It Takes Two Compasses to Fly Right

Drivers who never admit they're lost or ask for directions may fancy themselves as skilled as migrating birds. These winged travelers can stay on course for thousands of miles, thanks to two internal compasses that track magnetic and celestial cues.

Sometimes, however, these compasses provide conflicting information. Magnetic and geographic north do not coincide, particularly in upper latitudes. In these regions, birds heed the celestial advice; the magnetic cues appear to be redundant—or so scientists had believed.

Actually, "the interaction between the two cue systems is far more complex than this," Peter Weindler and his colleagues at J.W. Goethe University in Frankfurt am Main, Germany, report in the Sept. 12 NATURE. Certain types of migration appear to require the magnetic compass.

Weindler

The North Star looks stationary in this time lapse photo, while the other stars seem to move around it. Birds use the star to navigate during migration.

"Just when we thought we understood [avian navigation], a new set of experiments . . . adds a new level of complexity," asserts Princeton University's James L. Gould in an accompanying comment. The team's findings are "remarkable," he concludes.

Migratory birds are born with magnetite crystals above their nostrils that enable them to detect magnetic north. If they grow up under normal conditions, they also develop their ability to navigate using the stars. By the time they take their first trip, young birds have somehow acquired a sense of their route.

Weindler and his colleagues studied garden warblers (*Sylvia borin*), which breed in central and northern Europe and winter in Africa. The birds from central Europe don't migrate directly south, because they must veer around such troublesome barriers as the Alps. So on their autumn trips, they first fly southwest. At the end of September, when they reach the Iberian peninsula, they head southeast.

The researchers removed warbler chicks from their nests in the wild and raised them by hand. During the summer before their first migration, the birds stayed in cages equipped with an artificial, rotating sky containing small lights that mimicked the constellations. For one group of birds, the researchers blocked the local magnetic field.

In August, at the beginning of their normal migration period, both groups of birds were placed in cages that provided only celestial cues. The team then monitored the direction toward which the warblers oriented themselves. Birds that had been exposed to both celestial and magnetic stimuli "showed the seasonally appropriate tendency to orient to the southwest," the authors report. The others faced due south.

This suggests that garden warblers—and probably similar birds—must be exposed to both Earth's rotating sky and its magnetic field before their first migration if they are to establish their population's unique course, Weindler and his colleagues conclude.

Neither group of warblers changed its orientation later in the season, when the migrating birds ordinarily turn to the southeast. This supports previous studies showing that birds alter their course appropriately when given only magnetic cues.

Although early exposure to the stars allows a bird to migrate south even under unusual conditions, the magnetic field enables them to deviate from this basic direction, the team says. Celestial information clearly "provides only a default direction for migrants," Gould notes.

— T. Adler

Faulty circuit may trigger schizophrenia

Scientists increasingly suspect that schizophrenia, a severe and often debilitating mental disorder that usually emerges in young adulthood, reflects disruptions of brain development that originate before or shortly after birth. The exact nature of this neural damage remains poorly understood, but new evidence suggests that it may impair interconnected structures located at several sites in the brain.

Damage to the various parts of this far-flung circuit, which extends from the cerebellum at the back of the brain to the prefrontal cortex near the eyes, could account for the shifting spectrum of social, emotional, and thinking difficulties observed in people suffering from schizophrenia, reports a research team in the Sept. 3 PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES.

"We theorize that defects in this single, complex brain circuit can explain any and all symptoms of schizophrenia," asserts psychiatrist Nancy C. Andreasen of the University of Iowa College of Medicine in Iowa City, who directed the recent investigation.

In particular, Andreasen holds, a breakdown in this cerebral network causes cardinal signs of schizophrenia, most prominently a difficulty in integrating information rapidly from the outside world, formulating reactions swiftly, and expressing verbal or emotional responses.

Andreasen's group studied 13 neurologically healthy volunteers and 14 people diagnosed with schizophrenia who had not taken antipsychotic medication for at least 3 weeks. Positron emission tomography (PET) scans measured cerebral blood flow as participants recounted a story just after hearing it or retold a story they had heard a week earlier and then thought about in two practice sessions.

These tasks tap into learning and memory skills typically undermined by schizophrenia, Andreasen notes.

Schizophrenic participants remembered much less than the other volunteers on the immediate recall test, although the two groups performed equally well on the other task. During both tests, however, volunteers with schizophrenia displayed a consistent pattern of blood flow declines—signaling drops in neural activity—in certain brain areas. This implies that schizophrenia involves a fundamental breakdown in the circuit of brain structures used for these tasks, the researchers maintain.

Crucial components of this circuit include the cerebellum, which may pace thinking efforts; the thalamus, which filters incoming information (SN: 10/29/94, p. 284); and the prefrontal cortex, a center of complex thinking and judgment.

"This is an interesting study, but it will be a while before its implications are well understood," asserts Daniel R. Weinberger of the National Institute of Mental Health's Neuroscience Center in Washington, D.C. In particular, the cerebellum's impact on schizophrenia remains murky, he contends.

In addition, PET data cannot distinguish between brain areas that operate in parallel and those on a common circuit, Weinberger adds.

— B. Bower