Behavioral Research—
New York Zoological Park

Donald R. Griffin and members of the staff will discuss and illustrate the work at the Institute for Research in Animal Behavior on 28 December 1967. (See Science, *22 September 1967, for details about registration for the tour to the New York Zoological Park.)*

For many years the New York Zoological Society has ardently supported scientific research on animals in its own collection and under natural conditions. It was therefore fitting in late 1965 that the Society and the Rockefeller University should establish a jointly sponsored Institute for Research in Animal Behavior (*Science*, pp. 1791–1794, 31 December 1965). This venture brings into active partnership two institutions with great potential for mutual reinforcement in a symbiotic approach to some of the most significant questions that face biologists working with whole animals.

Under the direction of Donald R. Griffin, the Institute is actively engaged in diverse types of research centered at laboratories located in a nonpublic area of the Zoological Park (Bronx Zoo). For example, Griffin's research and that of two Rockefeller University graduate students concerns the behavior and orientation of different species of bats. The large carnivorous bat *Vampyrum spectrum* is being studied in detail to determine if echo spectrum alone, and not echo intensity differences, are used to discriminate between various shaped yet similar-sized objects. The spear-nosed bat *Phyllostomus hastatus* is being studied to evaluate the role of vision during homing. Radio tagging and tracking of individual bats after artificial displacement from their caves in Trinidad is proving a very useful technique which will also be used in the study of homing orientation by migratory bats native to North America. Another line of investigation is directed at determining the directional patterns of sound emission by bats flying in a specially designed wind tunnel. Sustained flight by bats in a wind tunnel keeps the experimental subject in an approximate fixed position and allows observation of behavioral reactions to real objects, simulated echoes, and various patterns of flowing air. The behavior of small flying birds can also be investigated using a wind tunnel. The basic orientations of head and body during flight in both smooth and turbulent air, method of food catching by insectivorous birds, and flight behavior during migratory restlessness are of particular interest.

The descriptive study of animal social behavior is the central theme of research being conducted by Peter R. Marler and students. Many different species of cardueline finches are being studied to obtain a qualitative account of their social signal repertoires and to relate these to structure and locomotor patterns of the individual species. The spectacular morphological and behavioral polymorphism of male ruffs, *Philomachus pugnax,* is being investigated in a group of captives displaying breeding behavior. Documentation of behavior by males with different ruff types is being followed up by breeding experiments on the genetics of ruff color and its coupling to behavior. A comparative study of prairie and woodland species of grouse has been initiated under field and captive conditions. The objective of this project is to define correlations between the structure of communication signals and the type of social system exhibited and the habitat used by different species of grouse. Another project uses white-crowned sparrow nestlings, *Zonotrichia leucophrys,* which are reared under various conditions of auditory experience in order to determine the factors that may determine the development of typical song. Marler and a graduate student carried out intensive field studies on East African chimpanzees, *Pan troglodytes,* in the summer of 1967. They have obtained correlated tape recordings and motion pictures which will be compared with information gathered from chimpanzees raised in the laboratory and the Bronx Zoo.

The Institute of Research in Animal Behavior presently has only one staff member working with invertebrates. Jocelyn Crane is extending her comparative analyses of ritualized combat in fiddler crabs, genus *Uca.* The field work is conducted at the William Beebe Tropical Research Station in Trinidad and other tropical areas.

Fernando Nottebohm is actively analyzing the role of auditory and proprioceptive feedback in the sound production in birds. New research has been initiated on two species of Trinidad parrots, *Amazona amazonica* and *Ara manilata.* This project, involving both wild and captive birds, concentrates on defining the social behavior of both species with particular emphasis on the incidence and function of vocal imitation. Such a goal necessitates extensive observations of normal displays, contact courtship, pair bond formation, duration of pair bond, parental and juvenile behavior, aggression and flocking. Information of this sort is basic for meaningful intra- and interspecific correlations and comparisons.

The remarkably precise directional hearing of owls is being intensively studied by Roger S. Payne. Infrared photography in a totally dark room reveals that owls accurately determine the direction of their prey and may also determine the distance of their prey. The owls perch on the surface on which the prey is walking and can be raised or lowered hydraulically to determine the accuracy with which distance is determined by hearing. Preliminary investigations are being conducted for the perfection of techniques to be used in the study of whale behavior. Humpback whales, *Megatera novaeangliae,* have been followed by power boat for short periods of time off Bermuda. A specially designed "quiet" boat is being built with the intention of

following whales for long periods of time. Small sonic transmitters have been built whose underwater signals have a range of 7 miles. Such transmitters, when properly attached, may prove essential for tracking whales during darkness.

Richard L. Penney is conducting research on the behavioral and physiological basis of sun-orientation in the Adélie penguin, *Pygoscelis adeliae*. Field experiments in Antarctica reveal that this penguin is capable of consistent direction orientation by use of sun azimuth position and a sense of time. A group of Adélie penguins captured in Antarctica are being maintained and bred in an environmental control room. Some of these captive birds are being trained by food reward to orient themselves in a circular chamber inside a sun simulator 70 feet in diameter. The accuracy of orientation is being measured along with observations and experimentation on responses to programmed photoperiods, discrimination of light intensity, light quality, and time, and the perception of sun movement.

In addition to the research projects summarized above, the Institute for Research in Animal Behavior has several staff members and associates working in the field in Africa and Trinidad. Most projects are a combination of observations and experimentation under both the natural and the better controlled conditions of the laboratory. Research objectives constanly change and this necessitates an atmosphere of intellectual creativity and a readiness to cooperate with specialists in many different areas of biological research. Thus, the creation of the Institute for Research in Animal Behavior and the execution of its aims is itself an experiment in social behavior.

Research also continues, on a less formal level, within the Zoological Park's exhibit collections and veterinary department. Most current curatorial investigation is directed toward applied problems in the acclimatization, breeding and maintenance of wild species and the formulation of principles and techniques for their solution. Ideally, the work of the Institute for Research in Animal Behavior will not only expand further into the exhibit collections but also prove complementary to their educational function.

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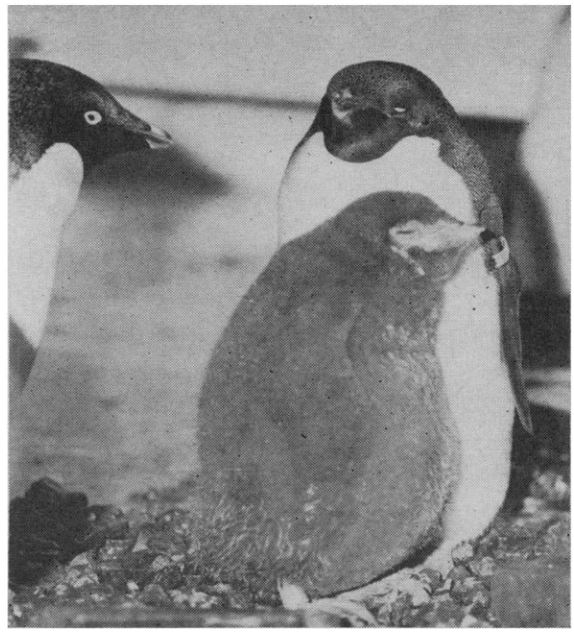

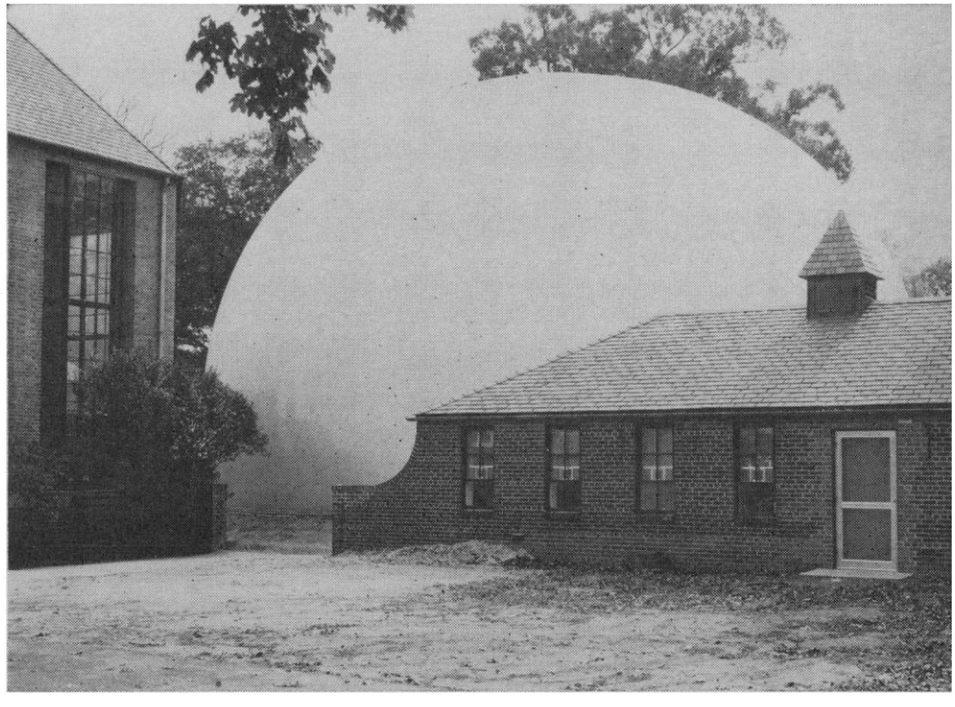

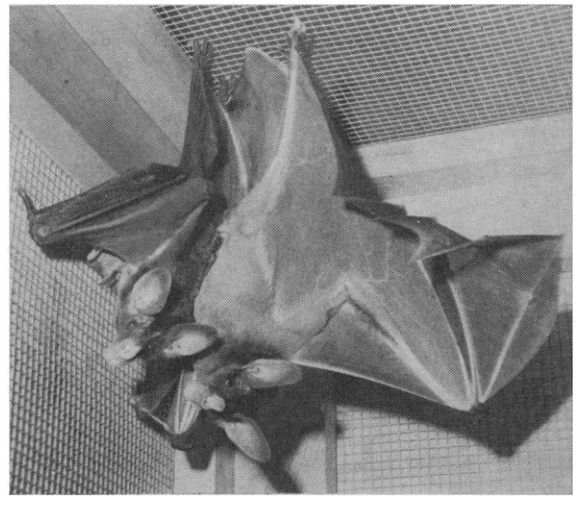

(Top). Adult Adélie penguin with its chick hatched in captivity.

(Center). Laboratory facilities and air dome housing a sun simulator at the Zoological Park's Institute for Research in Animal Behavior.

(Right). Carnivorous bats used in studies of echolocation.
[New York Zoological Park]