced from pollen – by bumble bees! Now there will be more of them.

I hope that you enjoy this issue and remember, if you have any short or long bee or bee related stories, do send them in.

And finally, can anyone tell me what this beekeeping photo is showing?



Best Regards

**David Cramp. Editor**

**NEWS** [Back to top](#)

### **French Bees under threat**

In a sort of 'bee history repeat' French honey bees are now under threat from hordes from the East. *Apis mellifera mellifera*, the native subspecies also known as the dark bee, is losing out to central and eastern European breeds because beekeepers find them easier to handle and less likely to sting.

Lionel Garnery, a bee specialist at the University of Versailles and a champion of Gallic bees, estimates the dark bee makes up around 75 percent of stocks in France after being totally dominant in the late 1980s. "If too many are imported, in certain regions, we risk causing the disappearance of local stocks that are best adapted to local ecosystems," Garnery said. The rival *Apis mellifera carnica* bees (Carniolans) are known for their calm temperaments and beekeepers like them simply because of their ease of handling. Probably due to successive beekeeping crises, caused by parasites and insecticides, which decimated dark bee stocks, apiculturists brought in overseas

A difference of opinion exists in the minds of beekeeping experts in France over the probable future of the French bee. Professionals have always preferred more prolific breeds compared to the dark bee, which has several vulnerabilities," said Thierry Fedon, one of France's largest bee breeders. "But I don't think its survival is threatened—we are only talking about certain honey-producing regions and the dark bee does rather well on its own in nature." But Raymond Borneck disagrees. A former head of beekeeping professional and technical associations whose career dates back to 1946, Borneck says the dark bees' future is "more or less a lost cause". Apiculturists must continue to survive and I think they will be using these other races more and more," he said.

## New Bee Fossil Find

Scientists have identified the oldest known bee, a 100 million-year-old specimen preserved in amber. The discovery coincides with the recent publication of the genetic blueprint of the honeybee, which reveals surprising links with mammals, including humans.

The ancient insect, trapped in tree sap, is at least 35-45 million years older than any other known bee fossil. It appears to share features with both bees and wasps, and supports theories of bee evolution. (Experts believe pollen-dependent bees arose from carnivorous wasp ancestors).



Wasp like *Mellitosphex burmensis* preserved in amber, the oldest bee fossil found and thought to be around 100 million years old.

With the arrival of pollinating bees, flowering plants blossomed on Earth. Prior to 100 million years ago, the plant world was dominated by conifers which spread their seeds on the wind. George Poinar, professor of zoology at Oregon State University, US, whose team reported the discovery in the journal *Science*, said: "This is the oldest known bee we've ever been able to identify, and it shares some of the features of wasps.

"But overall it's more bee than wasp, and gives us a pretty good idea of when these two types of insects were separating on their evolutionary paths."

The amber specimen, from a mine in the Hukawng Valley of northern Burma, has been named *Mellitosphex burmensis*. It has waspish features, such as narrow hind legs, but also branched body hair and other characteristics of bees.

The fossil bee is in remarkable condition, with individual hairs preserved on undamaged portions of thorax, legs, abdomen and head. Legs and wings are also clearly visible.

The bee's biological clock shares similarities with that of mammals

In terms of size it is tiny, measuring barely 3mm across. This is consistent with evidence that some of the earliest flowers were also small.

Professor Poinar added: "This fossil may help us understand when wasps, which were mostly just meat-eating carnivores, turned into bees that could pollinate plants and serve a completely different biological function."

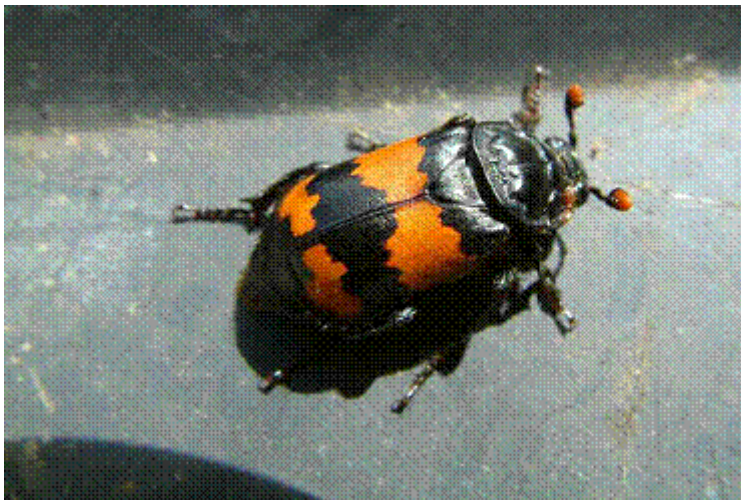
As you will have read, scientists have also recently published the genetic blueprint of the western honeybee *Apis mellifera* which is the fourth insect to have its genome sequenced, after the fruit fly, mosquito and silk moth. Locked within bee DNA there are striking links with mammals and humans, scientists discovered. Like humans,

honeybees spread into Europe from Africa, making at least two ancient migrations. They split into two genetically different European populations which, according to DNA evidence, are more closely related to African honeybees than to each other. Honey bees have an internal "biological clock" which is more like those of mammals than of flies, the research has revealed. The clock governs many activities, including time sensing, navigation, labour division, and the famous bee "dance language" which the insects use to communicate information about food sources.

**UK NEWS** [Back to top](#)  
**Hive beetle Found!**

This interesting report comes to us from Cyril McComb writing in the **Federation of Berkshire Beekeepers Associations Newsletter of November 2006**. Cyril asks if this is the first recorded instance of such an event?

Beetles in the hive are not good news at the moment. However, this specimen turned out to be very unusual. The colony had been struggling all summer, the problem being a severe infestation of varroa. Its treatment with Apiguard had proved fruitless. The result was a pile of rather smelly bees, left exposed on the floor of the WBC hive upon removal of the brood box.



The Sexton Beetle.  
Possibly *Nicrophorus*  
*Investigator*

The heap was gently moving up and down and investigation revealed a very large black beetle, banded with orange, foraging amongst the rotting debris. This turned out to be one of the several species of the banded sexton beetle to be found in Britain, probably *Nicrophorus Investigator*.

Normally the beetle searches for dead creatures, such as birds or small mammals. Having found one, it proceeds to bury the corpse beneath the soil, before removing feathers or fur and covering the cadaver with a mucus-like substance, which masks the smell of decay. This ensures that the beetle's larvae, when they emerge from their eggs, have the food source very much to themselves. The beetle and its mate are also unusual inasmuch that they care for the young grubs, feeding them with regurgitated flesh from the rotting corpse.

The beetle, when removed from the hive, proved to be covered with mites, although not those of varroa. These gamasid mites were simply hitching a ride and are not believed to be injurious to the host. Their prey is blowfly larvae and clinging to the beetle is the certain route to an infested corpse.

The writer wonders if this is the first instance of a banded sexton beetle being found in a beehive.

### **Man, manhole, and bees**

Earlier this month, a colony of bees was saved after being found in a manhole in Jersey. Don Anfray, the beekeeper who rescued them, says it is the strangest place he has ever found them. Parish workmen called him after they saw bees flying in and out of a manhole on Queen's Road. The 5,000 bees were thriving and had built comb.

Fearing they would have to be destroyed Mr Anfray took them home to his hives where he says they are doing well and will be producing honey for next year.

(Let us know the strangest place that you have found a comb. I think for my part, it was at RAF Waddington in Lincolnshire, the main gate of which couldn't be guarded (at the height of the IRA campaign), because the well armed guards were too scared to be there because of a swarm in the nearby hedge. Ed).

### **RESEARCH NEWS** [Back to top](#) **Global Warming and Trees**

Trees and other plants are the lifeblood of bees and beekeepers and it has often crossed many a beekeeper's mind how exactly global warming will affect trees and so affect their own beekeeping activities. It is of course doubtful that changes will come about rapidly but even now most of us have noticed differences in the timings of the flowering plants. But if matters change significantly over time, how will this affect trees. Now scientists are making some progress with this type of study. Research undertaken by scientists at the University of Illinois at Urbana-Champaign, shows that trees appear to respond slower to climate change than previously thought

Genetic analysis of living spruce trees provides strong evidence for the presence of a tree refuge in Alaska during the height of the last glacial period (17,000 to 25,000 years ago), and suggests that trees cannot migrate in response to climate change as quickly as some scientists thought.

White spruce (*Picea glauca*) is a dominant species in the boreal forests of North America. In their study, the researchers analyzed chloroplast DNA from 24 spruce forests in Alaska and Canada. Because chloroplast DNA contains genes inherited from only one parent, there is no confusing genetic recombination to take into account.



Spruce may have survived the last glacial maximum in tree refuges

They found a significant pattern in the geographic distribution of the chloroplast DNA haplotypes (groups of individuals with similar sequences of base pairs of genetic material) that differentiates into two regions.

The chloroplast DNA, offers compelling evidence that white spruce survived the last glacial maximum and probably some of the previous glacial episodes in Alaska. This survival must have been facilitated by the existence of favourable microhabitats ... and by adaptations of these trees to harsh climate.

The DNA data help resolve an old controversy over the manner in which trees had migrated in response to past climate change, said Feng Sheng Hu, professor of plant biology and geology at Illinois and corresponding author of the paper.

One view is that trees were restricted to areas south of the continental ice sheets covering North America, and then migrated extremely rapidly as the climate grew warmer. The other view is that there was a refuge in the ice-free areas north of the ice sheets, and spruce trees expanded within those areas as the climate warmed. It now seems clear that a glacial refuge did exist and so the trees advanced from at least two directions.

Based on the data, it also appears likely that the migration rate was lower than previously thought.

These results suggest that current estimated rates of tree migration from fossil pollen records are too high and that the ability of trees to keep pace with global warming is more limited than previously thought. Additional analysis of fossil pollen in sediments, as well as DNA data from living trees, could help pin down the actual rate of tree movement over time. The researchers' findings also illustrate the great resilience of white spruce – and perhaps other tree species – to climate change, and have important implications for the future.

For example, isolated populations of trees might persist in locally suitable habitats for long periods after regional climatic conditions have become unfavourable as a result of rapid global warming. This resilience might reduce the probability of species extinction and allow time for efforts at biodiversity conservation.

Or maybe not....

### **Pollen helps anglers!**

Pollen has been shown for the first time to benefit lakes. Mark Graham, a PhD student from the Department of Biological Sciences at the U of A has concluded that rich in nutrients, pollen is an essential component of plant fertilization but few think of its importance to fertilize lakes. Wind-dispersed pollen in early summer is not only visually striking, but it can represent a substantial pulse of nutrients to northern lakes. Graham's research team found that plankton responded strongly to additions of pollen in experimental enclosures, located along the shorelines of three boreal lakes in northwestern Ontario's Experimental Lakes Area. "Specifically, pollen subsidized the lake water nutrient levels and in turn, promoted the abundance of plankton," said Graham, who is working with Dr. Rolf Vinebrooke in the U of A's Freshwater Biodiversity Laboratory. "Our findings strongly suggest that pollen is an important linkable between terrestrial and aquatic ecosystems in northern environments."



Boreal lakes could benefit from being 'fertilised' by pollen

By increasing the availability of plankton, an important food resource for forage fish, the production of harvestable sport fish may also rise, all thanks to pollen.

This research is published in the current issue of the journal "Limnology and Oceanography."

## Using common dirt to fight hay fever



A new drug that tricks the immune system into thinking that it is under attack, could soon be used to tackle hay fever according to scientists. Allergic reactions occur when the body's defences react to harmless substances, such as pollen, and research suggests that diverting the immune system could be a successful way of preventing them.

Cytos Biotechnology, a company based in Zurich, Switzerland, has developed an experimental drug that fools the immune system into thinking that it is under attack from a germ called mycobacteria, found in dirt, and early results suggest a benefit for hay fever.

When 10 people suffering from hay fever were injected with the drug, CYT 003-QbG10, their sensitivity to grass pollen was reduced by a factor of 100, *New Scientist* magazine reports. Cytos said that the patients remained symptom-free for up to eight months, but it is not yet known whether the results are permanent. A previous study indicated similar benefits for patients allergic to dust mites. They are symptom-free a year on. Cytos has begun a study on more than 100 people with hay fever, dust mite allergy and atopic dermatitis. Mycobacteria, also found in soil, are pathogens to which people are exposed at much lower levels than in the past. Artificial exposure may "reboot" the immune system.

## Evolution and the Compound Eye

### What has a fruit fly got that a bee doesn't have?

Researchers at the University of California, San Diego have discovered that the presence of a key protein in the compound eyes of the fruit fly (which glow at centre due to a fluorescent protein) allows the formation of distinct light gathering units in each of its 800 unit eyes, an evolutionary change to an "open system" that enabled insects to make significant improvements in visual acuity and angular sensitivity. In contrast, beetles, bees and many mosquito species have the light-gathering units fused together into a "closed system."



In a paper published in the online edition of the journal *Nature*, the scientists report that one of three proteins needed to form these light gathering units is present in the visual system of fruit flies, house flies and other insects with open eye systems, but conspicuously absent in beetles, bees and other species with closed systems. The researchers showed that the loss of this protein, called "spacemaker," can convert the eyes of fruitflies—which normally have open eye systems—into a closed one.

In contrast, the introduction of spacemaker into eyes with a closed system transformed them into an open one. "These results help illustrate the beauty and power of evolution and show how 'little steps'—like the presence of a single structural protein—can so spectacularly account for major changes in form and function," said Charles Zuker, a professor of biology and neurosciences at UCSD and a Howard Hughes Medical Institute investigator, who headed the research team.

### **Bees and Flight Distance**

*This interesting piece of research adds considerably to our knowledge of how bees judge distance when dancing.*



Image motion  
gives honey bees  
distance cues

"Our study suggests that honeybees use cues based primarily on image motion to monitor flight distances of hundreds of meters in natural outdoor environments," reports Science author Mandyam V. Srinivasan. Passing many visual landmarks-such as trees or flowers-makes the insects feel they have travelled a long way, just as telephone poles whizzing by a car window may enhance a passenger's sensation of speed, says Srinivasan, a professor with the Australian National University's (ANU) Centre for Visual Science within the Research School of Biological Sciences. When foraging bees locate a meal more than 50 meters from the hive, it has long been known that they return to the colony and waggle their abdomens in the direction of the food source. The longer the dance, the farther the journey to food. If a meal is located closer than 50 meters, bees simply turn a few circles, performing what's called a "round dance."

In the late 1960s, other researchers had suggested that bees determine the distance to food based on the amount of energy expended during flight, Thomas Collett of the University of Sussex (U.K.) explains in a related Science "Perspectives" essay on Srinivasan's work. Then, in 1996, a different team discovered that bees flying between very tall buildings performed waggle dances suggesting they had flown half the distance signalled by bees travelling the same course near street level, presumably because "as the ground drops away, it doesn't seem to move as quickly by the bees' eyes," Srinivasan says.

Building on this earlier work, Srinivasan and his coauthors-Shaowu W. Zhang of ANU and Monika Altwein and Jüergen Tautz of Germany's Universität Würzburg-have prompted bees to waggle even when food is close to the hive, by bombarding their eyes with optical cues during the journey. The research, sponsored by the U.S. Defence Advanced Research Project Agency (DARPA) and the Australian Defence, Science and Technology Organization, ultimately may guide new military technologies. "We are interested in exploring the possibility of developing autonomous, flying vehicles that incorporate some principle of insect vision to avoid obstacles, perhaps for surveillance applications," Srinivasan says.

Such technologies might include, for example, "microair vehicles," just six inches long or smaller, adds Alan S. Rudolph, a DARPA program manager. To test bees' optical odometers, Srinivasan's group sent *Apis mellifera ligustica* Spinola specimens on a search for snacks inside a narrow tunnel, which was 6.4 meters long, 20 centimetres high, and only 11 centimetres wide-roughly 21 feet by 8 inches by 4.3 inches. The tunnel entrance was positioned near a specially designed "bee farm," a hive sandwiched between transparent observation windows. In a series of experiments, a feeder was then placed near the tunnel entrance, or 6 meters inside the tunnel, so that it was between 35 and 41 meters from the hive, a distance known to prompt only round dances among bees flying outdoors.

Decorating the tunnel's interior with a random, black-and-white pattern prompted most bees (90 percent) to waggle, although they danced in circles when flying similar distances between various outdoor feeders on the ANU campus. When the tunnel was adorned instead with horizontal black and white stripes, bees mainly performed round dances (86.7 percent), apparently because they were flying parallel with the lines, and therefore weren't receiving an exaggerated amount of optical input. Flying close to tunnel walls-particularly those decorated with overly busy wallpaper-amplified the bees' perception of distance, skewing the insects' optical odometer by as much as a factor of 31, the Science paper concludes. Consequently, 6 meters inside a tunnel feels to a bee like 186 meters outdoors.

In summary, a bee waggles one millisecond for every 17.7 degrees of image-motion it sees, the researchers found. The formula isn't absolute because a bee's perception of distance is "environment dependent," the researchers report. But, the findings should

help scientists better understand the optical mechanisms that allows bees to locate a promising buffet.

### **The evolution of social behaviour in Bees**

One of the questions in the evolution of bees is how some species developed social behaviours and over the last century there has been a wealth of research carried out on the subject. Now, Arizona State University Life Sciences associate professor Amdam thinks part of the answer can be traced back to bee reproductive traits.

Beekeepers will know that honeybees live in highly complex communal societies that include divisions of labour among worker bees. Workers are female bees whose jobs include cleaning, maintaining and defending the hive, raising the young and foraging for nectar and pollen.

Other species of bees, like carpenter bees, do not engage in social behaviour and instead lead solitary lives. This has prompted researchers to look into how social structures and divisions of labour have arisen in bees from their solitary ancestors. Amdam's research supports the idea that elements of the reproductive behaviour of those ancestors evolved to form a basis for social living and divisions of labour. This insight provides evidence for how complex social behaviour evolves—evidence that could have value for studies of social behaviour in other animals, possibly even humans.

"How social life emerged from a solitary lifestyle is a fundamental question," Amdam said. "One theory is that social behaviour emerged through new evolutionary inventions. Another is that ancestral solitary phenotypes (characteristics of an organism) were the building blocks of social life, providing a foundation from which social forms could be assembled. For bees, our research supports the latter theory." Amdam's research began as a doctoral dissertation at the Norwegian University of Life Sciences. She continued the work at University of California, Davis in 2003 researching the evolution of social behaviour and aging in bees.

While at Davis, Amdam met Professor Robert Page, who was breeding honeybee strains distinguished by whether the worker bees were more likely to collect pollen or nectar. Besides their differing collecting habits, the strains possessed various other physiological and sense-related traits, but researchers did not understand how these suites of traits emerged. Together, Amdam and Page theorized that foraging behaviour could have something to do with reproductive differences in the worker bees of the two strains. "Worker bees—which are exclusively female—are considered to be 'facultatively sterile,' meaning that when a queen is present, they do not lay eggs," Amdam said. "However, if the queen is removed, some of these females develop their ovaries and lay eggs." Foraging for pollen is a maternal reproductive behaviour in solitary species of bees, while non-reproductive solitary bees feed mostly on nectar. Amdam wondered if similar relationships were present in the highly social worker bees. She noticed that a certain protein—called vitellogenin—associated with a bee's reproductive status was more common in the strain of bees that preferred to forage for pollen (identified by Amdam as the high pollen-hoarding strain). Low levels of this protein were associated with bees that foraged mostly for nectar (the low pollen-hoarding strain).



Foraging for pollen is a maternal reproductive behaviour in solitary bees.

Is there a similar relationship in highly social honey bees?

Using that as a foundation, Amdam and Page hypothesized that the high pollen-hoarding strain of social worker bees, although non-reproductive, represented the maternal, reproductive state of its solitary ancestors, who presumably foraged for pollen when reproductively active. By contrast, the low pollen-hoarding strain of worker bees represented the state of those same ancestors when they were not reproductively active. Due to the emergence of colonies with queens responsible for reproduction, the ancestral foraging states were no longer linked to reproductive activity in worker bees, predicted Amdam. But the states could still influence foraging behaviour, resulting in a division of labour between pollen-foraging and nectar-foraging worker bees. To test this hypothesis, Amdam set up a race of sorts to determine which strain of worker bees became reproductively active the fastest. She separated the high and low pollen-hoarding strains into "teams," with the high pollen-hoarding strain representing the ancestral maternal reproductive state, and the low pollen-hoarding strain representing the non-reproductive state. If her hypothesis were correct, the high pollen-hoarders would win the race and develop ovaries sooner than the low pollen-hoarders.

Amdam's prediction proved to be correct when after 10 to 21 days, 76 percent of the high pollen-hoarding strain had developed active ovaries, compared to 42 percent of worker bees in the low pollen-hoarding strain. Students working with Amdam also noticed that the winning strain of worker bees was characterized by larger ovaries, which would contribute to greater reproductive output, furthering the case that foraging behaviour was tied to reproductive traits.

Amdam then put her results to a crucial test—wild-type bees (bees that had not been used in the experiment) were captured after their first foraging flight. Amdam and her team recorded what the bees brought back from the forage and measured their ovaries.

Results from the experiment validated her hypothesis, showing that pollen collection was primarily conducted by worker bees with larger ovaries, cementing the connection between high pollen-hoarding strains and reproductive traits. Amdam also found it remarkable that other physiological traits known to differ between the two strains also correlated with ovary size in the experiment. **The success of Amdam's research could prove more far-reaching than just the evolution of bee social behaviour**—scientists can use the findings as a stepping stone when looking at the social evolution of other animals. "Our findings identify a bridgehead between solitary and social behaviour," Amdam said. "If we can understand the emergence social behaviour in one system, we can use this insight to create a more general model. Once

we have a general model, we can build new hypotheses that outline how similar principles might apply to other animals.”

A paper describing Amdam’s experiments, “Complex social behaviour derived from maternal reproductive traits,” was the cover story of a 2006 issue (Jan. 5, 2006) of *Nature*. Additional authors of the paper included M. Kim Fondrk and Robert Page from Arizona State University, and Angela Csondes from the University of California, Davis.

### **Scientists Identify 36 Genes, 100 Neuropeptides in Honey Bee Brains**

From humans to honey bees, neuropeptides control brain activity and, hence, our behaviours. Understanding the roles these peptides play in the life of a honey bee assists researchers in understanding the roles they play in their human counterparts.

There are a million neurons in the brain of a honey bee (*Apis Mellifera*) and the activities of these neurons are influenced by the sea of peptides they are bathed in and these Neuropeptides play a role in the bees’ shift from working in the hive to foraging, displaying and interpreting dance language, and in defending the hive say researchers of the Roy J. Carver Biotechnology Centre at the University of Illinois at Urbana-Champaign and in order to use the honey bee as a model for sociogenomics, and to link molecular information to neurochemical and physiological data, they first must know the identities of the peptides used in the brain and the genes they are encoded by.

Using a combination of the newly available honey bee genome sequence, as well as bioinformatics and mass spectrometry, collaborators from the United States and Belgium inferred the sequences of more than 200 possible neuropeptides and confirmed the sequences of 100 neuropeptides from the brain of the honey bee.

This study lays the groundwork for future molecular studies of honey bee neuropeptides with the identification of 36 genes, 33 of which were previously unreported, the researchers write in the Oct. 27 issue of the journal *Science*.

Some of the neuropeptides the researchers discovered were a result of direct measurements of bee brains using an extremely sensitive mass spectrometer. Some of the genes were found because they resembled genes discovered in other species, such as the fruit fly (*Drosophila melanogaster*). And, because genes that produce neuropeptides often have repeating sequences, some of the genes were found by a computer algorithm that scanned the honey bee genome for such telltale sequences.

The research found 36 genes, from which were detected 100 peptides by mass spectrometry and by combining other techniques, from bioinformatics to proteomics, an additional 100 peptides were inferred. They admit that some of the inferred peptides may not have been measured because they were present at too low a level to be detected. Others may have been missed because they are present only during particular developmental stages. Future work will no doubt find and confirm more of the brain’s peptides.

At <http://www.neurobiologie.fu-berlin.de/beebrain/Model.html>, they present model which allows you to view and experience the Virtual Honeybee Brain visually and interactively in all three dimensions. It’s well worth a look especially for those interested in this type of research. You can download the complete atlas of the honey bee brain.

### **Amazing Hymenoptera Displaces Shrimps in the Record Book**

Can you imagine going to a sports meeting and watching an average man launch himself 44 feet into the air or 132 feet in the long jump? A miracle indeed, but one member of the hymenoptera, the trap jaw ant has evolved this capability simply by snapping their jaws and can move these distances (comparative to their size) with no difficulties. In fact, the mandibles of this ant have evolved two entirely separate

functions, one to attack and capture their prey and the other to escape in a hurry a lizards flicking tongue.

This species of ant is a native to Central and South America and is entering the annals of extreme animal movement, boasting jaws arguably more impressive than such noteworthy contenders as the great white shark and the spotted hyena.



The Trap jaw ant showing the incredibly fast mandibles about to snap shut.

Trap-jaw ants, *Odontomachus bauri*, fire their mandibles with such acceleration that when the mandibles strike a hard surface, the forces generated are strong enough to propel the ants' bodies through the air. In the 'escape jump', the ant's trajectory is directed upward. In a 'bouncer defence jump' by comparison, the ant clears a greater horizontal distance.

In clocking the speed at which the trap-jaw ant closes its mandibles, scientists found that they could do this at 35 to 64 meters per second, or 78 to 145 miles per hour - an action they say is the fastest self-powered predatory strike in the animal kingdom. The average duration of a strike was a mere 0.13 milliseconds, or 2,300 times faster than the blink of an eye. A research team at the University of California, Berkeley, calculated the kinematics of the trap-jaw ant's mandible strikes with the help of advances in high-speed videography.

The jaws, used to capture prey and to defend the ant from harm, accelerate at 100,000 times the force of gravity, with each jaw generating forces exceeding 300 times the insect's body weight. The ants in the study had body masses ranging from 12.1 to 14.9 milligrams. The researchers believe that the truly relevant number here is not the incredible mandible closing speed, but the acceleration that is most impressive. The acceleration is huge relative to the tiny mass of the mandibles. The mandibles are operating in the outer known limits in biology in terms of speed and acceleration.

The researchers acknowledged that falcons can dive as fast as 300 miles per hour, but say that the raptors must start from very high altitudes and get a boost from the force of gravity to reach those speeds. In comparison, animals such as trap-jaw ants and mantis shrimp (which formerly held the record for swiftest strike in the animal world) utilize energy stored within their own bodies. The mandibles of the trap-jaw ant, for instance, are held cocked by a pair of huge, contracting muscles in the head. The muscles are sprung when their corresponding latches, each on a shield-like plate called the clypeus, are triggered.

Having this latch system is critical in obtaining the explosive speeds. In general, muscles aren't good at generating fast movements. As an example, if a person were to throw an arrow, it wouldn't get very far. But by using a crossbow, elastic energy is stored in the bow, and a latch releases the stored energy almost instantaneously. As a result, the arrow shoots out very fast and goes much farther. That's exactly what really fast organisms are doing.

It's no wonder, then, that the trap jaw ants can launch themselves into the air with a mere snap of their jaws, achieving heights up to 8.3 centimetres and horizontal distances up to 39.6 centimetres.

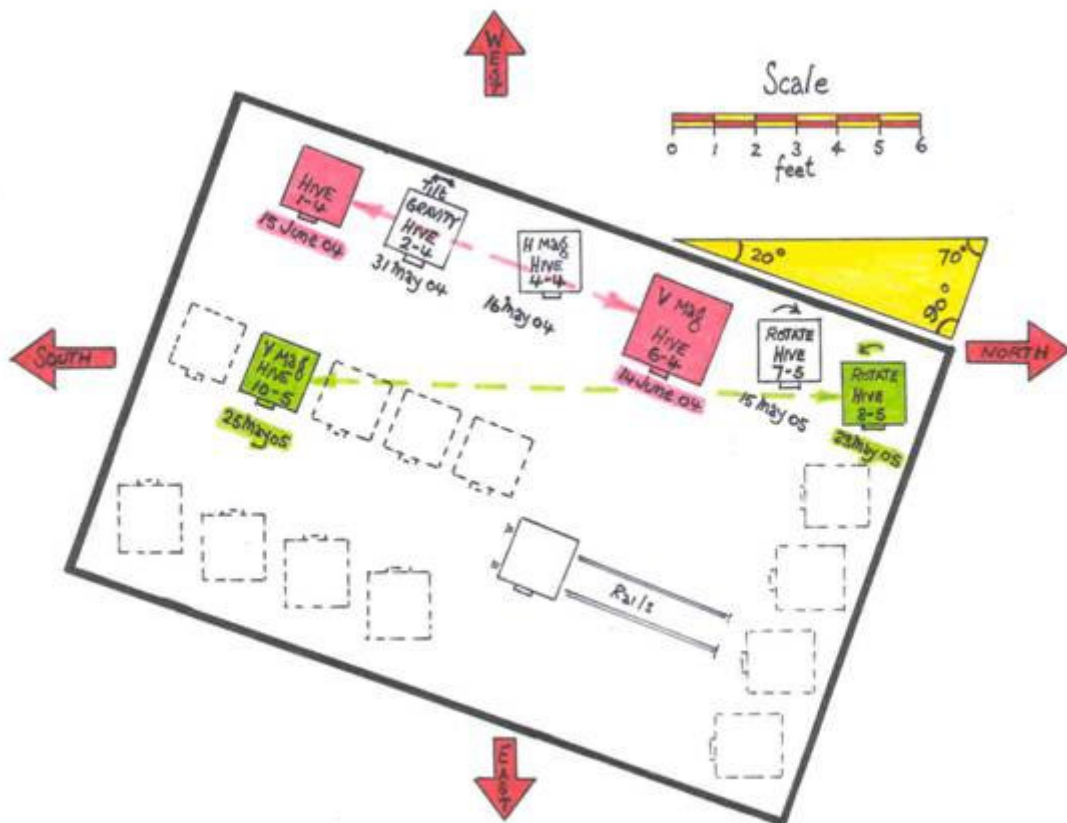
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### Bees and Rotating Hives (Part 5 of 5)

**Ian now concludes his fascinating 5 part look at bees and rotating hives. I think that the whole series has been excellent, so thanks Ian and tell us more as soon as you can.**

A problem now exists however concerning the two experiments with vertical magnetic fields due to the deviation of comb alignment being in one case 70 degrees, and in the other 90. Before proceeding further it would appear advisable to reconsider this situation to see whether some rational explanation may be forthcoming.

From the site diagram below, the position, and relative angles, regarding compass alignments, are shown and it is apparent that hive 6-4, provisioned with a swarm and a vertical magnetic field on the 14th June 04, is positioned 20 degrees East of North to hive 1-4, established 15th June 04. Arrangement shown in pink.



Winding the clock forward by one year, Rotating hive 8-5 established 23rd May 05 would be influenced by the arrival of hive 10-5 on the 25th May 05 together with a vertical magnetic field. Arrangement shown in green.

These two hives are in a direct North-South alignment. One might from this infer that the angles between hives 6-4 and 1-4 and between hives 8-5 and 10-5 relative to a North - South alignment might, in some way, influence the degree of comb deviation. If this were the case hive 1-4 would require to be aware of the position of hive 6-4, which is possible due to the location of the magnet, but hive 6-4 would then require to be aware of hive 1-4.

One is confronted with a seemingly illogical phenomena where particles, or in this case hives, appear to communicate with each other and be aware of each others presence, as in Quantum physics. This is no more than two inanimate objects being mutually attracted to each other as demonstrated by gravity, which to me is a most difficult thing to understand, let alone explain, without taking into consideration the rotating mass of an atom.

No matter, let us continue to enjoy the free beauties of Nature by further study of the bee.

### **RECIPE OF THE MONTH** [Back to top](#)

A couple of weeks ago I had a heart operation and during the various tests preceding the operation I had numerous test leads stuck to sticky pads on my body. The pain when they pulled the pads off was of course awful, yet some people actually pay to have this torture. This brings us to this month's recipe which is for depilatory waxes and creams. Make them up and by using them, at least you won't have to pay!

Depilatory waxes are made using various proportions of resins, beeswax and oils. To obtain a low melting point near 40 to 45 0C, honey is sometimes included. No other ingredients are essential for this mixture. The liquefied waxes are applied in a thin film on the skin and covered with a strip of muslin cloth pressed firmly to the skin. When cooled, the skin is pulled taut and the cloth strip is pulled against the direction of hair growth.

A French patent describes aromatic oils and resins added to beeswax as analgesics or perfumes and triethanolamine as an emulsifier. The final mixture is spread on a siliconized paper.

#### Depilatory Wax.

According to Anon (1965) it consists of the following (in parts by weight):

- 20 Beeswax
- 1 Benzoin
- 170 Resin
- 0.5 Lemongrass oil
- 90 Vegetable oil
- 1 Tolu balsam

#### Depilatory cream

Ingredients (in parts by volume):

- 42 Rosin
- 37 Beeswax
- 6 Carnauba wax
- 15 Mineral oil (white petrolatum)
- perfume

Melt the beeswax and the carnauba wax and mix in the resins and oil. When cooled to below 40°C add the other ingredients. If preservatives and antioxidants are not used, the cream has a limited life. If you do use them and they are heat stable, they can also be mixed earlier

### **HISTORICAL NOTE** [Back to top](#)

The historical note for this month looks at a time when beekeepers and bee ‘scientists’ or observers were just beginning to discover the true nature of the bees, but hadn’t quite got it yet. The Rev. William Cotton in his letter to cottagers (Part 2) talks about raising a queen in this passage and it seems that he almost has it right when he quotes Francoise Huber – but not quite.

*‘Francoise Huber, whom I shall call’ King of the Bees’ proved quite plainly that the Bees have the power of breeding up a new queen out of the egg of a common worker; he found that if he took away the queen from a hive in which there were grubs, not above three days old, the bees are able to turn a working grub into a queen, as soon as they find out the loss of the old. They pull together the six cells, which abut upon that which contains the young grub intended for their future queen: on this ruin they build a royal palace, quite different in shape. The long cells are the nurseries.*

*I do not believe they pour the queen’s food in upon her, as I have told you they do that on which worker grubs live and grow. And why? If they did so, it would run out again; for the queen’s nursery is like a bottle hanging with its mouth downwards: so when she wants food, she cries for it; and there is, I have no doubt, some kind nurse always ready to give it to her’.*

### **POEM OF THE MONTH** [Back to top](#)

This month’s poem is very short and simple. But when you really think about it, it says so much.



While honey lies in every flower, no doubt,  
It takes a Bee to get the Honey out.

Arthur Guthernon,  
A Poet’s Proverbs

**QUOTE OF THE MONTH** [Back to top](#)

In this issue we have reported on how neuropeptides control brain activity and hence, our behaviours and that understanding the roles these peptides play in the life of a honey bee assists researchers in understanding the roles they play in their human counterparts. Well this has all been thought about before now as we can see in the following quote: so who said this?

***'The human race, in its intellectual life, is organised like the bees: the masculine soul is a worker, sexually atrophied, and essentially dedicated to impersonal and universal arts; the feminine is a queen, infinitely fertile, omnipresent in its brooding industry, but passive and abounding in intuitions without method and passions without justice.'***

Last month's quote came from William Blake in his 'Proverbs from Hell'

