Moths, hawks and long migrations

Animal migration is a phenomenon that scientists have yet to fully understand. Little is known about what turns on and off migration restlessness or what guides the animals over hundreds and even thousands of miles. Currently, biologist Neal Smith and others at the Smithsonian Tropical Research Institute (STRI) in Panama are studying the spectacular migrations of two groups of dissimilar animals—moths and a bird of prey.

Last August, within a week's time, the populations of the tropical black and green day-flying moths *Urania fulgens* and *U. leilus* exploded in Central and South America. Swarms of individuals in flight were observed from Veracruz, Mexico, throughout Central America, west of the Andes to northern Ecuador, and over all of northern and central South America to eastern Bolivia. A little over a month later, the offspring of the August moths emerged and continued the flight over Central and South America into October. Flights suddenly and mysteriously ceased the first week of November.

Smith has analyzed the reports of *Urania* movements over the past 125 years and found that population explosions occur every 5 or 8 years, the last two being in 1964 and 1969. As might be expected, flights are quests for new and untouched food sources. (*Urania* larvae are picky eaters; they will eat only one plant, *Omphalea*, and first-stage larvae will eat only new leaves, not old ones). But contrary to what might be expected, Smith found that it is *not* the amount of food available to the larvae that triggers migratory instincts but larval density.

" 'Only child' larvae convert most of the energy received into eggs, and emerge as small adults loaded with eggs and which are sedentary in behavior," Smith says in his report. "Those larvae which were 'aware' that they had many brothers and sisters converted only a small amount of this *Omphalea* energy into eggs but put the larger amount into structural protein, emerging as large adults displaying the migratory urge."

Future research into *Urania* migration will examine the reason why synchrony of flight occurs across the equator. (The August outburst occurred over 34 degrees of trans-equatorial latitude.) Smith hopes to find the answer in the biology of the *Omphalea* plant.

STRI is located on Ancon Hill near the Pacific entrance to the Panama Canal. Directly overhead, the entire North American population of Swainson's Hawks, except for a few in Florida, flies every October to Argentina, a distance of almost 4,000 miles.

Rising on the updrafts of the prevailing winds off the Rocky Mountain-Andes chain, the hawks reach an average cruising altitude of between 540 and 640 meters. The narrowness of the Isthmus of Panama at the Canal Zone and the prevailing southerly winds off the Continental Divide force the birds into a narrow aerial lane about a mile wide. Smith has been able to confirm reports that the hawks fast for most of their journey. Upon examining roosts where hundreds of hawks had spent the night, he found no feces.

Joint research by STRI and the Air Force reveals that the hawks do not land when they encounter storms in flight but climb up over them. Sightings have found hawks and vulture flocks as high as 5,760 meters above Panama City. Closer observations found that the hawks do not flap their wings at this altitude but utilize the convection air current atop the storm to propel themselves. They can travel at speeds exceeding 20 knots and remain in this relatively airless environment for as much as three hours. □

Soviet super-hole

Soviet geologists and engineers are preparing to drill the deepest borehole in the country's history into the crust of the earth. The 15,000-meter shaft is being drilled near the small city of Saatly, about 150 miles inland from the Caspian seacoast near the Iranian border. Although the project is primarily one of scientific research, Soviet researchers plan to try to estimate the potential yields of ores, minerals, petroleum and natural gas.

Iron in the ice

Meanwhile, another Soviet research team has reported the discovery of substantial iron and coal deposits in the Friendship Mountains of Antarctica. The major find, which resulted from work in Operation Amery, a Soviet project that began in 1971, is a vast iron deposit about 170 kilometers long and up to 15 kilometers wide. In addition, 60 deposits of coal and several of "other minerals" were discovered in the area.

A new DNA-repair enzyme for humans

When ultraviolet light damages DNA, the hereditary material of the cell, it lumps pyrimidine bases in the DNA into a complex, or dimer. The cell finds these dimers distasteful and has a bag of tricks for getting rid of or going around them. Enzymes that work in the dark may cut out the dimers or let DNA be replicated around them. Or the cell may dispatch a photoreactivating enzyme that, with the help of light, can change the dimers back to their normal form.

Photoreactivating enzymes have been plucked from an assortment of vertebrate cells, but never from placental mammalian cells. Now such an enzyme has been found in human cells, by Betsy M. Sutherland, a molecular biologist from the University of California at Irvine. She reports her findings in the March 8 NATURE. Comments a scientist in the field, "It has been dogma, essentially, that there is no kind of photoreactivation in any placental mammal. Betsy's discovery of the enzyme puts this in a somewhat different light."

Sutherland first made an extract of human white blood cells. She then put highly purified DNA, damaged by ultraviolet light, in the presence of the cells. An enzyme in the cells set to work reversing the dimers in the DNA. It did this work in light. Lo!—the discovery of a photoreactivating enzyme for humans. Mysteriously, though, the enzyme doesn't seem to do anything for the cells that make it. "So it is clear," says Sutherland, "that we must find out whether the enzyme is active in the cell and whether it can do the cell any good."

She believes that the significance is not so much finding an enzyme that can be assayed in culture but in finding an enzyme that might be used to probe the chemistry of skin cancer. Skin cancer is known to be sparked by exposure to ultraviolet light, but the apparent lack of a photoreactivating enzyme in placental mammals has prevented direct evaluation of the role of dimers in skin cancer.

There is the possibility, for example, that the enzyme might reverse both DNA damage and cancer in cancerous skin cells. If so, this would be tough evidence that skin cancer is due to DNA damage, and susceptibility to skin cancer might be due to a lack of the photoreactivating enzyme. Or skin cells from patients with a rare form of skin cancer, xeroderma pigmentosum, might be checked for the presence of the photoreactivating enzyme. Patients with the disease were known to lack one of the dark repair enzymes (SN: 6/19/71, p. 415). There is now evidence that some may lack the other dark repair enzyme. It's possible that patients may be missing a light repair enzyme as well.