Home & Away

Pigeons' amazing homing ability has seen them used throughout history to save lives, control empires - and even deliver the post. But how they find their way home is still a major source of controversy. Heather McLean reports

In October 1918, one month before the Armistice was signed in the Forest of Compiegne, France, to end the First World War, 194 American soldiers found themselves surrounded by German troops in the Argonne Forest of Germany.

Cut off from friendly forces, their only hope was to alert the Allies of their position. They had no working radio and their commander, Major Whittlesey, had to make a desperate decision. He attached the co-ordinates of the Lost Battalion, as they were later to become known, to the leg of a pigeon and let it loose. The pigeon, named Cher Ami, had a driving natural instinct - to get home. He flew from behind enemy lines back to his loft 25 miles away, where Major Whittlesey's commanders were, in just 25 minutes.

Cher Ami was shot through the chest but made it home with the vital message hanging from a mangled leg. Hours later, the soldiers were rescued. Cher Ami was awarded the French Croix de Guerre with Palm for saving 194 lives.

This common bird's natural homing talents have been used throughout recorded history as an alternative to human messengers, notably in Ancient Egypt, the African city of Carthage and Roman Italy. These descendants of the wild rock dove were once the exclusive property of royalty and emperors and were the fastest and most reliable way of exchanging information. They kept rulers in touch with the latest modes of thinking, news of their vast lands, and warnings of attack. It is thought that Egyptians were the first to domesticate rock doves, carrying them on ships as early as 2900bc to alert the Pharaohs that visitors were approaching. Around 2000bc, the Sumerians used domesticated rock doves to deliver messages, which helped them maintain control of a vast territory that ranged from the Zagros Mountains in Iran to the Taurus Mountains in Turkey, and from the Persian Gulf to the Mediterranean Sea. The great empires of Persia and Egypt were not the only early civilisations to have captured rock doves and trained them to carry messages. China had a pigeon postal system, and in Ancient Greece pigeons brought results of the Olympic Games to Athens. Genghis Khan, the 13th-century Mongol emperor, used a pigeon relay network to communicate with his hordes of soldiers as they marched relentlessly across Asia and into Europe, creating an immense empire that stretched from Korea to Hungary.

While the use and appreciation of pigeons has dwindled considerably since ancient times - although they are still used today in parts of India to deliver the daily post - the fascination with just how they find their way home has not.

Scientists have spent more than a century trying to understand how a pigeon can orientate itself anywhere it is released, then navigate many miles back to its loft. There are two main schools of thought. The first is that pigeons use an internal magnetic compass to orientate themselves and an external compass, the Sun, to navigate. The second is that pigeons rely on external influences of olfactory and

visual cues to orientate and navigate.

Scientists who support the latter theory believe that it has not been conclusively proven that pigeons can read magnetic fields. In turn, supporters of the magnetic compass idea claim that, just because an experiment seems to confirm that pigeons will use visual cues to navigate, it doesn't mean that they don't use a magnetic compass. And so the arguments go on.

Although the pigeon's ability to navigate has been recognised for hundreds of years, it wasn't until the late 19th century that people began to scientifically question how the birds manage this feat. The first stage of learning about pigeon navigation was discussion, which gave rise to many hypothetical ideas on what might give the birds their homing ability. One suggestion from Charles Darwin in 1873 stated that pigeons were able to somehow follow their route from home to a given point, perhaps using visual or olfactory clues, so they could remember how to get back again.

Another early hypothesis came from C Viguier in 1882, who took his idea from human navigational charts based on the magnetic-field theory. Viguier suggested that pigeons were able to detect the Earth's magnetic fields and could feel them as a horizontal and vertical force, like a three-dimensional compass all around them. In the early 1900s, evolution in the scientific approach led to descriptive experimentation, with simple displacement experiments being used to test hypotheses. Pigeons were released at increasing distances from home to see how distance, the route used to take the birds to the release point, and varying weather conditions affected their navigational ability. It was found by E Clapar de in 1903 that no matter how convoluted the route had been, the birds took the shortest route home. Several other scientists recorded that a pigeon's ability to home efficiently decreased as the distance from the bird's loft increased, and that routes taken more than once were flown faster. They said this showed that as well as using innate homing mechanisms, pigeons were able to learn through experience, helping to fuel the visual theorists' arguments.

Later types of displacement experiments, which are still carried out today, also involved depriving the birds of different faculties that they might rely on to navigate, for example the sense of smell was tested by placing strongly smelling substances in the bird's nose or surgically cutting its olfactory nerves.

The first theoretical concepts of pigeon navigation were published during the 1950s, opening the way for more active types of scientific research.

One model, published by G Kramer in 1953 and still a dominant school of thought today, is the "map and compass" theory of homing. Kramer believed that birds were able to orientate themselves in unfamiliar territory, then navigate home using the Sun as an external point of reference or compass.

Kramer describes the map and compass method as: "... composed of two fundamentally different steps, one establishing the position of the release place, the other determining the direction of flight. Both steps are parallel in human orientation, the first being represented by the procedure of studying the map, the latter by consulting the compass."

This method of external compass use was demonstrated to work when pigeons were subjected to "clock-shifting" experiments by K Schmidt-Koenig in 1958.

Clock-shifting requires birds to be kept in dark rooms during the day and kept

awake at night. When released after clock-shifting, the pigeons found the right direction to fly in, but failed to find their way home because, Schmidt-Koenig said, they were not able to interpret the position of their Sun compass correctly.

Kramer's compass orientation was established as the basis for much avian navigation theory. It became the first solid theoretical framework on which scientists could base their ideas. Theories that did not include the idea of an external compass were disregarded and scientists began testing pigeons to see what else they might use to orientate and navigate, to support the theory of their use of the Sun as a compass and to try and ascertain what the birds used when the Sun was hidden by cloud.

In the 1970s, for the first time, it was demonstrated, behaviourally, that pigeons used magnetic fields for navigation. The researchers said pigeons are hatched with an internal magnetic compass and clock that allows them to learn to use the Sun and the Earth's magnetic fields. The Sun was thought to be the preferred method of navigation, while magnetic fields are used mainly for orientation. However, on days when the Sun is obscured, it was thought that the birds use magnetic fields to orientate themselves and navigate, and when they are closer to home they rely on visual landmarks.

On migration flights for first-time flyers, genetic navigation information was thought to be used in conjunction with the Sun and magnetic fields.

Scientists who support the magnetic theory now believe a tiny mass of tissue between the eye and the brain gives pigeons their magnetic compass.

They say the birds use the Sun and magnetic fields equally for navigation and that young birds inherit a sky chart as part of their genetic code.

This is triggered when they become aware of how the sky pattern above their hatching place fits into it.

Scientists who disregard the magnetic theory believe pigeons use olfactory signals to determine orientation and seek the correct route, then combine that information with visual signs. Italian biologist Floriano Papi claimed in 1972 that pigeons possess a visual map of known places and an olfactory map. Scientists who support this school of thought have shown that if a pigeon is released in an unknown place without a sense of smell, it cannot orientate itself.

Despite the decades of experimentation and discussion, no one theory can categorically state how pigeons return home. This is something that displeases Penny Hawkins, deputy head of the research animals department at the Royal Society for the Prevention of Cruelty to Animals. She says not only is all the research inconclusive, it's also cruel and has cost many pigeons their lives.

"Some research involves temporarily rendering birds incapable of smelling by introducing zinc sulphate solution into the nostrils, which can cause irritation and distress," she explains. "The most invasive research involves brain surgery to destroy connections to the hippocampus - the part of the brain that is concerned with spatial memory - and this will inevitably cause pain. However invasive the research methodology has been, birds are often released who have had their ability to navigate compromised in some way, which can put them at a serious disadvantage," she says.

Pigeons may have fallen from their exalted position as the exclusive property of monarchs, but they are still highly valued for their secret ability to do what they do best - find their way home.

www.pigeonracing.comBritish Homing World has the latest news and information on issues such as how to send lost birds home, and the problem of hawks and raptors snacking on racing pigeons.www.rpra.orgThe Royal Pigeon Racing Association's site has a lot of useful information, including a history of homing pigeon fancying in the UK.www.homeofheroes.com/wings/part1/3b_cherami.htmlThis site has a fantastic account of Cher Ami's war-time adventures.www.silvio-co.com/pigeons/The Silvio Mattacchione and Co site has an interesting article on pigeon-racing history and links to more resources about the birds.