Natural Sciences

A world concealed from man . . .

What subtle sensory cues enables a bird to navigate to an unseen site and home again with spectacular accuracy? William T. Keeton and Melvin L. Kreithen of New York State College of Agriculture and Life Sciences at Cornell University have found that birds can sense small changes in air pressure equivalent to a drop in altitude of less than 20 feet, and can "see" polarized light—light with waves that vibrate in one direction only.

In general, a falling barometer reading indicates favorable winds for fall migration, and a rising barometer is a sign of winds suitable for spring northward migration. The Cornell researchers suggest that birds with sufficiently sensitive pressure detectors might locate thermal updrafts and air turbulences. And because the plane of polarized light in the sky is related to the sun's position, sky polarization could be used when the sun is obscured by clouds.

Kreithen's and Keeton's preliminary work suggests that the fovea, a cup-shaped pit in the back of the eye, may be responsible for polarized light perception, and that the pressure receptor may be within the ear, since background noise affects the birds' ability to detect pressure. Their findings will be published in the JOURNAL OF COMPARATIVE PHYSIOLOGY.

. . . but known to birds

Meanwhile, biologists at the State University of New York at Stony Brook have found that by attaching a pair of small coils around the heads of homing pigeons and altering an applied magnetic field, they could change the orientation of the birds' flight.

Charles Walcott and Robert P. Green released two groups of homing pigeons from three different locations. Both groups had a magnetic field of about 0.6 gauss around their heads but one group (called Sups) flew with the south magnetic pole up and the other (Nups) flew with a reversed polarity. Under sunny and overcast days, the Sups normally oriented toward home. The Nups oriented toward home when the sun was visible but often flew away from home under overcast conditions.

"Taken together these results indicate that varying the direction of an artificial magnetic field around a pigeon's head has an effect on its initial orientation although it has little apparent effect on its total homing performance," the researchers report in the April 12 SCIENCE. ". . . Furthermore, since the effect of differing fields is more pronounced on overcast than on sunny days, it may be that pigeons are, in some way, using the earth's magnetic field as a compass when the sun is not visible."

Piranha population on the rise

Dams have tipped the ecological balance of rivers in northern and western Brazil in favor of the voracious piranha against the dourado, the piranha's natural predator. Both species live in the same rivers, but the dourado lives in turbulent water while the piranha lives along riverbanks. Dourados have a higher oxygen intake and thus need rapidly moving water. Dams built along the main rivers have cut off currents and lowered the oxygen content of the water. Consequently, dourados are dying out and the piranha population is on the increase.

It is being suggested that artificial oxygenators be placed on river bottoms to raise the oxygen content of the water, thus allowing the dourado to live in currentless water.

Planetology

From our reporter at the meeting of the American Astronomical Society in Palo Alto

Measuring moon by moon

A year-long worldwide program of coordinated observations will wind up in May with reams of data from almost 90 eclipses and occultations among various combinations of Jupiter's four innermost moons.

These clusters of mutual occultations, lasting many months, occur about every six years when the planes of the orbits of the "Galilean satellites"—Io, Europa, Ganymede and Callisto—are seen edge-on from earth. Calculations for spotting the events have been published ever since 1929, says Robert Millis of Lowell Observatory, but only in the relatively little-read *Handbook* of the British Astronomical Association. It took a 1972 paper by Robert Brinkman of the Lunar Science Institute in Houston to inspire a hastily organized Jovian moonwatch, involving about 20 observatories around the world.

Data from seven occultations, for example, enabled Kaare Aksnes and Fred A. Franklin of the Center for Astrophysics in Cambridge, Mass., to refine the radius of Europa (1,830 kilometers), as well as to reduce the uncertainties in the orbits of Io and Europa by 50 percent. Several researchers, including Millis, have made unsuccessful searches for a recurrence of the controversial "post-eclipse brightening" of Io. First seen in 1964, the phenomenon was suggested, amid some dispute, to be caused by frost or haze formed while the satellite was shielded from sunlight, which increased its reflectivity briefly as it emerged.

The tides that warm cold Neptune

Neptune, unlike any of the other planets in the solar system, may be heated primarily by internal tides caused by one of its own moons, according to Laurence M. Trafton of the University of Texas at Austin.

Previous studies have shown that while Uranus is heated largely by energy from the sun, Neptune's heat source is internal. The cause, he suggests, is the dissipation of tidal friction created by Neptune's moon, Triton. Trafton calculates that if this is true, about 85 percent of the total energy comes from the despinning of Neptune, and the rest from the decay of Triton's orbit.

The results of Neptune's moon-made warmth, the actual temperature patterns in the atmosphere, seem to be complex but with only small variations on the global average, according to Kathy Rages of Cornell and colleagues.

Day-night variations are less than 18 degrees F., they report, and may be absent altogether. Based on a 1968 occultation of a star by the planet, they add that the average temperature increases by less than 27 degrees between the equator and 55 degrees latitude.

The mystery of the hemispheres

A major surprise in the early days of lunar exploration was the discovery that the soft maria visible from earth were far more rare on the moon's farside, presumably because of some one-sided influence of the earth. Now refinements of Mariner 9 data show one hemisphere of Mars to be far rougher than the other, and Mariner 10 suggests the same asymmetry for Mercury. Data files grow, observes Bruce Murray of the California Institute of Technology, yet so does the mystery of hemispherical asymmetry. "We now know," he says, "a little less about the moon."