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POLICY STATEMENT

The primary purpose of the *Laboratory Primate Newsletter* is to provide information on maintenance, breeding, and procurement of nonhuman primates for laboratory studies. A secondary purpose is to disseminate general information about the world of primate research. Requests for information, for special equipment, or for animal tissues or animals with special characteristics will be included in the *Newsletter*. As a rule, the only research articles or summaries that will be accepted for the *Newsletter* are those that have some practical implications or that provide general information likely to be of interest to investigators in a variety of areas of primate research. However, special consideration will be given to articles containing data on primates not conveniently publishable elsewhere. General descriptions of current research projects on primates will also be welcome.

The *Newsletter* appears quarterly and is intended primarily for persons doing research with nonhuman primates. There is no charge for new issues or the current issue. Volumes 1-6 may be purchased for $4.00 per volume, Volumes 7-9 for $2.50 per volume, and back issues for the current year for $0.75 each. (Please make checks payable to Brown University.)

The publication lag is typically no longer than the 3 months between issues and can be as short as a few weeks. The deadline for inclusion of a note or article in any given issue of the *Newsletter* has in practice been somewhat flexible, but is technically the fifteenth of December, March, June, or September, depending on which issue is scheduled to appear next. Reprints will not be supplied under any circumstances.

PREPARATION OF ARTICLES FOR THE *NEWSLETTER*.--Articles and notes should be submitted in duplicate and all copy should be double spaced. Articles in the References section should be referred to in the text by author(s) and date of publications, as for example: Smith (1960) or (Smith & Jones, 1962). Names of journals should be spelled out completely in the References section. Technical names of monkeys should be indicated at least once in each note and article. In general, to avoid inconsistencies within the *Newsletter* (see Editor's Notes, July, 1966 issue) the scientific names used will be those of Napier and Napier [*A Handbook of Living Primates*. New York: Academic Press, 1967].

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Managing Editor: Kathryn M. Huntington

CONTENTS

BLOAT SYNDROME IN *MACACA MULATTA*: REPORT ON TWELVE CASES[1]

Arthur E. Turner and Alan Cowey

University of Oxford

This report describes the death from acute gastric dilatation of 12 rhesus monkeys (*Macaca mulatta*) in the monkey colony at the Institute of Experimental Psychology, Oxford, England. The colony was started in November, 1967, and a total of 70 rhesus monkeys and 4 baboons have been kept since then. The great majority of the animals are used in behavioral experiments lasting 2 to 3 years. They all weighed 2-3 kg on arrival. The animals live in galvanized steel mesh cages, 48 × 34 × 22 inches, equipped with automatic drinking spouts connected to a main water supply. Most animals live in pairs, only the largest animals living alone, and the smallest live in trios. They are fed once daily with from 25-70 pellets of Diet 41B (the precise amount varying according to the experiment)[2]. Each animal is tested for 5 or 6 days per week, and at weekends is given 1, or, more rarely, 2 days of *ad libitum* Diet 41B, together with one or more of the following: carrot, apple, peanuts, dates, rutabaga (swede). During behavioral testing the animals receive from 50 to 200 peanuts or CIBA banana-flavored pellets per testing session.

Of the 70 rhesus monkeys in the colony, 6 were used for anatomical studies within 6 months of arrival. Of the 64 remaining monkeys, 12 (20%) died of acute gastric dilatation from 10 to 38 months after arrival.

Features Common to All Deaths

All animals but one were apparently healthy until found dead. Six animals were found dead on Sunday mornings, 3 on Saturday mornings, and 3 on a Thursday. Ten of the animals had been fed *ad libitum* the previous day or two days. This coincidence between death and conditions peculiar to the weekend period (e.g. additional feeding, unusual quiet in the animal room) is too remarkable to ignore[3].

The postmortem examinations were carried out on 4 animals by ourselves, on 7 by the University Veterinary Officer with one of us (A.E.T.) present, and on 1 by the staff of the Pathology Department at the London

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[1]It is a pleasure to acknowledge the advice and assistance of Mr. G. R. Hovell, who performed 7 of the autopsies. We are also indebted to Mr. R. N. Fiennes for examining the sixth animal to die.

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[2]This diet is widely used in England for monkeys. It is manufactured by Styles Limited, and its composition is: wheat 45%, oats 38.65%, white fishmeal 7.5%, dried skimmed milk 2.5%, dried yeast 1.25%, molasses 5%, and salt 0.1%.

[3]One of the 3 animals found dead on a Thursday had been fed *ad libitum* the day before.

Zoo. With certain exceptions which will be mentioned later, the findings were very similar in each examination, and were as follows.

External appearance.--Seven of the 12 animals were found face down on the floor of the cage, the legs drawn up and the front paws gripping the steel mesh. There were numerous cuts on the lips and tongue, apparently caused by the teeth, and in one case the teeth were broken and gums damaged where the animal had bitten the steel mesh. Two animals were found in a sitting position without any wounds of the lips or tongue. The 3 remaining animals were lying on their backs, with limbs extended by severe subcutaneous emphysema.

In every case, the abdomen was grossly distended, and in 4, there was extensive subcutaneous emphysema over the groin, abdomen, thorax, entire arms, neck and face. One animal also had blood in both external auditory canals and blood and froth in the nose and mouth. Numerous smaller hemorrhages were commonly present subdermally on thighs and upper arms, and in the conjunctiva. There were no signs of vomiting in 10 of the 12 animals. In 2 cases, stomach contents were found on the tray immediately beneath the animal's head, but we cannot be certain whether this was released before or after death. All but one of the animals had complete *rigor mortis* when found, and had apparently died during the night. The seventh animal to die was closely observed up to death. Although in this animal the head and limbs were of normal appearance, the abdomen was very distended and taut.

Autopsy findings.--When the abdominal cavity was opened a grossly distended stomach was found, containing variable amounts of partly digested, semi-liquid food with the characteristic stale sweet alcoholic odor of fermentation. Less often the large intestine was also distended, and where this occurred it was again gas rather than food that was responsible. In 6 animals, the stomach had ruptured close to the pylorus, releasing stomach contents and gas into the peritoneal cavity, into the thorax via a ruptured diaphragm, and, in 4 cases, gas was in the subcutaneous tissue from groin to head. There was no sign of hemorrhage or inflammation at the ruptured area, indicating that the rupture almost certainly occurred after death.

Numerous small hemorrhages were found in the mesenteric membranes and lungs, and the heart was always congested. The trachea and bronchii showed no signs of inhaled stomach contents. The liver, spleen, pancreas, kidneys and bladder appeared normal on superficial examination. Four animals had a prolapsed rectum.

The most thorough examination was performed by the staff of the Zoological Society of London on the body of the sixth animal, approximately 48 hours after death. The animal was a male rhesus, weighing 5.4 kg and living alone, who had been in the colony for 30 months, and was found dead in a sitting position. The body was placed in the refrigerator until the postmortem could be carried out at the Pathology Department of the London Zoo 2 days later. The postmortem report, kindly provided by R. N. Fiennes, was as follows:

Externally, the animal showed profuse bleeding from the nose and apparently also from the ears; the latter was found to be illusory, since the ears were, in fact, intact. There were wide areas of subcutaneous edema, and there were diffuse purpura-like lesions of the skin over the hind limbs and belly. The abdominal cavity was bloated and filled with gas. The stomach was ruptured and over-distended with soft and pulpy fermenting food material. The omentum appeared to be inflamed, but this may well have been due to postmortem changes. In the pyloric region, there was diffuse hemorrhagic gastritis, the intestines appeared normal and were irregularly filled with ingesta.

Parts of the liver had a parboiled appearance and the organ was small and pale. The spleen appeared normal and the lymph glands were not enlarged. The kidneys were small and somewhat hemorrhagic. The capsules were adherent, leading to a suspicion of glomerulonephritis. The adrenals were very small, indeed, and appeared atrophied. The brain was normal, but congested.

Bacteriological investigations were made on heart blood only, since it was judged that the rest of the carcass was not sufficiently fresh. The results were negative.

As regards histological examination, nothing of significance, or, rather, nothing that could be differentiated from postmortem changes, was found in any other organs except the lungs. Characteristic changes were found in the lungs due to invasion, both of lung tissue and bronchioles, with lung mites (*Pneumonyssus*). There was bronchiolitis, peribronchitis, and bronchopneumonia. That this condition was due to lung mites was evident from the extent of eosinophilia found which resembled Löffler's syndrome.

A very few intramuscular inclusions were found in the epithelial cells of the lungs, which resembled cytomegalovirus or adenovirus. The pathologist discounted the importance of these. There were no inclusions, elsewhere, and no other evidence of viral infections.

In the opinion of the pathologist, this was an unhealthy animal as a result of respiratory lesions arising from lung mite infection. It would be possible to argue that this caused choking, and the rest of the syndrome followed on this cause. However, in view of the history and the probably chronic nature of the adrenal and renal lesions, this is hardly likely.

Previous symptoms.--Eleven of the 12 animals appeared to be normal up to, and including, the day before death. Only one animal was obviously unwell beforehand, and the following account of his behavior may be useful:

The animal weighed 7 kg and was a mature male who had lived alone for about 3 months. Before this he had fathered an infant born in the

colony. For each of the 3 days before death he was noticeably subdued. Usually an aggressive and active animal, he became largely immobile in a sitting position at the back of the cage, and would only move around when closely approached. Nevertheless, he ate the usual amount of food and tested normally in an auditory discrimination experiment with peanut rewards the day before death. He was fed *ad libitum* with Diet 41B, plus cabbage and apple, on Friday afternoon, and ate a large amount. On Saturday morning, he was lying on the floor of the cage. Respiration and pupils were normal, there was no dehydration, and the stools beneath the cage were fresh and normal. The animal was very immobile, even when provoked with a catching net. Copious quantities of saliva dripped from his mouth. He was offered fruit, but only consumed an eighth of an apple.

At 11:00 a.m., the animal was caught and examined by the University Veterinary Officer. The abdomen was swollen and very painful when palpated. Rectal temperature had fallen to 95.5°F. Intramuscular injections of one ml of Chloromycetin (330 mg/ml) (Parke-Davis) and 1 ml of benzathine penicillin (300,000 units/ml) (Penidural or Bicillin, Wyeth) were given. The Mantoux test for tuberculosis was given by intradermal injection in the right thigh. Although the animal moved his head and showed a brisk pupillary response to a flash of light or a threatening gesture, he remained very immobile during the examination. He was returned to the home cage with hot water bottles and made no immediate attempt to move from the lying position. His condition was unchanged at 2:00 p.m., except that he was sitting up. At 5:30 p.m., he was found dead in a sitting position. The body was still warm and limp. The abdomen was distended and taut, but there were no signs of hemorrhage externally, and the face was not contorted. The autopsy revealed extensive areas of gastritis over a distended but unruptured stomach, which contained a large quantity of partly digested food and gas. The heart was very congested, and there were areas of slight congestion at the extremes of the lobes in the left lung. The administration of antibiotics in this animal may have retarded the formation of gas.

Bacteriological Examination

Specimens of heart blood together with stomach and intestinal contents were analyzed for bacteria in two of the animals. The blood proved to be sterile. The gastric fluid contained a mixed heavy growth of *E. coli I* (var. neopolitanna), *E. coli I* (var. communior), *Streptococcus viridans* and *Lactobacillus*. The intestinal samples contained the above, and, in addition, *Proteus mirabilis* and *S. faecalis*. No obligatory anaerobes were found. An additional test for anthrax on one of these animals proved negative. None of these findings could account for the bloat syndrome: the flora of the intestinal tract was unremarkable. The blood, liver, kidney, and stomach contents from another animal were tested for lead and copper poisoning, as the animal had licked the grease off the cage runners. This grease contained both of these minerals (lead 20%, copper 10%) in a bentone base. The analyses of the liver, kidney, and stomach contents for lead and copper is summarized in Table 1. The small amount of lead found in the liver would not appear to be of any great sig-

nificance, and would hardly account for death by acute lead poisoning.

Table 1

Summary of Analyses for Lead and Copper

	Copper (ppm)	Lead (ppm)
Liver	5.0	2.0
Kidney	4.5	4.5
Stomach Content	4.0	4.0

Differential blood film counts were: polymorphs, 26%; monocytes, 11%; basophils, 4%; lymphocytes, 25%; eosinophils, 27%; multinucleated cells, 7%. The high eosinophil count is suggestive of parasitism; in this case, lung mite infection. There was no evidence of punctate basophilia, which would be expected in lead poisoning.

Discussion

Acute and fatal bloat syndrome, with symptoms remarkably like those described here, was reported in 24 rhesus monkeys by Smith, Casey, Lacroix and Johnson (1968), and in 8 rhesus and stumptailed (*Macaca arctoides*) monkeys by Chapman (1967). J. E. Brinkart (personal communication) has also recorded three similar deaths in a colony of rhesus monkeys in Holland, and we suspect that these extremely disruptive occurrences may be even more widespread. The colony described by Smith *et al.* contained an average of 800 monkeys over a 5-year period, and their report dealt with deaths in a 12-month period towards the end of the 5 years. Assuming that deaths in other periods were never more frequent than those reported during the 12 months, and that the same 800 monkeys were present during that year, the incidence of bloat syndrome is 3%. We recorded 12 deaths out of a total of 64 monkeys kept for more than 6 months over a 38-month period, which is approximately 7% per year. This is a disturbingly high figure in a colony of animals that are kept for several years for behavioral experiments.

Although Smith *et al.* drew attention to the possible connections between diet and bloat syndrome in a variety of animal species, they did not report any correlation between time of death and any unusual feeding procedures. Indeed, their animals were fed 3 times daily and were not obviously deprived at any time of the week. A striking correlation between *ad libitum* weekend feeding and time of death in our animals cannot be ignored, and we have introduced a feeding schedule whereby the average daily intake is unchanged, but very large single meals are avoided.

We would welcome the opportunity to correspond with colleagues in other laboratories who have observed bloat syndrome in monkeys.

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NEW DIRECTOR FOR THE WISCONSIN REGIONAL PRIMATE RESEARCH CENTER

Dr. Robert Goy, currently Chairman of the Department of Reproductive Physiology and Behavior at the Oregon Regional Primate Research Center, will become Director of the Wisconsin Regional Primate Research Center on June 1, 1971.

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NEW PRODUCTS AND SERVICES*

Monkey Chow in Tablet Form

RALSTON PURINA is now supplying a primate diet in the form of 750-mg tablets. The tablets are made from their Monkey Chow with stabilized vitamins A and C added. The form of vitamin D in this product is D_3. For further information contact: R. E. Hunter, Product Manager, Special Chows, Ralston Purina Company, Checkerboard Square, St. Louis, Missouri 63188. Phone: (314) 982-2657.

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*All information in this section has been abstracted from material supplied by the vendor.

BEHAVIORAL ADAPTABILITY IN FREE-RANGING CHIMPANZEES: A POSSIBLE VARIANT FORM OF TOOL USE

Robert B. Eckhardt

University of Michigan

Reports of tool use by wild chimpanzees were made before field studies were conducted by trained scientists. It is suggested that some of these reports, largely ignored until now, might contain information of potential value in suggesting directions for future field research.

Since the early part of the century instances of nest-building, dropping of branches, throwing of objects, etc., by wild chimpanzees have often been reported, usually by untrained observers; and chimpanzees in captivity have frequently shown the propensity to shape objects and environmental situations to meet their requirements. A comprehensive early review of these observations made under natural and unnatural conditions was given by Yerkes (1929), who conservatively concluded then:

> One naturally infers from the literature that in nature this anthropoid ape (the chimpanzee) does not to any considerable extent utilize environmental objects as instruments. Possibly the inference is incorrect, for it must be granted that information is both meager and of uncertain value [p. 361].

It was not until the reports of Goodall (1963a, 1963b, 1965a, 1965b), accompanied as they were by superb photographic documentation, that the use of tools (natural objects modified for some particular purpose) under some conditions by free-ranging chimpanzees was generally accepted as a proven fact by students of animal and human behavior.

The real significance of Goodall's observations was not, however, merely the unequivocal demonstration that wild chimpanzees use tools. Indeed, the use of modified natural objects is widely, if spottily, distributed throughout the animal kingdom: the activity of certain ants in cutting leaf fragments to be used as a substrate for the growth of fungi which these leaf-cutter ants consume; the appropriation of an uninhabited shell for use as a protective covering by the hermit crab; the construction of nests fashioned from aquatic vegetation by the three-spined stickleback; the use of a cactus spine by one species of Galapagos finch (*Camarhynchus pallidus*) to spear insects burrowing in trees; and the employment of a chest-held stone anvil by the sea otter for cracking

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MEETING ANNOUNCEMENTS: VII INTERNATIONAL CONGRESS OF ANIMAL REPRODUCTION AND ARTIFICIAL INSEMINATION

This congress will be held in Munich, Germany, June 6-9, 1972, and will feature a symposium on reproductive problems and artificial insemination of nonhuman primates. This symposium will be held on the afternoon of Wednesday, June 7, 1972. In addition, organizers of this symposium are requesting that scientific papers related to reproduction in nonhuman primates be submitted for presentation at the meeting. Efforts are underway to obtain charter flight arrangements for those wishing to attend this meeting. Further information on the Munich Congress can be obtained by writing to Dr. H. C. Messerschmidt, Secretary General, VII Internationaler Kongress, 53 Bonn, 1 Adenaueralle 176, W. Germany. Information on the symposium itself can be obtained from Dr. W. Richard Dukelow, Endocrine Research Unit, Michigan State University, East Lansing, Michigan 48823, USA.

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PRIMATES IMPORTED INTO U.S.A. IN 1970

The numbers of primates that entered through various ports were as follows: New York, 24,975; Miami/SE-U.S., 57,921; Los Angeles, 1,220; San Francisco, 379; All others, 656. Total: 85,151. (From *ILAR News*, 1971, *14* [2], 19-21. Based on statistics compiled in the Branch of Permits, Division of Management and Enforcement, Bureau of Sport Fisheries and Wildlife, United States Department of the Interior, Washington, D. C. 20240.)

EFFECTS OF CHLORAMPHENICOL ON BARBITURATE AND HALOTHANE ANESTHESIA IN RHESUS MONKEYS (*MACACA MULATTA*)*

Stephen Potkay and Amos E. Palmer

Laboratory Aids Branch, Division of Research Services

National Institutes of Health

Chloramphenicol is employed in a variety of medical and surgical situations involving nonhuman primates. Its efficacy in treating certain infectious diseases has been described and it is commonly used to provide antibacterial prophylaxis following surgery on monkeys (Cass, 1952; Hardy, 1954; and Young *et al.*, 1957). It was recently reported that chloramphenicol potentiated the duration of pentobarbital anesthesia in dogs and cats (Adams & Dixit, 1970). Inasmuch as pentobarbital sodium is a frequently used anesthetic for monkeys (Young, 1965 and Domino *et al.*, 1969), it was of interest to ascertain whether the same effect would be observed in rhesus monkeys (*Macaca mulatta*). The effects of chloramphenicol administration on thiamylal sodium and halothane anesthesia were also examined.

Materials and Methods

Forty-eight adolescent rhesus monkeys weighing 1.8 to 3.4 kg were used. The monkeys, obtained from a commercial source, were quarantined for at least 8 weeks prior to study. All of the monkeys used were clinically normal as determined by physical examination.

Chloramphenicol sodium succinate (Chloromycetin, Parke-Davis), pentobarbital sodium (Pentosol, A. J. Buck & Son, Baltimore, Md.), thiamylal sodium (Surital, Parke-Davis), and halothane (Fluothane, Ayerst Laboratories) were used in these experiments. Control monkeys received sterile water in the same volume per kg and by the same route as those treated with chloramphenicol. Neither chloramphenicol nor anesthetic agents were administered to any monkey during the quarantine period.

The monkeys were divided into 4 treatment groups, each containing 3 males and 3 females. The corresponding controls in each group consisted of 3 male and 3 female monkeys. The following experiments were performed.

Group 1.--Chloramphenicol (30 mg/kg) was administered intravenously followed immediately by pentobarbital sodium (26 mg/kg) by the same route.

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*The authors wish to acknowledge the assistance of Dr. John Petersen with this study.

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Group 2.--Chloramphenicol (30 mg/kg) was given intramuscularly followed immediately by intravenous pentobarbital sodium (26 mg/kg).

Group 3.--Chloramphenicol (30 mg/kg) was given intramuscularly followed immediately by intravenous thiamylal sodium (26 mg/kg).

Group 4.--Anesthesia was induced using thiamylal sodium (26 mg/kg) given intravenously. Halothane (1.0%) was administered to maintain surgical anesthesia for 1 hour using an out-of-circuit vaporizer (Fluomatic, Foregger Co., Roslyn Heights, N.Y.), an Ohio-Heidbrink Kinet-O-Meter and a positive pressure ventilator (Ohio Chemical and Surgical Equipment Co., Madison, Wis.). Chloramphenicol was administered intramuscularly (30 mg/kg) immediately prior to induction of anesthesia. Monkeys weighing from 3.18 to 5.80 kg were used in this group to facilitate endotracheal intubation.

Assignment of treatment (chloramphenicol) and control (sterile water) injections to the monkeys in each group was made using a table of random numbers. The order of administration of chloramphenicol or water was also determined randomly in each group. Recovery time was calculated as the lapsed time between the administration of the anesthetic and the time at which the monkey could stand in a quadrupedal position without support. In Group 4, calculation of recovery time was begun when the administration of halothane was stopped. Monkeys were returned to their cages for observation immediately following the administration of anesthesia. Food was withheld for 12 hours prior to study. Water was available *ad libitum*. The experiments were performed using a blind procedure; the individual who administered the anesthetic and measured the recovery time did not know whether the animal had received prior treatment with chloramphenicol or sterile water. Data were evaluated using the F-test for randomized experiments.

Results

The results obtained in each Group are shown in Figure 1. The mean recovery time of monkeys in Group 1 which received chloramphenicol intravenously was 321 minutes (SD = 126), whereas that of the controls was 201 minutes (SD = 27). Similarly in Group 2, the recovery time for monkeys given chloramphenicol intramuscularly was 317 minutes (SD = 94) compared to 190 minutes (SD = 54) for the controls. The difference in recovery time between monkeys receiving chloramphenicol and controls in both groups was significantly different ($F = 8.34$, $df = 1/10$, $p < 0.05$). There was no difference in recovery time between monkeys in Groups 1 and 2 which received chloramphenicol ($F = 0.00$, $df = 1/10$, $p > 0.05$). Likewise, the recovery time of monkeys in Groups 1 and 2 which received sterile water was similar ($F = 0.22$, $df = 1/9$, $p > 0.05$).

Administration of thiamylal sodium to monkeys in Group 3 which were given chloramphenicol intramuscularly was associated with a recovery time of 85 minutes (SD = 38). Recovery time in the controls, which was

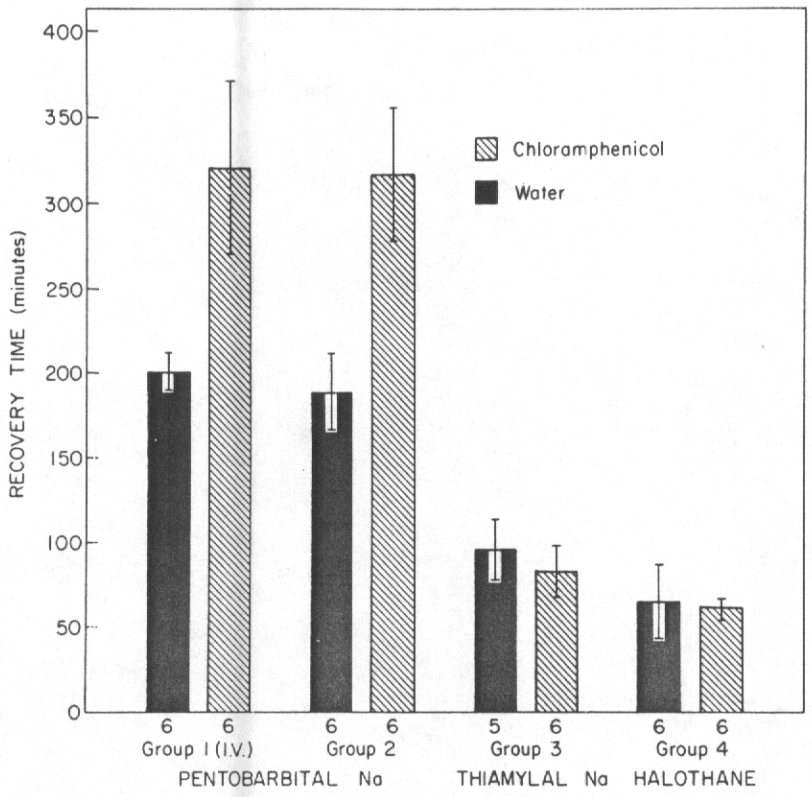

Figure 1. Effects of chloramphenicol sodium succinate on recovery from pentobarbital sodium, thiamylal sodium and halothane anesthesia in rhesus monkeys. Standard errors of means are represented by small vertical lines. The numbers below each bar indicate the numbers of monkeys used.

96 minutes (SD = 40), did not differ significantly from this (F = 0.23, df = 1/9, $p > 0.05$). One control monkey was discarded from the study because a portion of the anesthetic was inadvertently administered perivascularly.

The time required for recovery from halothane anesthesia was 66 minutes (SD = 56) in controls and 62 minutes (SD = 15) in monkeys given chloramphenicol intramuscularly. The difference was not significant (F = 0.02, df = 1/10, $p > 0.05$).

Discussion

Previous studies in dogs and cats showed a prolonged duration of pentobarbital anesthesia in animals treated with chloramphenicol (Adams & Dixit, 1970). The present study extends this observation to include the rhesus monkey. Experiments performed in mice indicate that chloram-

phenicol interferes with the biotransformation of certain oxybarbiturates through inhibition of hepatic microsomal enzme activity (Dixon & Fouts, 1962). It is possible that the results obtained in dogs, cats and rhesus monkeys are related to inhibition of pentobarbital degradation by chloramphenicol in a manner similar to that reported in mice. Further results which are consonant with the foregoing appeared after the present study was completed. Adams (1970) reported that chloramphenicol administered in conjunction with pentobarbital, hexobarbital or amobarbital was associated with prolongation of recovery from anesthesia in rhesus, cynomolgus (*Macaca fascicularis*), and squirrel (*Saimiri sciureus*) monkeys.

Recovery from thiamylal and thiamylal-halothane anesthesia was not influenced by chloramphenicol administration in monkeys. Thiamylal and other thiobarbiturates are metabolized in kidney, brain, and heart as well as in the liver (Cooper & Brodie, 1952). However, the anesthetic activity of thiamylal is more related to tissue uptake and vascular distribution than it is to hepatic metabolism (Brodie, 1952; Greene, 1968). Failure to observe any potentiation of halothane-maintained anesthesia by chloramphenicol may be related to the brief (1 hour) period of anesthesia and the apparently small role that hepatic enzymes have in elimination of halothane from the body. It is also possible that different hepatic enzyme systems are involved in the biotransformation of oxybarbiturates and halothane.

It is generally desirable that surgical subjects become ambulatory as quickly as possible following surgery. In such instances the combined administration of chloramphenicol and pentobarbital to monkeys should be avoided. Surgical levels of halothane anesthesia are easily maintained after induction with thiamylal. These characteristics coupled with rapid recovery from anesthesia indicate the appropriateness of thiamylal-halothane anesthesia compared to pentobarbital anesthesia for rhesus monkeys.

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CHARTER FLIGHTS FOR 3RD CONFERENCE ON EXPERIMENTAL MEDICINE AND SURGERY IN PRIMATES

A charter flight with flexible return dates, or other group flight arrangements, may be arranged for American scientists and their families for purposes of attending the Third Conference on Experimental Medicine and Surgery in Primates in Lyon, France, June 21-23, 1972.--Contact: J. Moor-Jankowski, M. D., Laboratory for Experimental Medicine and Surgery in Primates (LEMSIP), New York University School of Medicine, 550 First Avenue, New York, New York 10016.

PRIMATE ANESTHESIOLOGY*

R. A. Hilloowala

West Virginia University Medical Center

With the growing use of primates as a research animal, anesthesiology in a research laboratory is acquiring an increasing importance. Techniques commonly used in human anesthesiology have been adapted to primate use, and details are presented.

An anesthesiologist was once defined as "a man half asleep looking after another man half awake." In veterinary anesthesiology, the surgeon is often the anesthetist. This situation may be then characterized as "a man only half looking at an animal half awake." This double duty can be somewhat perilous in that after induction of anesthesia, monitoring is limited to an occasional glance at the subject animal's breathing, and observation of the color and blood flow at the operation site. Another common and equally unsatisfactory arrangement in many veterinary institutions is that of a senior technician responsible for the administration of anesthesia. All too often this technician must double as a circulating nurse. Under these circumstances little, if any, consideration is given to interspecies variation of physiologic or pharmacologic parameters.

Several techniques that we have developed for the administration of anesthetic agents to primates are described in this note. Most of the subjects were rhesus monkeys (*Macaca mulatta*) though some baboons (*Papio*), African greens (*Cercopithecus sabaeus*) and even a few chimpanzees (*Pan*) were handled using the same techniques.

Anesthetic Techniques

Intravenous.--The longer-acting barbiturates are used in surgical procedures, such as oral surgery, fractures, and amputations. The most commonly used is pentobarbital sodium, at a dosage level of 25 mg per kg of body weight.

Advantages: Ease of administration.
Disadvantages: Once induced, the depth of anesthesia cannot be controlled and, as such, respiratory and circulatory complications present formidable problems. A long post-

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*The work was done at Bionetics Research Laboratory, Falls Church, Virginia and conducted under Contract PH 43-62-412 within the Special Virus-Leukemia Program of the National Cancer Institute, National Institutes of Health.

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operative recovery period, varying from 3 to 8 hours or longer, during which unnoticed aspiration of regurgitated stomach contents may occur, increases the possibility of pneumonia.

Inhalation.--Methoxyflurane (Metofane, Pitman-Moore) is used almost exclusively. In the open drop method of induction, methoxyflurane is administered through a rubber anesthesia face mask fitted with a single layer of gauze covering the opening at the top of the mask. In the average adult animal (e.g. rhesus monkeys weighing 6.8-9.1 kg) administration of 10 to 15 drops of methoxyflurane per minute will induce a plane of anesthesia which allows the mouth to be opened, and an endotracheal tube to be inserted. Induction time varies from 3 to 5 minutes. A No. 14 or 16 French endotracheal tube is readily inserted with the aid of a Foregger Laryngoscope No. 2 straight blade and at times also a McGill forceps. Once the tube is inserted, its cuff is inflated and the tube itself attached to a gas apparatus (Ethaire Unit, Air Shields Company, Hatboro, Pennsylvania). The unit is of simple design, inexpensive and can be regulated to deliver a gradually increasing or decreasing concentration of methoxyflurane mixed with air or oxygen. This is a non-rebreathing system; therefore, there is no build-up of carbon dioxide and no need for soda-lime canisters.

Advantages: Inhalation anesthesia allows for dose control of the depth of anesthesia, especially important in old or debilitated animals. The postoperative recovery period is short, and the animal can be allowed to awake on the table as soon as the procedure is completed.
Disadvantages: A longer period of induction and the necessity for coping with a struggling animal.

Combined intravenous and inhalation.--The intubation procedure can be facilitated by the intravenous induction of anesthesia with a short-acting barbiturate such as thiopental sodium. Following intubation, inhalation anesthesia is administered as described. For cesarean section the combination method is modified so that the intravenous anesthetic is injected after the operation site is prepared and draped and just before incision.

Advantages: Short induction time and a smooth recovery.
Disadvantages: No significant disadvantages.

Supportive Procedures

Monitoring.--The patient's blood pressure, heart beat, and respiration are monitored throughout the procedure. Blood pressure is determined by auscultation using an infant-size sphygmomanometer. The cuff is applied just above the monkey's elbow. Before administration of anes-

thesia, the systolic blood pressure of an animal under restraint may be as high as 180 mm of mercury. In anesthetized animals, the systolic pressure varies from 120 to 90 mm of mercury and the diastolic from 80 to 50 mm of mercury. In smaller animals (e.g., 3.2-3.6 kg rhesus monkeys) it is sometimes difficult to determine diastolic pressure.

Pulse monitoring was attempted with a commercial pulse monitor but the procedure was discontinued as it was unreliable in monkeys because of smaller body size than humans, which resulted in displacement of the needle with routine movements during surgery and subsequent false readings. Monitoring of heart beat with a stethoscope placed over the precordium was substituted. Respiration is monitored or evaluated by visual, tactile, or auscultatory observation.

Intubation.--Tracheal intubation is routinely used in all anesthetized animals to assure a patent airway and to facilitate resuscitative measures if required. We have found it very desirable to also intubate the esophagus. In the event of regurgitation, this prevents vomitus from pooling in the pharynx with subsequent aspiration. This technique also prevents swallowing of foreign bodies.

Fluid therapy.--Intravenous saline drip is also standard procedure. In cases where it is difficult to obtain a vein and infusion is essential, subcutaneous infusion of saline with 75 U.S.P. units of hyaluronidase is done and the absorption is satisfactory.

While this is considerable progress from the "rag and bottle" anesthesia, it is anticipated that additional sophisticated equipment and techniques could be incorporated such as cardiac monitors, a pacemaker, and a defibrilator.

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HUMAN INFECTION WITH MONKEYPOX VIRUS IN AFRICA*

Between September 10, 1970, and December 9, 1970, five human infections with monkeypox virus were reported from West Africa.

(1) The first case occurred in a 4-year-old girl in Bouduo, Liberia, who began experiencing fever, sore throat, and malaise on September 10. A generalized rash developed on September 13, and she was admitted to a hospital in Zwedru the following day with a clinical diagnosis of smallpox. She had not been vaccinated. On September 18, the girl was afebrile, but she still had a diffuse vesiculopustular rash with peripheral distribution. She had lesions on the palms of her hands and soles of her feet. On October 7, the scabs fell off, and she was discharged from the hospital the next day. (2) The second case was in a 4-year-old boy who lived in the same room with the 4-year-old girl. He developed a low-grade fever on September 11 and a mild vesicular rash the next day. Lesions cleared within 5 days and left no scars. The boy had never been vaccinated. (3) The third case occurred in a 6-year-old girl, an unvaccinated playmate of the 4-year-old patients, who lived in a nearby compound. The girl became ill with fever and a rash on or about September 11. Physical examination revealed fewer than 10 lesions. (4) On October 2, a 9-year-old unvaccinated boy from Tarr Town, northwest of Bouduo, began having a generalized vesiculopustular rash with all lesions appearing in the same stage. The lesions were firm, deep-seated, and distributed primarily on the arms and legs. There was one pustular lesion on the right cornea. The child was afebrile and uncomfortable, but not severely ill.

These four cases were clinically diagnosed as smallpox. The first three patients, with similar dates of onset, presumably had a common exposure. However, no connection between these cases and the fourth case could be found. No other cases among household contacts and friends were reported. Five poxvirus isolations were made from specimens from cases 1 and 4, the most severe cases. The viruses were studied extensively at reference laboratories in Atlanta, Moscow, London, and Utrecht and were identified as monkeypox. Blood specimens from 18 local monkeys were also examined, and five were found to contain antibodies to poxvirus with low level hemagglutination inhibition (HI) titers. One specimen was also positive for neutralizing antibodies. Specimens taken from 55 monkeys in Nigeria contained no HI antibodies.

The source of the infections in Liberia remains unknown. Although there is known contact between people and monkeys in the area (monkeys are a source of food), specific exposure of the patients to sick monkeys could not be documented.

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*From *CDC Veterinary Public Health Notes*, March, 1971, pp. 3-5.

(5) The fifth case reported from West Africa occurred in a boy from the village of Aguebu, Sierra Leone, who was seen by the medical officer of the Moyamba District Hospital on December 10 (the 10th day of rash). The patient had large pustular lesions on his face and extremities. There was no evidence of a smallpox vaccination scar, and his illness was clinically diagnosed as smallpox. Laboratory examination revealed poxviruses, later identified as monkeypox, in crust and vesicular fluid. The patient had removed the intestines and stomach of a red monkey 3-4 weeks prior to onset of his illness. He denied having had any other contact with monkeys, and he did not see any skin lesions on the monkey he handled. Four of 16 serum specimens from chimpanzees captured in Sierra Leone contained low level HI antibodies against poxvirus, suggesting the possibility of infection in the monkey the boy had contact with.

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CORRESPONDENCE

PROSIMIAN VISUAL DISCRIMINATION APPARATUS

Sir: I read with interest the article by J. L. Fobes *et al.*, "A rear projection visual discrimination apparatus for prosimians" (this *Newsletter*, 1971, *10* [1], 7-8).

Since the plexiglas surfaces measure only 4 cm in diameter, it occurred to me that another solution might be feasible which would not require a current to be sent through the animal's body, nor would in any way effect the projected image: I suggest (1) stretching a transparent plastic sheet at a small distance from the plexiglas surface and (2) installing an electric eye system between the two surfaces. A very slight pressure on the plastic sheet would interrupt the electric beam and allow recording of the action.

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CHIMPANZEE-ASSOCIATED HEPATITIS*

Between Dec. 24, 1970, and Jan. 5, 1971, eight cases of infectious hepatitis occurred among 16 people associated with an animal hospital in Culver City, California. The patients included three veterinarians, a lab technician, two veterinary assistants, the wife of one of the veterinarians, and a chimpanzee trainer. All patients had symptoms of hepatitis, and five were jaundiced. All had abnormal liver function tests consistent with viral hepatitis and negative tests for hepatitis-associated antigen. Blood samples were also collected from other exposed employees and clients of the hospital and from household contacts, but no additional cases were found. On Jan. 25, 1971, however, a ninth case occurred in a part-time employee of the hospital, possibly representing secondary spread of infection.

None of the nine patients had been exposed to known cases of viral hepatitis, blood transfusions, contaminated food or water, or needles. None had traveled recently or could recall sharing common meals or attending large social gatherings. Seven of the nine patients, however, had had direct contact with two chimpanzees which had arrived at the hospital from Sierra Leone, West Africa, via Ferndale, Michigan, on Nov. 25, 1970. The other two patients had been indirectly exposed to these chimpanzees.

One chimp had been ill on arrival and died 2 weeks later, apparently from parasitic infestation. No blood was available for liver function studies, and postmortem results are pending. The second chimp remained healthy and began work at a movie studio on December 1. Although over 100 people have come in contact with this second chimp, none have contracted hepatitis. This animal had normal liver chemistries recorded early in January 1971.

Of the seven hospital employees who did not become ill, only two had been directly exposed to these chimpanzees; one of these had had hepatitis 1 year before. The other five had had minimal contact with the two chimpanzees. None of the hospital employees had received immune serum globulin within the past year or had used special precautions while handling the chimps.

The two chimpanzees had arrived with six others in Ferndale, Michigan, from Sierra Leone on Nov. 20, 1970. One of the six other animals was sent to a zoo in Bridgeport, Connecticut, and has been implicated as a source of hepatitis for at least eight people. No cases have been reported in association with the other five chimpanzees.

Editorial Comment.--Within the past 12 months, four outbreaks of

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*From *Morbidity and Mortality Weekly Report*, 1971, *20* [14], 128. The editorial comment is also from the original source.

chimpanzee-associated hepatitis have been reported to CDC. (Two of the outbreaks are referred to above.) Another occurred in San Francisco, California, in May 1970 and involved a veterinarian and an animal handler. The fourth occurred in St. Louis, Missouri, and involved 14 cases. These outbreaks illustrate the risk of hepatitis for handlers of chimpanzees. Persons who work with newly imported higher primates should be advised to handle the animals and their excreta carefully and to take immune serum globulin for protection.

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PRIMATE ZOONOSES SURVEILLANCE

The contents of Report Number 4 (Annual Summary 1970) of this series (see *Laboratory Primate Newsletter*, 1971, *10* [2], 24-27 and 1970, *9* [4], 32, for further information) are as follows:

I. Introduction
II. Surveillance Data
  A. Surveillance of disease in nonhuman primates
  B. Occurrence of human disease associated with nonhuman primate contact
III. Case Reports
  A. Preliminary note on an epizootic of tuberculosis in a great ape population
  B. An unusual outbreak of simian tuberculosis
  C. Spontaneous Herpesvirus hominis infection in tree shrews (*Tupaia glis*)
  D. A fatal case of human shigellosis associated with a pet spider monkey
  E. Three recent outbreaks of chimpanzee-associated hepatitis
IV. Special Reports
  A. Hemagglutination-inhibition antibody titers for vaccinia and monkeypox in nonhuman primates
  B. Rabies in nonhuman primates
V. Other Reports
  None
VI. Appendices
  Reported non-fatal disease tabulated by reporting period, by length of time in colony, by age group, and by species group
  Reported fatal disease tabulated by reporting period, by length of time in colony, by age group, and by species group
  Nonhuman primate population at the participating centers

NURSERY REARING OF NONHUMAN PRIMATES USING FOSTER MOTHERS[1]

Irwin S. Bernstein

Yerkes Regional Primate Research Center

Isolation rearing experiments (Harlow, 1963; Mason, 1968) have demonstrated that profound behavioral disturbances result when nonhuman primate infants are nursery reared in bare cages, on surrogates or even when housed in small groups. In colonies dedicated to the production of behaviorally normal animals, such rearing practices must be avoided. The stimulation provided for by mothers and peers is adequate to prevent the development of bizarre stereotypies characteristic of infants raised in deprivation environments. From time to time, however, infants must be removed from their mothers to insure survival, and laboratory personnel are faced with the task of providing the stimulation requisite for normal development.

In order to provide a constant source of stimulation, monkey infants of the Yerkes Field Station, whose own mothers cannot care for them, are reared in the presence of a foster mother and other infants. Since young infants require frequent feedings, three tractable females (two *Macaca nemestrina*, one *Cynopithecus niger*) were selected which not only tolerated and cared for infants, but also permitted technicians to handle and feed the infants. Familiar technicians can open the cage doors, bottle feed the infants and offer supplemental foods without resorting to restraining procedures or protective gloves. This procedure has proven quite satisfactory and infants reared under these conditions do appear to be behaviorally normal.

The case of one foster mother is remarkable. This pigtail female was received into our colony in February 1967. She appeared to be a young adult at that time (about six years old) but was judged nulliparous on the basis of the condition of her nipples. All efforts to breed this animal failed and she was selected as a foster mother on 8 December 1969. She was placed with a three-month-old hybrid (*Macaca silenus* × *Macaca nemestrina*) and a five-week-old surviving twin pigtail monkey infant. The adult female carried the younger infant in the normal ventral-ventral position with the older one usually on the back or to the side of the younger. The younger one was usually in contact with and sucking on the female's nipple. By the end of January, the younger infant began to refuse bottle feeding. On 5 February the infant and female were examined and it was discovered that the female was lactating. Several drops of

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[1]This research was supported by Research Grant No. MH-13864 from the National Institute of Mental Health and in part by Grant No. FR-00165 from the Division of Research Resources, National Institutes of Health.

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milk were readily expressed from her breasts by hand stripping. This procedure was repeated on 17 March and 20 August and small quantities of milk were expressed each time, although in August the supply was considerably reduced.

The foster mother program has proven successful in that the infants so reared appear to be behaviorally normal and are active and play with other infants. There are no evidences of behavioral disturbances, or stereotypies, nor do the fostered infants suck digits. Sexual behavior appears normal. This system appears to be one of the less costly procedures for rearing normal monkeys orphaned by their natural mothers at birth.

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* * *

REQUEST FOR INFORMATION: SOURCES OF *TUPAIA TANA* AND *PTILOCERCUS LOWII*

I would like to locate a supplier or a laboratory/zoo colony of the following treeshrew species: *Tupaia tana* (terrestrial or great treeshrew) and *Ptilocercus lowii* (feather-tailed treeshrew).--Farish A. Jenkins, Jr., Department of Anatomy, College of Physicians & Surgeons of Columbia University, 630 West 168th Street, New York, N. Y. 10032.

DEDICATION OF NEW PRIMATE BUILDING AT N.I.H. HELD

Dedication ceremonies were held May 20, 1971 in Wilson Hall at the National Institutes of Health, Bethesda, Maryland, for a building especially designed for quarantine, conditioning, and breeding of nonhuman primates. The new Primate Building is located on the 513-acre National Institutes of Health (NIH) Animal Center approximately 30 miles from Bethesda near Poolesville in Montgomery County, Maryland. It will house 1500 Old World and New World monkeys and apes. A total of 4000 primates will be processed each year in support of NIH biomedical research.

The 20,000-square-foot structure contains 69 rooms including indoor runs, cage areas, a surgery, a pharmacy, an automatic watering system, and food-preparation and cage-washing equipment. Modern environmental controls and equipment for medical care of the animals are incorporated in the building along with an electrically operated double door system for complete containment and control of the animals. Primates will spend a minimum 60-day conditioning period in these quarters. The building cost $884,000.

The central core design of the building will permit economical, rapid construction of additions which can double its capacity should breakthroughs or new biomedical research require an increased number of prime condition primates.

The NIH Animal Center is operated by the Laboratory Aids Branch of the Division of Research Services, NIH. William B. DeWitt, Ph.D., is Division Director; Joe R. Held, D.V.M., M.P.H., is Branch Chief; and Amos Palmer, D.V.M., is Chief of the Center.

With the completion of the primate building, for the first time space for a central holding facility for primates is available on the NIH campus at Bethesda. George L. Clarke, D.V.M., M.S., will manage this part of the overall primate program.

As part of the dedication, a day-long symposium on tuberculosis in primate colonies was held. Principle speakers at the symposium were: Leon H. Schmidt, Ph.D., Southern Research Institute, Birmingham, Alabama; James D. Roswurm, D.V.M., M.P.H., U.S. Department of Agriculture, Hyattsville, Maryland; Earl Fife, M.S., Walter Reed Army Institute of Research, Washington, D. C.; Peter Baram, Ph.D., American Dental Association Research Institute, Chicago, Illinois; Julian E. Villareal, M.D., Ph.D., University of Michigan, Ann Arbor, Michigan; and Thomas B. Clarkson, D.V.M., The Bowman Gray School of Medicine, Winston-Salem, North Carolina and The National Academy of Sciences.

monkey. Includes 116 large plates consisting of photographs with matching explanatory line drawings on facing pages in four series: (1) gross orientation, (2) sagittal, (3) horizontal, and (4) transverse sections.

Nutrition and disease in experimental animals. W. D. Tavernor (Ed.) London: Baillière, Tindall & Cassell, 1970.

Chapters include: Protein and amino acid requirements of experimental animals, P. R. Payne; The vitamin requirements of laboratory animals, R. J. Ward; Vervet monkey disease (Marburg disease), Zlotnik, I.

FILMS

Vocalization of wild chimpanzees. (16 mm color, sound, 40 min.) Lawick, H. van, Marler, P., & Lawick, J. van. Rockefeller University Film Service, New York, N. Y. 10021. (Rental price: $20; Sale price: $400)

Sound signals used by the chimpanzees of the Gombe National Park in Tanzania have been recorded in synchrony with the filming of other ongoing social activities. Thus, the film portrays the social context in which the different vocalizations occurred, along with the gestures and facial expressions that accompanied them. Titles give classifications of the vocalizations based on sound spectrographic analysis.

Behavior and ecology of vervet monkeys. (16 mm color, sound, 40 min.) Struhsaker, T. T. Rockefeller University Film Service, New York, N. Y. 10021 (Rental price: $20; Sale price: $400)

Filmed in the Masai-Amboseli Game Reserve of Kenya, this field study describes basic aspects of the behavior and ecology of free-ranging vervet monkeys, including social structure, behavior patterns employed in social interactions, dominance, sexual behavior, and mother-infant relations. The narration describes the general habitat and interspecific relations of this vervet population.

DISEASE

Acute bloat syndrome in stumptailed macaques (*Macaca arctoides*): a report of four cases. Newton, W. M., Beamer, P. D., & Rhoades, H. E. (Coll. Vet. Med., U. Illinois, Urbana, Ill. 61801) *Laboratory Animal Science*, 1971, *21*, 193-196.

Husbandry conditions and lesions associated with 4 cases of acute bloat syndrome in monkeys were not unlike those associated with enterotoxemia in ruminants. *Clostridium perfringens* organisms were cultured from the intestinal contents, and *Clostridium perfringens* toxis was demonstrated in the colon contents of 1 animal.

Idiopathic muscle necrosis with apparent myoglobinuria in *Macaca arctoides*. Seibold, H. R., Roberts, J. A., & Wolf, R. H. (Tulane Univer., Delta Reg. Primate Res. Cen., Covington, La. 70433) *Laboratory Animal Science*, 1971, *21*, 242-246.

A young, male *Macaca arctoides* developed a syndrome consistent with idiopathic paraxysmal myoglobinuria (Meyer-Betz disease) shortly after being subjected to a marked change of environment. Clinical signs were marked depression, dehydration, aliguria, and terminal collapse. Necropsy revealed asymmetrical white discoloration of skeletal muscles, along with pulmonary congestion and edema. The essential histopathological alterations were severe, acute muscle necrosis, and blockage of renal collecting tubules with myoglobin casts.

Acute pasteurellosis in owl monkeys (*Aotus trivirgatus*). Benjamin, S. A., & Lang, C. M. (Dept. Comp. Med., Pennsylvania State U. Coll. Med., Milton S. Hershey Med. Cen., Hershey, Pa. 17033) *Laboratory Animal Science*, 1971, *21*, 258-262.

The gross and microscopic findings in 3 juvenile owl monkeys, dying of acute pasteurellosis were described. The lesions were similar to those reported for this disease in other animal species. They were those of an acute bacteremia and included an acute fibrinopurulent pneumonia and pleuritis, acute interstitial pneumonitis, purulent enterocolitis, purulent meningoencephalitis, and disseminated bacterial embolism. *Pasteurella multocida* was isolated from the lesions of 1 of the animals and a morphologically identical organism was present histologically in the lesions of the other 2.

DRUGS

Reactions to fluphenazine hydrochloride by two adult male macaques. Boelkins, R. C. (Primate Behav. Lab., Dept. Psychiatry, Stanford U. Sch. Med., Stanford, Calif. 94304) *Laboratory Animal Science*, 1971, *21*, 272-274.

Prolixin Enanthate (fluphenazine hydrochloride), one of the phenothiazine group of tranquilizers, was given intramuscularly to 2 adult male macaques at a dose rate of 0.07 mg per kg of body weight. The *Macaca fascicularis* tolerated the drug well, showing a mild tranquilization lasting for about 12 days. The *Macaca arctoides* had a severe and prolonged Parkinsonian neurologic reaction requiring treatment with Cogentin (benztropine mesylate) for 4 days and hand feeding for 8 days. Possible reasons for the different responses were suggested.

FACILITIES, CARE AND BREEDING

The owl monkey (*Aotus trivirgatus*) as a research animal.

Cullingham, T. J. (Liverpool Sch. Tropical Med., Liverpool, England) *Journal of the Institute of Animal Technicians*, 1970, *21*, 84-92.

The care and handling of owl monkeys is described.

Breeding the stump-tailed macaque, *Macaca arctoides*. Trollope, J., & Blurton-Jones, N. G. (Dept. Growth & Development, Inst. Child Health, 30 Guilford St., London, W.C.1, England) *Laboratory Animals*, 1970, *4*, 161-169.

The establishment of a small breeding colony of *Macaca arctoides* is described and compared with reports on breeding *Macaca mulatta*. Despite restrictions imposed on the breeding methods by a developmental ethological study, 7 young, 6 of which were conceived in the laboratory, have been obtained from 6 females in just over 3 years.

ECOLOGY, FIELD STUDIES, & TAXONOMY

Report on primates collected in western Thailand. Fooden, J. (Field Museum Nat. History, Roosevelt Rd., Lake Shore Dr., Chicago, Ill. 60605) *Fieldiana Zoology*, 1971, *59* [1], 1-62.

During 4 months of field work 152 specimens of 9 species of primates were collected in western Thailand. Three species--*Macaca fascicularis*, *M. nemestrina*, *Presbytis cristatus*--are Indo-Malayan; 3--*M. mulatta*, *M. assamensis*, *P. phayrei*--are Indo-Chinese; and 3--*Nycticebus coucang*, *M. arctoides*, *Hylobates lar*--inhabit both faunal and subregions. Specimens collected indicate that the range of *M. nemestrina* is marginally sympatric with that of *M. assamensis*, whereas the ranges of *M. fascicularis* and *P. cristatus* appear to be allopatric with those of *M. mulatta* and *P. phayrei*. Analysis of new evidence concerning the zoogeographical and morphological inter-relationships of *M. fascicularis* and *M. mulatta* suggests that these macaques should be regarded as species instead of subspecies as previously indicated. Most encounters with the 9 primate species collected were in evergreen forest, but *N. coucang* *M. fascicularis*, and *M. mulatta* also were taken in groves of bamboo. Only *M. arctoides* was encountered out of the trees on the forest floor. For each species collected external measurements are given and observations are recorded on habitats, group size, stomach contents, and reproductive condition.

INSTRUMENTS AND TECHNIQUES

A restraint system for chronic study of the baboon. Findley, J. D., Robinson, W. W., & Gilliam, W. (Dept. Psychiatry & Behav. Sci., John Hopkins U. Sch. Med., Baltimore, Md.

21205) *Journal of the Experimental Analysis of Behavior*, 1971, *15*, 69-71.

Laboratory studies using combined behavioral and physiological techniques in larger primates continue to present numerous problems in the proper restraining of the subject. The difficulties of restraint increase markedly with the use of electric shock, indwelling cannulae and other surgical preparations, particularly where long-term experimentation is required. The report describes a system used with baboons and rhesus monkeys based upon an arm cuff device that serves both to hold the subject and to give control over the hands. Once the subject's arms are controlled and their reach limited, additional control of the head and feet may be accomplished easily and flexibly. The general approach is to anchor the arm cuffs on a movable track along with a waist plate and seat. This confines the baboon to a sitting position on a movable cart and allows ready transfer in and out of an experimental chamber.

The trapping and subsequent behavior of baboons in Kenya. Berger, M. E. (Dept. Wildlife Sci., Texas A. & M. Univ., College Station, Texas 77843) *Journal of Wildlife Management*, 1970, *34*, 817-820.

Baboons (*Papio cynocephalus*) are found in many areas of Kenya, but their distribution is limited by food and places to sleep safely. Equipment for trapping includes traps, pole-syringe, and a drug for sedation. Conditioning of the troop to be trapped is of the utmost importance and may take as long as 2 weeks to accomplish. Males are captured first, females and young ones later. The animals exhibit emotions of fear and anger on first being caught, but, after 1-2 days, become adjusted to captivity and the constant proximity of man. Our method allows a high degree of selectivity of animals and causes far less stress than other current methods.

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