The riddle of migratory birds: Another evidence of God's design

by Kyu Bong Lee

A divine design behind all wonders of nature.

"Even the stork in the sky knows her appointed seasons, and the dove, the swift and the thrust observe the time of their migration." —JEREMIAH 8:7, NIV

Autumn is almost drawing to an end. Winds from the Arctic are gently blowing south, heralding that winter is not far away. Soon the northern lands will freeze, covered by snow. Suddenly you hear a noise in the sky. You look up, and you see a flock of birds flying south—escaping the freezing temperatures and seeking warmer lands. Flocks and streams of birds continue their journey for hundreds of miles. Come spring, the reverse occurs, and the birds fly north to breed and raise their young. The migration is unmistakable, annual, and rhythmic—revealing one of the great wonders of the natural world.

How does one account for such migrations? Why do birds migrate at all? How do they know when it's time to begin the long journey? What guides their flight path and direction? How do they know their destination, and how do they prepare for the trip?[1]

These and other questions have occupied research of scientists for years. Some questions have brought clear answers; others are still being searched out. For a scientist committed to the Christian worldview, the migration of birds is another instance revealing that there is a divine design behind all such wonders of nature.

Dispersion of migratory birds

With birds, migration usually means a two-way journey, an annual round-trip. Mostly, this occurs with birds in the large lands of the Northern Hemisphere that are covered seasonally with winter's snow and ice. Flocks of birds living in Eurasia and North America cross the Equator to spend the winter season in Africa or South America.

For example, a tagged arctic tern was picked up 90 days later on the coast of southeast Africa, 9,000 miles (14.481 km) away from its northern home. Another tern flew more than 10,000 miles (16.090 km) from Greenland to reach southeast Africa. Still another, ringed on the Arctic coast of Russia, was retaken off Australia, an impressive distance of at least 14,000 miles (22.526 km).

The white-rumped sandpiper makes the same autumn sea hop from maritime Canada to the tip of the Antarctic. Among land birds, the bobolinks navigate 7,000 miles (11.263 km) or more between the clover fields of Canada and the grasslands of Argentina. The most famous migrant in Europe is the widely beloved white stork. Sometimes they ride the thermals to a great height before gliding the 10 miles over water to Africa.

Some sandpipers have been clocked at more than 100 miles (161 km) per hour. Some birds migrate long distances over water and fly as high as 14,000 feet (4.267 m). The highest altitude recorded thus far is 29,500 feet (8.992 m) for geese near northwest India.

How birds navigate during the migration

Most biologists offer four theories, and suggest that birds use one or a combination of these in their navigation over long distances.

Use of visual landmarks. This has long been a popular theory. Many birds seem to follow visual clues such as rivers, coastlines, and mountain ranges in order to arrive at the correct destination. However, this idea does not explain how birds keep from getting lost during their very first migration.

Use of the Sun. According to this theory, birds, like humans, possess an internal circadian clock that allows them to track the daily light-dark cycle. Along with this internal clock, birds seem to use the Sun's shadows to gain a sense of location. Through the use of these two devices, birds would be able to use the Sun as a compass.

Birds traveling by daytime would orient themselves by the position of the Sun. But on cloudy days when the birds cannot see the Sun at all, how are they able to align themselves properly? They have an internal time clock by which they are ruled. Perhaps this can be explained as a result of God's creation.

Use of the stars. Because many birds migrate at night, these nocturnal migrants appear to have learned to use the stars for navigation. Birds can orient themselves in relation to the North Star, and unlike the Sun-compass, this "star-compass" is not time dependant. Young birds seem to use this pattern of rotation to distinguish north from south. This theory is supported by an experiment that was conducted with indigo buntings.[2]

Some birds seem able to use patterns of stars, small clusters of stars, or the Moon to determine what direction they need to fly. A disadvantage of using the stars to navigate is that the North Star cannot be seen in the Southern Hemisphere. Another problem arises on cloudy nights, when the stars cannot be seen.

Use of the Earth's magnetic field. Biologists have two different theories on how birds could use the Earth's magnetic field to navigate. One is that birds have certain pigments in their eyes that become weakly magnetic when they absorb light and thus alter certain nerve signals that the eyes send to the brain.[3] A second, and more popular theory, comes from the fact that scientists have detected tiny crystals of magnetite along the olfactory tract in the brains of some birds.

Biologists still do not know how the birds can sense the position of the magnetite crystals in their heads, and there is little experimental data on the sub-

Salmon migration: Using magnetic sense?

One of the mysteries of nature is how salmon manage to navigate in the oceans and return to spawn in the very same streams from which they came. It is known that the odor or taste of the particular stream plays a role. Salmon can home-in on the smell of "their" stream if they are sufficiently close to its mouth so that the water has not been diluted to the point where it is unidentifiable.

But how can odor play a part when the fish migrate over thousands of miles in the open ocean and cross ocean currents which destroy any possible "trail" that may lead them back? At any rate, it is known that salmon do not follow meandering paths back "home" to answer the spawning instinct, but travel directly to their spawning grounds by the most direct route when sexual maturity occurs....

What is it that points them in the right direction? Probably there is more than one homing mechanism that fish use to find their way. An olfactory "imprint" is made on smolts as they leave their home stream. This enables them to identify it by smell as they approach it later from the ocean. But to approach the stream mouth from the open sea, at least one other imprint must first be made in order for them to arrive in the general area. It has been shown that some fish are remarkably perceptive of the Sun's azimuth and altitude, and that they are sensitive to the time of day. Under ideal conditions, this would permit a method of determining geographic north. But in a region where overcast conditions predominate (as they do in the North Pacific and Bering Sea), and because the fish swim at night and move into deeper water during the day, celestial clues are not consistently available. Therefore another means of correcting navigation is probably used. It is strongly suspected that the ability to sense the earth's magnetic field may provide this additional method....

Extrapolating these findings to the migration process, the conjecture is that, after the salmon fry have grown to smolts and entered salt water, chemical and hormonal changes occur which imprint upon the fishes' nervous system a "memory" of its magnetic latitude and longitude at the time that it enters the ocean.

There appear to be two possible ways by which the magnetic field can influence a fish's nervous system. The first is that the ferromagnetic mineral magnetite in the creature's brain may function as a biological compass which is 'set' at the time of entry into the ocean (magnetite occurs across the biologic spectrum from bacteria to dolphins). The information retained is the vertical and horizontal components of the Earth's magnetic field at that point, and the declination of the horizontal component, which is the difference between magnetic and true north, presumably determined by the Sun. These factors taken together provide a combination that is unique for any geographic location.[7]

—Larry Gedney

ject. (Interestingly enough, some researchers say that humans have the ability to sense the magnetic field as well.) Two observations are worth noting. First, with reference to homing pigeons:

"Careful tests with homing pigeons and other birds displaying the ability to judge direction show that the birds are affected by changing magnetic field. . . . If birds are released at places where the earth's magnetic field is anomalously strong, their homing ability is entirely disrupted. . . .

"Next to, or essentially in, each pigeon skull, [the researchers] have located a tiny piece of tissue 1 mm by 2 mm (about 1/16 in by 1/8 in) that was somewhat magnetic. Searches inside this tissue with an electron microscope revealed the presence of more than ten million tiny crystals each four times as long as wide. Other tests demonstrated that these crystals were magnetite, the iron-oxygen compound of which compass needles are made."[4]

Second, a research observation on bird migration from northern Wisconsin to the Amazon:

"How birds find their way from a northern Wisconsin pine tree, south to the Amazon and back again is still not completely understood by science. But a half-century of research is shedding some light on this amazing feat.

"Birds can track the sun, the moon and the stars, using their apparent movement as a compass. Birds also use other senses. They can detect weak magnetic fields with tiny magnetite crystals in their heads. They follow faint odors as does a salmon returning to its birth river from the ocean. They can see polarized light and use barometric pressure. Along with memory and genetic urges to head in a certain direction, birds use a combination of these senses to cross continents and oceans."[5]

Recently it was discovered that monarch butterflies have an internal magnetic compass that enables them to make their winter journey without the guidance of sunlight.[6] As mentioned in the above paragraphs, it was shown that some fishes and butterflies also use their magnet-detecting senses. (See sidebar, "Salmon migration.")

Despite all the theories and experiments dealing with bird migration, there is much that is still not understood about how birds determine their position in relation to a fixed goal. The fact is that they continue to migrate on a cyclical and predicable pattern through centuries.

What causes birds to migrate?

What causes birds to migrate? When did the practice of migration begin? Some scientists once suggested that the ice sheets during the Ice Age might have been originally responsible. This idea sounds plausible, but it does not explain migration in many parts of the world that have never been touched by glaciations. Consequently, most ornithologists now reject this theory as a basic cause of migration.

There is no question that the birds that originated in warm climates spread outward in their search for food. Most Creation scientists have held that the Ice Age existed for hundreds of years in some areas after Noah's Flood because of change in weather. After the Flood, many birds found food in abundance in higher latitudes but were forced to withdraw when winter came.

What stimulates birds to begin their migration at approximately the same time each year? What internal clock or external stimuli? From a physiological point of view, we know that the endocrine glands—the controls that make male birds sing and females lay eggs—undergo great changes before the nesting season. Other changes occur after the nesting season is over. Most birds migrate during this period.

While evolutionary scientists may have their views, we as Christian scientists can attribute all these magnetic mysteries to God's design, the same as we do with many other kinds of animal migration. God made birds to adapt themselves to the change in their surroundings. Because birds need extraordinary stamina to travel long distance, these migrants have the ability to store a vast fuel supply in the form of fat, sometimes doubling their weight. Moreover, the greatest wonder of migration is the manner in which birds find the way—their navigation skill. Surely, one can see a supernatural design in all these!

Conclusion

Navigation is the part of migration that has puzzled scientists the most. How birds can find their way with apparent ease over vast distances remains the unsolved riddle of migration. So precisely can they follow their invisible paths that scientists have from time to time suspected that birds possess a special sense unknown to us. At one time they were thought to have a kinesthetic sense, by which they could form patterns of their route through pressures on

Lessons in providence and trust

"The swallow and the crane observe the changes of the seasons. They migrate from one country to another to find a climate suitable to their convenience and happiness, as the Lord designed they should."[8]

"The birds are teachers of the sweet lesson of trust. Our heavenly Father provides for them; but they must gather the food, they must build their nests and rear their young. Every moment they are exposed to enemies that seek to destroy them. Yet how cheerily they go about their work! how full of joy are their little songs!"[9]

— Ellen G. White

the inner ear. Another idea was that birds navigate through responses to the Earth's magnetic field, perhaps even to its rotational effects. None of these hypotheses has, however, stood the test of experiment.

The Bible, however, invites us to study the wonders of nature and to see in them evidences of the handywork of a wise Creator: "'Ask the animals, and they will teach you, or the birds of the air, and they will tell you.'" "'Look at the birds of the air,...your heavenly Father feeds them'" (Job 12:7, 8; Matthew 6:26, NIV).

So, what we can learn by observing or studying bird migration? First, not all birds migrate. Therefore, migration is not the law of all flying birds. Secondly, birds take more or less the same migratory routes. This selection cannot be by chance. Third, before sin, there would have been no migration, for in the pre-Fall world, there would have been no harsh climate necessitating bird migration.

Consider migration itself and its relation to the Earth's magnetic field and gravity. The magnetic field changes according to the latitude of the Earth and height. The strength of gravity also changes according to latitudes, though we usually say, "gravity is constant". God created the Earth, populated it with all kinds of creatures, and designed each of them to be adapted to its circumstances. Also, the Sun radiates the light and electromagnetic energies to all the creatures. These might be affected by quantum energy even though they may not feel it. God designed the birds to make good use of their tiny variation in energy and also gave them abilities to detect even the smallest amount of gravity and variations in the magnetic field in ways that are unknown to us, and to orient themselves toward this direction. To the extent this happens, migration reveals God's intelligent design and benevolent providence.

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Notes and references

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