



Eva Crane Trust

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## On the scientific front

### Magnetism and bees

A number of enquiries have been received about recent work on relationships between magnetism and bees. In *Bee World* in 1974<sup>1</sup>, we described experiments on the direction in which bees build combs, which had indicated that swarms and their daughter swarms built combs oriented in the same direction with respect to the horizontal component of the earth's magnetic field. However, later research workers were not able to obtain similar results.

David De Jong<sup>2</sup> tried to find answers to some of the questions raised in the *Bee World* article, and he was one of those who could not repeat the earlier results, whether he used either artificial swarms or wild swarms. When swarms established themselves in the bait hives he provided, the direction of combs they built was random with respect to both the hive entrance and the earth's magnetic field. However, when swarms were relocated in further empty hives *within 5 days* of the original occurrence of swarming—when only a few combs had been started—they did, to a significant degree, build comb in the second hive in the same direction as in the first. If swarms were left 9–10 days before relocation, they did not. (Other experiments showed that when honeybees start comb building they *can* use the earth's magnetic field as a directional reference.) It is therefore suggested that the memory of comb direction is ephemeral. Bees can remember the direction while this memory is still in the process of being imprinted on them at the start of comb building, but when more combs have been built and this memory is no longer required, it disappears.

From this and other evidence, for instance effects of magnetic fields on their dances, it must be accepted that honeybees can perceive both strength and direction of magnetic fields. We now know how this is likely to be done.

Before 1970 the idea that any animals could perceive magnetic fields was regarded as suspect and ill founded, but since 1970 good evidence has been presented that this is so.

Various groups of animals are sensitive to magnetic fields, including many bacteria, fish (rays and sharks), homing pigeons and, now, honeybees. James Gould<sup>3</sup> has published an interesting general account. With his colleagues at Princeton University, USA, he has found that the body of a worker honeybee contains a million or more tiny crystals of magnetite ( $\text{Fe}_3\text{O}_4$ ). These are apparently synthesized late in the pupal stage, several days after the larva has finished feeding. The crystals are in the front of the abdomen, near one of the bee's two gravity-detecting organs, and their net alignment produces a natural magnetic field in the horizontal plane of the bee, at right angles to its body axis. They provide a mechanism whereby the bee can respond to magnetic fields such as that of the earth. This has been further explored by Kirschvink<sup>4, 5</sup>, who also examined published experimental data on 'errors' in direction indication by honeybees dancing in different magnetic fields. Calculations gave results consistent with the concept of magnetoreceptors, each containing a slightly elongated crystal of magnetite (about  $10^{-12}\text{mm}^3$  in volume) that is free to rotate into alignment with the geomagnetic field.

This year it has been reported<sup>6</sup> that Robin Baker, Janice Mather and John Kennough in Manchester University, UK, have located magnetic material in the bones of the sinus in the human nose. If confirmed, this could explain why at any rate some human beings can 'feel' the direction of the earth's magnetic field. Such a sensitivity is likely to be better developed in primitive peoples, who are accustomed to use it, than in others.

### References

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