ludovicianus). Since the Rose-breasted Grosbeak, like the Indigo Bunting, is a long-distance, nocturnal migrant, this individual was kept in captivity through the summer in order that its behavior might be observed in the following autumn migration season.

The bird was housed with several Indigo Buntings in an outdoor aviary ($4 \times 8 \times 6$ feet). Shelter, food (consisting of white millet and canary and sunflower seeds plus occasional lettuce greens), and water (to which ABDEC liquid vitamins were added once a week) were continuously available.

The bird remained in good health and molted normally between late July and early September. By late September noticeable quantities of fat had been deposited in the furcular and abdominal regions of the body, and nocturnal restlessness, or *Zugunruhe*, had commenced.

Because I was concentrating on Indigo Bunting experiments, the orientation of the grosbeak's nocturnal activity was not recorded until the week of 10–15 October, when the bird was tested outdoors under the natural night sky in an open field 25 miles northwest of Ann Arbor. This location was selected to minimize the possibility of interference from phototactic responses to horizon glows produced by city lights. All tests were conducted under moonless conditions, a fact which necessitated the abandonment of early-evening observations after 10 October.

Prior to each experiment, the bird was placed in a small, funnel-shaped cage (upper diameter 41 cm; lower diameter 10 cm). The sides of this cage were constructed from a cone of white blotter paper and rested on the rim of an aluminum pan. A thin sponge sheet, moistened with black printers' ink, covered the inside bottom of this pan and formed the cage's floor, while a square of one-half-inch hardware cloth capped the funnel, folded down at the four corners to hold it in place (Emlen and Emlen, Auk, 83:361–367, 1966). From inside the funnel-cage, the sky overhead is clearly visible, but all terrestrial and celestial objects within 25° of the horizon are blocked from view.

Every time the bird jumped forward onto the sloping paper sides of this cage, it left a footprint record before sliding back to the ink-covered floor, and the accumulation of these inked footprints produced the orientation record of the bird's activity. The footprint density in each 15° sector of the funnel was then evaluated numerically by direct comparison with densities on a reference key designed to represent 20 equally increasing units of activity. The quantified results could then be plotted in vector form and subjected to appropriate statistical treatment (Emlen and Emlen, *ibid*).

The results obtained from this Rose-breasted Grosbeak show a clear, consistent, southerly orientation of nocturnal activity (fig. 1). In fact, vector analysis of the data yields a mean direction of exactly 180°—due south (angular deviation = 60°). This coincides well with the presumed autumn migratory flight path of the species, which breeds in southern Canada and northeastern and north-central United States and winters in Central America and northern South America.

This caged grosbeak was therefore able to determine its correct migratory direction in the absence of visual, terrestrial cues. This suggests a reliance upon celestial cues. However, since overcast conditions were not encountered, and planetarium tests were not conducted with this individual, the chance that geophysical factors influenced its directional behavior cannot be ruled out.

Although results obtained from a single bird cannot be regarded as conclusive, the present experiment suggests that the Rose-breasted Grosbeak might be an excellent subject for further studies of the mechanisms involved in migratory orientation.

I wish to thank Harrison B. Tordoff and Richard D. Alexander for commenting on the manuscript. The study was supported by a National Science Foundation Graduate Fellowship.—STEPHEN T. EMLEN, *Division of Biological Sciences, Section of Neurobiology and Behavior, Cornell University, Ithaca, New York, 17 May 1966.*

Pintail Banded in Northwestern California Taken at Baykal Lake, Russia.—On 12 February 1956 an adult male Pintail (*Anas acuta*) was banded with band number 546 43449 at Humboldt Bay, Humboldt County, California.

This bird was shot apparently in 1963 at Baykal Lake, Central Siberian Uplands, Russia. The

United States Fish and Wildlife Service record refers to the date by the phrase "dispatch of October 24, 1963." The record was taken from the official newpaper Red Star of Soviet Union dated 25 October 1963.

Possibly more of the Pintails that use California wintering grounds frequent the Asiatic land mass for breeding than we have assumed in the past.—CHARLES F. YOCOM, *Wildlife Management, Division of Natural Resources, Humboldt State College, Arcata, California, 5 May 1966.*

Hemoglobins of a Ring-necked Pheasant × Jungle Fowl Hybrid.—The use of protein molecules as a source of taxonomic information is well established in theory, and in recent years considerable effort has been expended in the study of avian molecular systematics. This has produced significant information on the inter- and intraspecific variations of selected proteins (Sibley, Ibis, 102:215, 1960; Lush, Genet. Res., 5:257–268; 1964). However, there are no data available on intraspecific geographic variation in avian proteins and little information available on the proteins of hybrid birds. The description by Manwell *et al.* (Comp. Biochem. Physiol., 10:103, 1963) of the electrophoretic behavior and oxygen equilibrium curves of the hemoglobin from a Japanese Quail (*Coturnix coturnix*) × Jungle Fowl (*Gallus gallus*) hybrid and the work of Hilgert and Vojtiskova (Folia Biol. (Praha), 5:317, 1959) on the alkaline denaturation of hemoglobin from a Guinea Fowl (*Numida numida*) × Domestic Fowl hybrid appear to be the only studies on avian hybrid hemoglobins available.

The properties of avian hemoglobins as taxonomic characters have been explored electrophoretically at the level of the whole molecule, chemically at the level of total amino acid content and amino acid content of selected trypic peptides (Saha, Biochim, Biophys. Acta, 93:573, 1964), and at the level of physiological attributes such as oxygen equilibrium curves (Ghosh, Comp. Biochem. Physiol., 16:341, 1965). This paper is a report on an investigation of the genetic variability of the hemoglobins in several strains of the Domestic Fowl and the hemoglobins from a Ring-necked Pheasant (*Phasianus colchicus*) × Jungle Fowl hybrid.

Blood from mutant strains in six breeds of Domestic Fowl and from the Jungle Fowl and pheasant parents and F_1 hybrids was obtained through the cooperation of Ralph Somes, Department of Poultry Science, University of Connecticut.

Blood was collected by heart puncture in heparin–coated syringes. Hemoglobin solutions were prepared according to the methods of Manwell *et al.* (*loc. cit.*). Electrophoresis was carried out in vertical starch gel in a discontinuous Tris-citrate:borate-LiOH buffer system (Ashton and Bradon, Aust. J. Biol. Sci., 14:248, 1961) and in cellulose acetate on the Beckman Microzone Apparatus in both continuous (barbital and phosphate) and discontinuous (see Graham and Grunbaum, Amer. J. Clin. Path., 392:567, 1963) buffer systems. The pH of the various buffers ranged from 8.2 – 8.6 and the best results in acetate were obtained in the continuous barbital system (pH = 8.6, $\Gamma/2 = 0.05$), and the discontinuous Tris system. Separations were carried out at 250 v for 60–90 minutes in cellulose acetate and at 250 v for 8 hours in starch gel.

Total proteins were detected in starch gel by staining with Amido Black and in cellulose acetate by staining with Ponceau Red-TCA. Hemoglobins were stained selectively with dianisidine.

Gallinaceous birds have a multiple hemoglobin system which appears to consist of two fractions. The minor component, in alkaline pH, always moved anodally relative to the major fraction. No differences were apparent which related to the various techniques employed. This study indicates that there are no detectable differences in the mobilities of the hemoglobin fractions in the mutant strains of the Domestic Fowl, no differences between the Domestic Fowl and the Jungle Fowl and no difference among the Jungle Fowl, Ring-necked Pheasant, and their hybrid.

Previous morphological and biochemical studies on the Phasianinae have suggested an extreme homogeneity. The results of this study do not differ in this conclusion. However, the pheasant × Jungle Fowl cross failed to produce a third hemoglobin component as was reported for the Coturnix × Jungle Fowl cross by Manwell *et al.* (*op. cit.*) The causes and significance of this difference are currently under investigation.

This investigation was supported, in part, by a grant from the University of Connecticut Research Foundation.—ALAN H. BRUSH, *Department of Zoology, The University of Connecticut, Storrs, Connecticut, 28 April 1966.*