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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 the mailing list is open to anyone in the primate field expressing an interest. There is no charge for new issues or the current issue. Back volumes will be furnished free of charge to any library operated by a nonprofit organization with the understanding that they will be kept in the library. Individuals may purchase Volumes 1, 2, 3, and 4 for $4.00 per volume, Volumes 5, 6, and 7 for $2.50 per volume, and back issues for the current year for $0.50 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. As a rule, authors of longer articles will receive five extra copies of the issue in which the article appears; 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 reference 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 reference 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), beginning with the April, 1969 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

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HERPES SAIMIRI, A VIRUS THAT PRODUCES A DISEASE RESEMBLING RETICULUM CELL SARCOMA IN NONHUMAN PRIMATES*

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Herpes saimiri is a virus reported previously as squirrel monkey kidney isolate 83 (SMK1-83) (Meléndez *et al.*, 1968). This virus was one of six indigenous agents obtained in kidney cultures from 10 different squirrel monkeys. The search for a "clean" kidney culture to study *Herpes saimiri* led us to the isolation of 21 indigenous viral agents from a total of 31 squirrel monkeys obtained from 2 different ecological niches. It has not been possible to completely characterize all of the 21 agents isolated as we devoted our efforts to study the host parasite relationship of *Herpes saimiri*.

Tissue cultures from sources other than squirrel monkeys were tested for susceptibility to *Herpes saimiri*. This met with success as kidney tissues from owl monkeys *(Aotus trivirgatus)* and cotton-top tamarins *(Leontocebus oedipus)* were destroyed by the viral agent.

To assess the behavior of *Herpes saimiri* in its natural host, squirrel monkeys were inoculated with the virus by various routes (Meléndez *et al.*, in press *a*). No evidence of disease was observed in this monkey species in spite of multiple inoculation and large doses of virus employed. It was also peculiar to observe that the level of antibodies developed in the animals was very low. This characterizes *Herpes saimiri* as a virus of low antigenic capacity.

The failure to detect any manifestation of disease in squirrel monkeys led us to inoculate other New World primates with *Herpes saimiri*. This attempt met with success as both marmoset monkeys and owl monkeys proved to be susceptible to the virus. *Herpes saimiri* produced in these two primate species a reticulo-proliferative disorder very similar to reticulum cell sarcoma. The extensive invasion in various organs by cells identified morphologically as reticulum cells closely resembles reticulum cell sarcoma as seen in both man and other animals. A detailed description of these findings is given elsewhere (Meléndez *et al.*, in press *b*).

Some viruses of the *Herpes* group are known to have oncogenic properties in animal hosts: Lucké frog adeno-carcinoma (Lucké, 1938; Lunger, 1964) and Marek's disease in chickens (Biggs & Payne, 1967;

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Kenzy & Biggs, 1967). Herpes-like viruses and Herpes simplex have also been suspected as etiological agents for some neoplasias like Burkitt's lymphoma and human cervical carcinoma (Mitchell *et al.*, 1967; Rawls *et al.*, 1968). Thus, the ability of *Herpes saimiri* to induce a disease with neoplastic characteristics in owl and marmoset monkeys might not be unusual. There are many aspects of this experimental disease that need to be studied further; however, this singular behavior of a virus derived from one primate species having the capacity to provoke a disease very similar to a neoplasia in other primate species might prove a useful model to study similar pathological conditions of man.

Since man is also a primate, this further suggests the need to be cautious in handling squirrel monkeys. To learn by lack of careful handling that man is susceptible to *Herpes saimiri* is too costly.

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AN EFFECTIVE RESTRAINING CHAIR FOR SMALL PRIMATES*

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In connection with some experiments on behavioral thermoregulation using squirrel monkeys *(Saimiri sciureus)* as subjects, it has been necessary to restrain the animals completely. Special problems are posed by the extreme environmental temperatures to which the animals are subjected. For example, these temperatures preclude the use of any metal in that portion of the restraining device that contacts the animal's body. Since no commercial device fulfilled all of our requirements, we designed and built our own restraining chairs. They have proved to be not only satisfactory but also economical and extremely durable. A description and drawings of the chair are presented below. It should be noted that the dimensions, as given, are appropriate for adult squirrel monkeys weighing between 600 and 1000 gm.

The chair consists of a heavy stand and two adjustable plates, one to hold the neck and the other to hold the waist. Wrist restrainers in the neck plate are optional. An overall view of the chair is shown in Figure 1. It is constructed entirely of plexiglas, the only metal parts being a few screws and the cotter pins holding the restraining slides in position in the two plates. Thus the chair is easily cleaned and can be sterilized if necessary. In addition, all major parts are adjustable: the two plates move up and down independently on the support rods; the slides adjust in and out; and the vertical hip clamps on the waist plate may be moved from side to side. The waist plate with seat rods comes apart completely.

The base consists of a 6 by 6 by 1 in. plexiglas slab with two 15 in. high, 1 in. diameter plexiglas rods set and screwed in the position shown in Figure 2A. These rods are milled to a 3/8 in. flat above the base in the screw contact area. Figure 2B gives a top view of the neck plate, slide and optional wrist hole cover. The beveled neck hole of 3/4 in. radius is centered in the plate and the beveled edge of the slide has the same radius. Narrow slots are milled in the plate to accept the slide flanges which are held in place with cotter pins dropped into small holes (see detail in Figure 3). All flat parts are machined from 1/4 in. stock, except for the wrist hole cover which can be thinner if desired. The heavy tightening rings (I.D. 1 in., O.D. 1-3/4 in.) set with 10-40 nylon screws are glued to the plate with Rez-N-Bond or similar plastic solvent.

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*The restraining chair described in this note was developed under U. S. Public Health Service Contract Number ES00354-01.

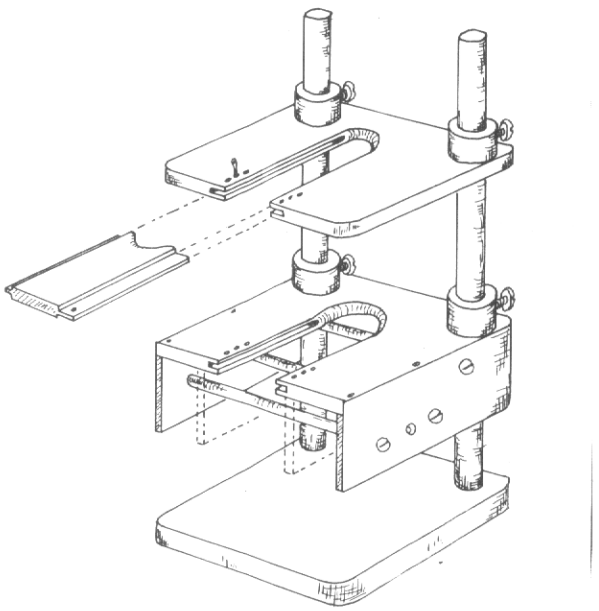

Fig. 1. Overall view of restraining chair for small primates.

The top of the waist plate is of the same design as the neck plate except that the radius of the beveled center hole is 1 in. A drawing of top and sides is given in Figure 2C. The top is screwed to each side with three 1/2 in. 2-56 stainless steel machine screws. Seat rods are 5-1/2 in. long and 3/8 in. diameter plexiglas rods, drilled and tapped at each end for 1/4-20 nylon screws that hold them to the side plates. Of course, the configuration of holes drilled in the side plates can vary according to individual requirements. A pair of inner plates, whose position is indicated by dotted lines below the waist plate in Fig. 1, can be used to prevent the animal from rotating in the seat. Machined the same as the outside plates, they can be pushed up to the hips and tightened against one of the seat rods by means of thumb screws.

Chairing an animal is best accomplished by two persons. One guides the monkey backward into the seat while the other pulls the tail between the rods and inserts first the neck and then the waist slides, pinning each in a comfortable position. Chairing for a gradually longer

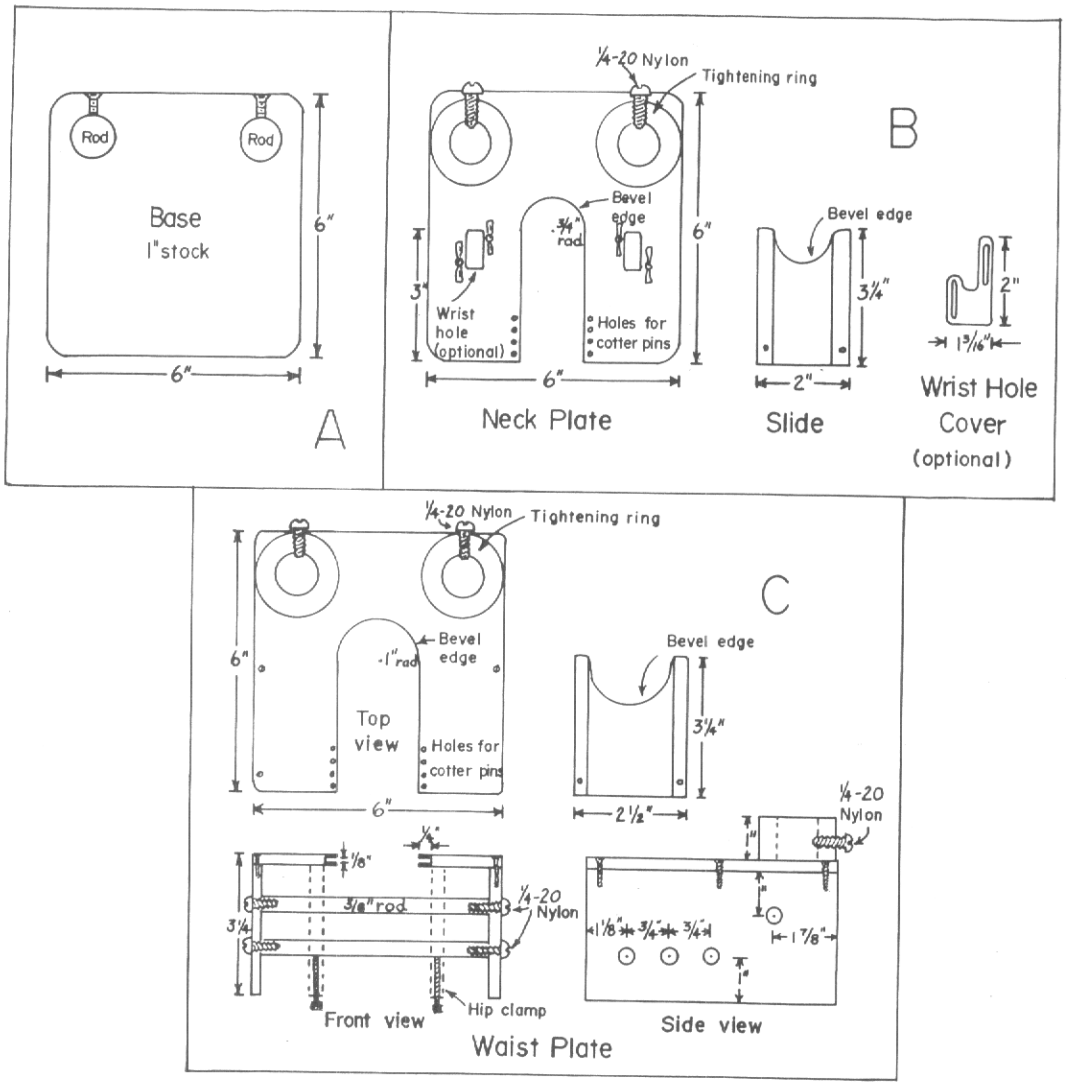

Fig. 2. Scale drawings of the parts of the restraining chair: A. Base plate showing position of rods. B. Neck restraining plate with slide and optional wrist hole cover. C. Waist restraining plate and slide with side supports for seat rods. Hip clamping plates are optional.

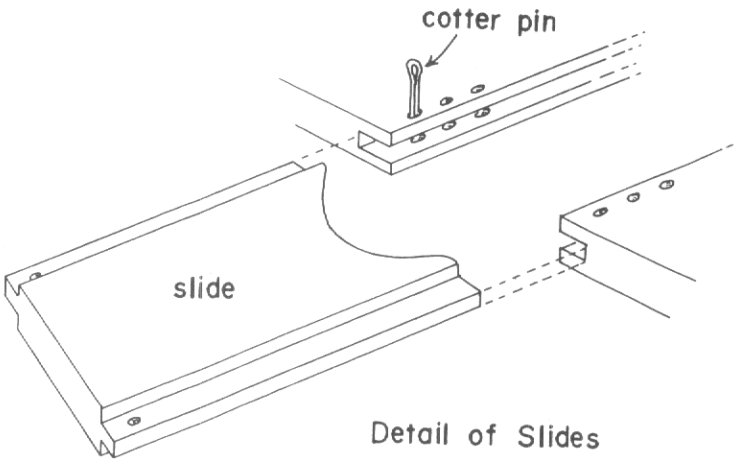

Fig. 3. Detailed drawing showing construction of slides (not to scale).

period every day for about 3 weeks results in good adaptation in most animals. Feeding preferred foods in the chair helps also. The monkey can be easily transported in this chair because it is small and light. Both IP and IM injections can easily be given to animals so restrained. Plexiglas chairs made as described in lots of 3 or more cost less than $100 each including labor.

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REQUEST FOR MONKEYS DISPLAYING ROCKING BEHAVIOR

We are interested in obtaining young macaques who were reared under unusual conditions and who show a significant amount of repetitive seated body rocking in their behavior repertoire. Rhesus monkeys between 1 and 2 years of age are most preferred but other macaques between 6-months-old and adulthood would also be useful. We would expect to purchase the animals and to pay for transportation.--Dr. Gershon Berkson, Illinois State Pediatric Institute, 1640 West Roosevelt Road, Chicago, Illinois 60608.

HALOTHANE ANESTHESIA FOR SQUIRREL MONKEYS USED IN NEUROPHYSIOLOGY STUDIES[1]

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In a developing program of cerebellar and experimental epilepsy studies in the squirrel monkey, *Saimiri sciureus*[2], halothane (Fluothane, Ayerst Laboratories Inc., New York) gas anesthesia has proved to be our anesthesia of choice for both short and long operative procedures. As we have encountered some significant side effects and technical errors in the use of this anesthesia in the squirrel monkey and have developed criteria for its safe use, this communication will deal with our experience and methods.

Since its introduction in 1956, halothane anesthesia has had a wide and successful use in medicine and a considerable literature exists on its pharmacology, administration, and side effects. The third edition of L. S. Goodman and A. Gilman's (1965) *The Pharmacologic Basis of Therapeutics* and the insert from the Ayerst Laboratory supplied with the anesthetic are good starting points for information and current literature. As there are no published studies, to our knowledge, on the specific use of this anesthetic in the squirrel monkey, we have kept some notes on its use in twelve adult animals in approximately 50 procedures varying in length from 5 min. to 5.5 hrs.

HALOTHANE PROPERTIES, STORAGE, AND ADMINISTERING EQUIPMENT

Halothane (2-bromo-2-chloro-1:1:1 trifluoroethane) is a pleasant smelling, non-irritating fluid supplied in 125 cc or 250 cc amber bottles which retard the formation of volatile acids. It is non-flammable. Mixtures with oxygen to concentrations of 50% are reported by the manufacturer to be non-explosive. Its potency is high and, therefore, its use in a semi-closed or closed delivery system must be precisely controlled.

In preparation for the use of this type of gas anesthesia, we purchased a Fraser Sweatman small animal anesthesia machine (Fraser Sweatman Inc., Hatfield, Pennsylvania) at a delivery cost of about $800.00 which included the machine, a Dräeger vaporizer with flush valve, a heavy

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[1]This work was supported by a grant from the National Institutes of Health, NB-02289.

[2]*Saimiri madeirae juruanus* according to Hill's (1965) classification scheme, Gothic type according to MacLean's (1964).

duty mobile stand, a cannister of soda lime (with indicator) and a 125 cc bottle of halothane. Other needed items include plastic adapters between the "Y" piece of the instrument delivery system and several sizes of inexpensive polyethylene tubing to be cut for use as endotracheal tubes since halothane interacts with rubber and some plastics but not with polyethylene. Some care must, therefore, be taken with materials used in the delivery system. In addition, we obtained a small clear plastic head chamber with a gas inlet at one end and an open rubber diaphragm at the other end through which the monkey's head is inserted. (The apparatus can also be used for cats.)

The Fraser Sweatman machine was obtained because it uses a precision Dräeger vaporizer which provides constant vaporized gas concentrations through ranges of 0.3-5.0 vols % at linear flow settings of 0.3-12.0 liters/min. The design of this vaporizer also prevents excessive changes in concentration during manual ventilation, an important point in animals with small tidal volumes. We find it a versatile and precise instrument with adequate control and safety features. It is sturdy, easy to clean, and can be purchased with a heavy duty castor stand. By providing an "in-circle" flow pattern whereby gas is recirculated in a semi-closed or closed loop fashion, low concentrations of gas, e.g., 0.7-1.0%, can be used during surgery at a relatively economical cost of operation.

For example, in a two-hour period of anesthesia (for animal Q-12 as described in detail in a later section) 14 cc of halothane were required at a cost of $1.12/hr. This is still more expensive than conventional anesthetics, especially when the cost of equipment is considered; however, the rapid recovery period, absence of prolonged post-operative care procedures, and the ability to study the animals shortly after surgery are among its decided advantages.

INDUCTION TECHNIQUES AND MONITORING

Monkeys selected for anesthesia are placed on a water-only regimen 12 hours prior to surgery. Approximately 15-30 minutes before anesthesia, the animal is given 0.2 mg/kg of atropine sulfate IM. Although halothane anesthesia is said to reduce secretory activity, during induction we have observed moderate amounts of salivary secretions in the squirrel monkey. Atropine appears to block this response completely in this animal and in addition appears to promote a more stable course of anesthesia. After the premedication period, the monkey is brought to surgery. When the animal is in a quiet state, the induction chamber is slipped over its head and a gas mixture of 2-3% in oxygen is given at 2 liters/min. Induction of anesthesia is extremely rapid and usually occurs within 60-90 sec. Eye blinking and minimal struggling occur during induction. This phase is continued until complete muscle relaxation is achieved, taking another 1-2 min. The chamber is removed and the animal is quickly placed on its back. A soft polyethylene endotracheal tube is, with some practice, easily placed with the aid of a premature infant sized laryngo-

scope blade (Welsch-Allen, Skaneateles Falls, New York, Model No. 635). The trachea of the squirrel monkey is of small diameter and it is important to use a tube of the correct size, i.e., one that can be passed with some difficulty but without trauma. We have not been able to obtain an endotracheal cuff tube of the requisite small size. Gagging means the anesthetic level is too light. An animal can be returned to the induction chamber and the procedure repeated. We have not found muscle relaxing or curariform agents necessary as is sometimes the case with macaques.

After intubation, the monkey is placed beneath the stereotaxic frame on a covered heating pad preferably with a feedback control (Mills & Swett, 1964) set at 37.5-38.5°C. Input leads to the anesthesia machine are connected and gas concentration is lowered slowly to 1.5% and given at flow rates of 600 cc/min. in a semi-closed system. The animal is placed in the stereotaxic frame, draped, and EKG needles are inserted in the forehand and contralateral hindfoot. The signal is amplified and led through a conventional recording system to an oscilloscope and loudspeaker. These procedures provide for visual timing of the fast heart rate and a method for detecting arrhythmias early by a change in cadence. A rectal thermocouple is taped in place and the temperature read out on a YSI (Yellow Springs Instrument Co., Inc., Yellow Springs, Ohio, Model 41TD) recorder. On one occasion, an animal developed respiratory distress and an obstruction sound could be detected using a stethoscope. Anesthesia was discontinued and the endotracheal tube withdrawn; it had become plugged with thick secretions. Since then, it has become our practice to tape a stethoscope to the chest wall in order to check for any obstruction sounds.

When anesthesia is discontinued, the monkey is observed until it can ambulate, and then is returned to its cage. Most animals can move well about 45 minutes following the end of intubation. The best sign of recovery is a tendency to drink immediately. A transient weakness is present in the hind limbs but disappears by about 2 hours following anesthesia. After surgery incisional and bone wounds are undoubtedly sensitive but appear to bother them little. How much this anesthesia promotes analgesia is uncertain, but this is not a property of halothane in humans.

Use of other anesthetic agents as a combination of barbiturate and propriomazine (Largon, Wyeth, Inc.) gives a prolonged recovery period in the squirrel monkey (8-24 hours in our experience). In these situations we have used 5-8 mg of injectable hydrocortisone (Solucortef; hydrocortisone sodium succinate; Upjohn) at the recommendation of Prof. L. S. Woodburne (personal communication) who found that squirrel monkeys tolerate surgical stress better with a steroid supplement. We have intermittently used steroids in conjunction with halothane but have not, at least in healthy animals, been able to detect if it makes any difference. We do use it when surgical procedures are lengthy and it has been tried in an animal with a collapsing circulatory system without ap-

parent effect.

DATA FROM A TWO-HOUR PERIOD OF ANESTHESIA

To illustrate the clinical course of a squirrel monkey's response to anesthesia, data from a 0.598-kg male monkey (Q-12) is presented in Table I. This was a monkey on whom no surgical manipulation was performed.

TABLE I

Data From a 2-Hour Period of Halothane Anesthesia

Time	Halothane Conc.(% in Oxygen)	Flow Rate (L/min.)	Heart Rate	Resp. Rate	Temp. (°C.)	Notes
10:40 AM			284	116		Animal caught. 0.1 mg atropine, IM.
11:10				88		Animal drowsy, hand held. Pupils 4.5 mm.
11:13	3%	3.0			39.5	Induction.
11:16	2%	3.0	228	56		Animal asleep; muscle tone, corneal reflexes absent.
11:17	1%	0.8				Intubated. Gag reflex absent. Laryngeal reflex absent.
11:22			244		38.0	EKG leads, rectal thermocouple placed.
11:28	2%					Muscle tone reappears. Anesthesia increased. Pupils 4.5 mm.
11:33			252	72		
11:35			228	66	37.7	Placed in earbars. Heating pad on.
11:36	1.5%					Animal ok for surgery.
11:41	1%		240	66		Maintenance anesthesia.
11:53			252	84	38.5	

Time	Halothane Conc.(% in Oxygen)	Flow Rate (L/min.)	Heart Rate	Resp. Rate	Temp. (°C.)	Notes
12:13 PM		0.6	268	84	38.9	Animal stable
12:28			256	84	39.1	
12:43			216	80	39.3	
12:53			204	84	39.0	Begin rewakening procedures.
12:58	0.5%		204	84	39.0	Anesthesia diminished.
1:13	0.0%	0.0	204	84	39.0	Anesthesia stopped; monkey removed from frame.
1:33			222	78	38.5	Corneal reflexes present.
1:43			222	78	38.3	Spontaneous head movement.
1:48			222	84	38.3	Eyes open. Endotracheal tube removed.
1:58			240	84	37.3	Animal alert, moving.
2:06			240	78		Appears photosensitive, sleepy. Absent light reflexes. Horizontal nystagmus. Pupils 6 mm, dilated.
2:20			234	72		Placed in cage. Moving with slight ataxia. Drinks voluntarily. Light reflex present. No nystagmus. Pupils 4.0 mm.

These data differ in no discernable way from those from anesthetized monkeys undergoing electrode implantation. Records were obtained at 5 min. intervals or more frequently during particular manipulations. In order to save space, entries in Table I are limited to significant

maneuvers or changes in response. These data are typical but considerable variation in the heart rate, respiration and body temperature occur. The heart rate drops from a resting rate of about 280-320/min. to 210-220/min. At low concentrations of gas, the cardiovascular rate appears to stabilize at a range of 210-250/min., roughly 25-30% of the awake resting rate. Our findings on resting rates in awake squirrel monkeys are similar to the 273-350/min. range reported by Scheckel *et al.* (1962). During anesthesia, respirations return to preanesthetic resting levels but body temperature decreases.

There are several comments about the information in Table I. After atropine premedication, a period of 15-30 min. is allowed to elapse before induction of anesthesia. After induction, complete muscle relaxation, a regular respiratory rate, and a loss of the corneal reflex are used as criteria for attempting intubation. We initially had difficulty with intubation as the trachea is small and the laryngeal reflexes remain brisk. For example, we tried to pass a tube which was too large. This could result in injury and subsequent edema of the laryngeal vestibule and chords which should be avoided. Repeated attempts at intubation also waste anesthesia time. A principle problem was not having the correct diameter of tubing. The tubes should be measured for length so that they do not reach the carina but are long enough externally to slightly increase dead space, thus promoting a rapid buildup of pCO_2 during recovery.

Note that intubation (11:17) in Table I was accomplished at 1% halothane concentration. This was a departure from our routine as the 3% concentration is usually continued until intubation is complete. That the lower concentration was not adequate was revealed at 11:28 when it was necessary to increase the concentration to 2% for the next 7 min.

When the monkey is placed in the stereotaxic frame, care must be taken to prevent orbital bar pressure on the eyes. On one occasion this seemed a direct cause of diminished heart rate in an unatropinized monkey.

In general, the corneal reflex and muscle tone are crude but adequate indices of the depth of anesthesia. We have not found pupillary changes to be practical as the irises are dark and the small pupils are obscured by the orbital bars. Pupils appear to reach their preanesthetic diameter during anesthesia and, interestingly, seem to dilate during the recovery stage when the monkey appears drowsy. Muscle tone during anesthesia is easily tested by manipulating a forelimb. If the EKG signal is unfiltered, rhythmic EMG activity from respiratory motor units may also be heard on the audiomonitor and provides added information. When anesthetic levels are light, increased motor unit activity can be heard and measures are then taken to raise the gas concentration.

At 12:53, 15 minutes before an estimated time of completion of surgery, maneuvers were undertaken to rewaken the animal. This is generally begun during the suturing stage by loosening earbars and other head clamps and is followed by progressively diminishing the gas concentration. Anesthesia

is stopped, the endotracheal tube is left in place but detached from the anesthesia machine. The monkey is removed from the stereotaxic frame but wrapped and maintained on the heating blanket. During this early recovery phase episodes of shivering occur when low rectal temperatures are recorded. With the onset of spontaneous head or licking movements, the endotracheal tube is removed. At this point the monkeys are hand-held, jiggled, and talked to in order to promote a more rapid recovery; otherwise they tend to be quite sleepy. Note that heart rates remained low one hour after anesthesia was stopped.

PROBLEMS WITH HALOTHANE ANESTHESIA

The principle troubles encountered in use of this anesthesia on squirrel monkeys are those of arrhythmia, hypotension, a falling heart rate and a late depression of respiration. As we have had three deaths in our work with halothane, all of which we felt were preventable, we think it is instructive to review them separately to illustrate specific problems and their remedy or prevention.

Monkey Q-6.--The monkey (0.520 kg male) was taken to surgery for electrode implantation under routine halothane anesthesia. Difficulty was experienced during intubation. The procedure was repeated; the anesthetic level lightened and the animal vomited. Aspiration was prevented and a smaller diameter tube passed after a third period of induction. About 45 min. were utilized in induction and intubation. Trauma to the laryngeal vestibule was noted. The animal was placed in the stereotaxic frame and the halothane concentration maintained at 1-1/2%. The monkey's respiratory movements increased in rate and amplitude and the anesthetic level appeared to be lightening. The gas concentration was increased but it became obvious shortly thereafter that the animal was in respiratory distress. The delay in recognition of the problem was too long and the monkey died. At autopsy the endotracheal tube was found plugged with secretions and one lung was atelectatic. The endotracheal tube had occluded one bronchus.

In this death, errors accumulated. Atropine was not given as a preanesthetic, the animal was not food deprived 12 hours before surgery, and valuable time was lost trying to place the wrong sized endotracheal tube. Measurement of the endotracheal tube length, a small syringe and catheter for removing secretions in the tube and appreciation of respiratory distress symptoms are additional points. This is an instance in which use of a stethoscope to listen for obstruction sounds would have been useful. As the monkey was draped for surgery, the amplitude of respiration was not visible but rate and amplitude can be followed indirectly by watching the flutter valve excursion on the anesthesia machine.

Monkey Q-8.--The second death occurred in a monkey (0.600 kg male) implanted with electrodes three weeks earlier. The initial implantation procedure had taken 5 hours with no apparent aftereffects despite the long anesthetic period. The animal was reanesthetized without incident

for 1-1/2 hours two weeks later in order to repair electrodes. A few days later the monkey developed an abscess in the tissues surrounding the head plug. The animal was returned to surgery for debridement. Anesthesia was begun in a routine manner and some minor difficulty was experienced with the placement of the endotracheal tube. At a 0.7-1.0% level of halothane, the animal appeared to be doing well except that ear flicks and increased muscle tonus in respiratory muscles indicated that the anesthesia level was too light. The animal abruptly went into shock, possibly from intense earbar pressure, and died.

Autopsy did not reveal a cause of death, but hypotension incident to pain with an increase in vagal drive is plausible. The effective level of anesthesia had not been appreciated, the animal was not atropinized and measures for relieving earbar pressure and treatment of shock were not carried out. The role of a gram negative infection in this case is unknown. Not enough attention had been paid to the moment-to-moment state of the animal and when his difficulties were appreciated, an effective diagnosis and remedy were not made.

Monkey Q-11.--The death of the third animal (0.469 kg female) occurred at the end of implantation surgery. In this situation, the animal was healthy, well controlled and no difficulty was experienced during induction, intubation, or placement in the stereotaxic frame. The period of anesthesia, however, was lengthened to include a new method for electrode localization by stimulation techniques. As the death of Q-8 had occurred in the preceding week, the decision was made to maintain monkeys at deeper levels (1-1/2-2%) of anesthesia. The higher concentration also seemed a better test of the experimental maneuver.

Following five hrs. of anesthesia, the heart rate dropped below 200/min., extra systoles developed, and respiratory movements were frankly depressed. The concentration of halothane was lowered to 0.7%, earbars, orbital clamps and mouth clamps were loosened, and 10 mg of injectible hydrocortisone was given IM. There was no immediate response, the heart rate continued to fall and the arrhythmia worsened. The animal was removed from the stereotaxic frame, placed in a head-down position, kept warm and bag breathed on pure oxygen. Shortly thereafter, the EKG monitor demonstrated ventricular fibrillation and the animal expired. Atropine had not been given prior to surgery and pressor agents were not tried.

Prolonged anesthesia at moderately high concentrations of halothane was presumably the direct cause of death. Autopsy failed to reveal liver changes and death was presumed secondary to circulatory collapse. A post-mortem blood sample revealed a normal hematocrit but a leucocytosis with 73% lymphocytes, a finding suggestive of an intercurrent viral infection.

This case illustrates a principle concern in the use of halothane: its effects on the circulatory system. At concentrations of 0.7-1.5%, several hours of anesthesia are possible in the squirrel monkey without

difficulty, and their response is generally similar to humans. We have not encountered hepatic necrosis or choleostatic jaundice as has been occasionally reported in humans following halothane anesthesia. The circulatory effects in humans (Price and Dripps, 1965) are those of depression of the myocardium and vascular smooth muscle, reducing systemic arterial blood pressure, cardiac output, and total peripheral resistance. Arrhythmias seen have been ascribed to halothane "sensitization" of cardiac conduction times to circulating catecholamines, hypoxia and respiratory acidosis. And for this reason, catecholamines or analogues are to be used with caution in attempting to reverse hypotensive episodes.

At this time, we have not found a satisfactory treatment for the situation of a depressed heart rate, respiration and the occurrence of arrhythmia arising after a prolonged period of anesthesia. The various measures indicated as releasing earbar and head clamp pressure, a head-down posture, stopping halothane, manually increasing the respiratory rates and amplitudes with oxygen and the use of steroids have not helped. Although the pressor agent methoxamine (Basoxyl; Burroughs Wellcome & Co., Inc.; Tuckahoe, New York) is reported to reduce or prevent hypotension from halothane in humans, we have not tried it in the squirrel monkey. It has been easier to avoid problems by using lower concentrations and keeping procedures short.

Arrhythmias which occurred early in anesthesia have been effectively handled by lowering the concentration of anesthetic. Although they are uncommon, they have been invariably associated with induction at high gas concentrations not rapidly reduced to maintenance levels.

GUIDELINES FOR HALOTHANE ANESTHESIA IN SQUIRREL MONKEYS

In recapitulating our experience with halothane, we have developed empirical guidelines which have proved effective in carrying squirrel monkeys safely through anesthesia and recovery. They are on the conservative side and at times can be a nuisance. But in every instance, they have proved their merit in our laboratory. The principle ones are as follows:

1. The animals should not be fed within 12 hours prior to surgery. It is additionally helpful to water-deprive 2 hours before anesthesia. 2. Atropine sulfate should be given as a preanesthetic 15-30 minutes prior to anesthesia. 3. Following induction and endotracheal intubation, heart rate, respirations, and body temperature should be continuously monitored. 4. The animals should be kept normothermic by use of drapes and a heating pad. 5. Anesthesia should be discontinued and a check for airway obstruction made if the heart rate falls below 200/min. or if arrhythmias develop. 6. Maintenance levels of anesthesia should not exceed 1.5%. In a closed system the maintenance would be less but our experience is limited with this method. 7. The total period of anesthesia should not exceed 4-4.5 hours. Longer periods of surgery

should be planned for two stages. 8. One person should be trained to supervise the administration of the anesthesia and the post-operative recovery period.

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* * *

REQUEST FOR ISOLATION-REARED ANIMALS

The National Institute of Child Health and Human Development is extremely interested in obtaining nonhuman primates, particularly rhesus monkeys, who have been reared from birth to about the first six months or more in isolation from their mothers and peers. Animals that have been kept either in individual colony-type cages or in more complete isolation would be suitable. Animals manifesting the behavioral pathologies of movement-stereotypies, hyperexcitability, hyperreactivity, and violent aggressive behavior are particularly wanted. The animals should be at least one year of age.--Contact Dr. James W. Prescott, Growth and Development Branch, National Institute of Child Health and Human Development, Bethesda, Md. 20014. Call collect Area Code 301 496-5575.

A NOTE ON THE PRODUCTION OF PRIMATE HYBRIDS

Irwin S. Bernstein

Yerkes Regional Primate Research Center

Emory University

A program of deliberate hybrid breeding of selected primates has been undertaken at the Field Station of the Yerkes Regional Primate Research Center. Natural matings of compatible animals has been the only technique employed to date, but artificial insemination techniques are being considered where cooperative partners cannot be found.

An initial pilot program produced: two viable hybrids by breeding a male *Macaca irus* (cynomolgus monkey) with two female *M. nemestrina* (pig-tailed monkey); one hybrid by mating a male *M. mulatta* with a female *M. nemestrina*; and one infant, which died at 5 months, by breeding a male *M. nemestrina* with a female *Cynopithecus niger* (a monkey with the common name, black ape). The present program started in June of 1967 and has yielded: another hybrid from a male *M. nemestrina* and a female *C. niger*; two stillborn infants resulting from matings of a male *C. niger* with a female *M. nemestrina*; a hybrid resulting from mating a male *C. niger* with a female *M. maura* (Celebes or moor macaque) (the infant was lost after the mother died of post partum complications--prolapsed uterus and resulting hemorrhage); and a normal *M. nemestrina* infant from the mother of the *M. mulatta-M. nemestrina* hybrid. The rate of success is, however, quite low considering that over forty adult monkeys are involved in this program.

Efforts are being continued and the oldest hybrids resulting from the pilot program are now sexually mature. A back cross is being attempted.

The hybrids are being used as part of a behavioral study program investigating the expression and development of social responses in specially constituted groups. Biological samples are provided to other cooperating laboratories and a program in cytogenetics will include examination of all hybrids, their parents and normal siblings.

In addition to the hybrid breeding program, we are pleased to report the birth of twins in the normal breeding of *M. nemestrina*. This was the fifth successful pregnancy for this pigtail, who had herself been born in captivity in 1957. All other deliveries had been normal single births.

ANESTHESIA OF THE TREE SHREW *(TUPAIA GLIS)*

Ralph J. Berger

Crown College, University of California, Santa Cruz

We have recently begun polygraphic studies of sleep in the tree shrew *(Tupaia glis)*. We experienced some initial difficulties in finding suitable types and doses of anesthetics to perform surgical implantation of electroencephalographic (EEG), electrooculographic (EOG), and electromyographic (EMG) electrodes. A search of the literature did not readily reveal sufficient details of the anesthetic techniques used in other studies involving surgical procedures with the tree shrew. The purpose of this note is to save the time of other investigators in trying to arrive at appropriate dosages of sodium pentobarbital (Nembutal, Abbott) for anesthesia.

Initially, we began using ether, but were unable to achieve a satisfactory level of anesthesia with this agent. We then turned to nembutal and found that intraperitoneal administration of doses of 35 mg/kg was insufficient, although it is a typical anesthetic dose for cats, monkeys, and chimpanzees. We progressively increased the dose with successive animals and finally arrived at an anesthetic dose of 75 mg/kg. Anesthesia was induced within 10 to 20 minutes and was maintained for 3 to 4 hours. Behavioral recovery occurred at 6 to 8 hours.

When compared with the 45 mg/kg dose required by the rat, which is similar in size to the tree shrew, the dose required by the tree shrew seems to be disproportionately large. This suggests that the tree shrew may have an extremely high rate of metabolism.

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REQUEST FOR INFORMATION ON PRESERVATION OF PRIMATE SEMEN

Information on the assessment and preservation of primate semen, especially that of the baboon, is requested.--Dr. I. A. Beattie, Biological Sciences Division, Arthur D. Little Research Institute, Inveresk, Midlothian, Scotland.

DURABLE IMPRESSION TRAYS FOR PRIMATE DENTAL CASTS[1]

Robert B. Eckhardt

Department of Anthropology

The University of Michigan

To obtain material needed for a study of the inheritance of tooth size in primates, it was necessary to take dental impressions from a number of living animals. From these impressions casts of the complete dentition were made for later study and measurement.

Trays of a size and shape suitable for making such dental impressions of primates (in this case, chimpanzees) are unavailable ready-made at dental supply houses; thus they must be custom-made by the investigator.

While commercial materials (such as Kerr Formatray) are available for such work, trays made of these were found to be somewhat unsatisfactory in use. When the walls of the tray are thin enough to fit comfortably into the animal's mouth, the tray breaks easily; when thick enough to be durable it does not fit well in the mouth.

After a number of other substances were tried, a rather unorthodox one, epoxy resin, proved to be quite satisfactory. This is readily obtainable from hardware and auto-supply stores.[2]

The procedure used in making the trays is relatively uncomplicated. A previous cast, palate or mandible, of appropriate size is used as a base. This is protected with a sheet of aluminum foil, then the appropriate area is covered with a one-quarter to three-eighths in. layer of clay or wax (which allows space in the finished tray for the alginate impression material). Over this is placed a second layer of foil, which will form the core of the finished tray.

The epoxy resin is mixed in a disposable container according to instructions, and one or more layers of it spread over the foil. After this hardens and bonds to the foil, the structure may be lifted from the clay base, and the foil on its inner surface is then also coated with the resin. To increase the strength of the tray, a layer of screen

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[1]I am grateful to the Director and personnel at the Yerkes Regional Primate Research Center for their assistance in this work.

[2]The material may also be ordered from Montgomery Ward, Chicago, Illinois 60607, as Epoxy Resin Auto Body Kit, catalog number 61 A 9981. This includes one half-pint each of filler and hardener, plus 144 square inches of screen, for a total cost of $2.98. One of the kits described above is sufficient for making a dozen or more large trays.

may be imbedded in the resin, and additional layers of resin added. Numerous small holes (about 1/16"-1/8" diameter) should be drilled through the tray so the impression material is retained as the tray is withdrawn from the mouth. Any rough areas or projections should be buffed off on a grinding wheel, or with a piece of sandpaper, to prevent injury to the mouth. While several steps are involved in this process, each of them takes only a short time.

Trays made of this material have several advantages over those made of the commercial products: 1. They are less expensive. 2. They do not break easily, even if dropped. 3. If a tray should be cracked in use (a very infrequent event) it may be easily repaired with a thin layer of the epoxy and set aside to harden.

* * *

CORRESPONDENCE

SENSITIVITY OF SQUIRREL MONKEYS TO ANTIBIOTICS

Sir: Although the sensitivity of squirrel monkeys *(Saimiri sciureus)* to Combiotic (Pfizer) has been reported earlier (Matanic, *Laboratory Primate Newsletter*, 1967, *6* [1], 12; Editor's Notes, *Laboratory Primate Newsletter*, 1967, *6* [2], iii, the data from our laboratory may be useful. Nine squirrel monkeys had been treated with Combiotic for conditions including metritis, respiratory infections, abcesses and bite wounds. Dosage was 0.5 cc to 1.0 cc/kg, IM, administered daily or on alternate days, 3 to 5 doses total. One mature female being treated for a severe bite wound, exhibited uncoordinated movement, rapid heart rate, depression and other symptoms of shock for approximately one hour following the fourth daily dose at the rate of 1.0 cc/kg; recovery was uneventful. A male, under treatment for a facial abcess, was given two 0.5 cc/kg doses separated by two days and exhibited similar symptoms after the second dose. A third male, also under treatment for a bite wound, died within 15 minutes of administration of the second of two 0.5 cc/kg doses. Convulsions of approximately one-minute duration began within one minute of injection. This was followed by respiratory arrest and rapid heart action; finally cardiac arrest occurred during artificial respiration. Although uneventful recovery was observed in eight of nine animals treated, use of this antibiotic for squirrel monkeys has been discontinued in this facility because of the incidence of symptoms of shock in one-third of the animals treated.--Eugene W. Hupp, Biology Department, Texas Woman's University, Denton, Texas 76204.

TIGONI PRIMATE RESEARCH CENTRE CLOSING DOWN

Cynthia Booth

I am closing down the Tigoni Primate Research Centre on December 31, 1968, and should like to thank all those who have helped to support this project since it was begun in 1959.*

The aim of the project has been studies of East African monkeys, including taxonomy, geographic distribution, ecology, behavior, breeding, and growth and development from birth to maturity. The approach has been to combine field expeditions, for collecting specimens of skins and skeletal material, trapping live monkeys and making field observations, with studies of a captive breeding collection.

In the beginning there was only myself working with one African assistant. The project grew, especially as the caged breeding collection became established, and in 1961 I gave it the name Tigoni Primate Research Centre. Until 1965, the Centre was entirely on my private land. The staff was housed in my own house and in a flat which my husband built, and the monkey cages, museum and garden for monkey food used some of my 10 acres. In 1965, Munitalp Foundation most generously purchased a 20 acre plot of land with a large house for staff for the use of Tigoni Primate Research Centre, the title deeds being held by the Museum Trustees of Kenya. Gradually the activities of Tigoni Primate Research Centre moved from my own land to this new plot, but the last cages were not moved until June, 1968.

Dr. L. S. B. Leakey, Hon. Director of the National Centre for Prehistory and Palaeontology, Nairobi, has taken an interest in the Tigoni Primate Research Centre throughout and has always been willing to lend it a helping hand, particularly in the matter of using his personal influence to assist me in finding financial support. With the closing of the Tigoni Centre, Dr. Leakey tells me that he feels it is a pity that there should be no primate research centre in Kenya, and he therefore proposes to start one himself. The plot of land vacated by the Tigoni Centre is, I understand, to be made available to him for this purpose, and I am handing over some of the present collection of live monkeys to him. He has not yet stated definitely what the name

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*In the first few years, my research project was supported by grants from a number of sources, including Leverhulme Research Awards, the Percy Sladen Memorial Fund and the Rockefeller Foundation. Since 1962, it has been partly supported by U. S. Public Health Service Grant MH-05784, from the National Institute of Mental Health. In 1963-5 the National Geographic Society gave several grants; the Munitalp Foundation gave operating grants in 1966 and 1967; and in 1967 I also received Grant No. 307 from the World Wildlife Fund.

of the new centre is to be.

I personally shall be leaving Kenya and can be contacted in the future c/o Mrs. Evison, Manton House, Charing, Kent, England.

Please do not write to me asking for museum specimens or live monkeys. Arrangements have been made for all the live animals, and the museum skins and skeletal material will be distributed to those museums to which they have been promised for some years.

* * *

CHIMPANZEE BREEDING PROGRAM AT HOLLOMAN

The 6571st Aeromedical Research Laboratory at Holloman Air Force Base, New Mexico recently had its eighth chimpanzee birth during 1968. The first for the year was on 1 January, and the latest arrival came on 3 October. Other female chimpanzees are expected to deliver in the near future. Seven of the infants are being raised by their respective mothers and all are healthy. The fifth infant, born 7 May 1968, had to be placed in the nursery due to the untimely death of the mother. No problems have been encountered with this infant either. This Laboratory has three chimpanzees which were born here prior to 1968, the oldest of which is now two years of age. Detailed results of the breeding program were presented at the American Association for Laboratory Animal Science meeting in October 1968.--Thomas M. Butler, Captain, USAF, 6571st Aeromedical Research Laboratory (AFSC), Holloman Air Force Base, New Mexico 88330.

DISEASES OF NONHUMAN PRIMATES STUDY SET AVAILABLE

The American Registry of Pathology, Armed Forces Institute of Pathology, Washington, D. C. 20305 has available on request a study set of diseases of nonhuman primates composed of lantern slides illustrating gross and/or microscopic pathology and microscope slides. Viral, bacterial, mycotic, protozoan, parasitic and miscellaneous other diseases are demonstrated and discussed.

RECENT BOOKS AND ARTICLES*
(Addresses are those of first authors)

BOOKLETS, PAMPHLETS, CATALOGUES

Nonhuman primates: Standards and guidelines for the breeding, care, and management of laboratory animals. Washington, D. C.: National Academy of Sciences (Publication No. 1677), 1968.

This booklet can be purchased at a cost of $2.50 from Printing and Publishing Office, National Academy of Sciences--National Research Council, 2101 Constitution Ave., Washington, D. C. 20418.

DISEASE

Natural fatal infection of an owl monkey *(Aotus trivirgatus)* with herpes T virus. Emmons, R. W., Gribble, D. H., & Lennette, E. H. (Viral & Rickettsial Dis. Lab., Calif. State Dept. Pub. Hlth, Berkeley, Calif. 94704) *Journal of Infectious Diseases*, 1968, *118*, 153-159.

Several South American monkeys in a pet shop died shortly after onset of an illness with signs indicative of pruritis. One owl monkey *(Aotus trivirgatus)* was available for postmortem examination. Lesions, usually necrotizing, were present in most organs, including the brain and Gasserian ganglia. Herpes T virus was isolated from the brain, tongue and liver. A serologic survey of 5 species of South American monkeys from the pet shop revealed herpes T virus neutralizing antibody in squirrel monkeys *(Saimiri sciureus)* but not in other species.

Results of screening for *Shigella* and other enteric bacteria in rhesus monkeys during quarantine. Caraway, B. L., Estes, R. R., Neola, P. M., & Thornton, O. W. (USAF Sch. Aerospace Med., Aerospace Med. Div. [AFSC], Brooks Air Force Base, Texas) *Laboratory Animal Care*, 1968, *18*, 568-569.

This is a report of the incidence of *Shigella* sp. and other gram negative bacilli in 1490 apparently healthy rhesus monkeys *(Macaca mulatta)* undergoing quarantine. Only 3% were *Shigella*-positive on initial screening. 725 of these

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*In many cases, the original source of references in the following section has been the Current Primate References prepared by The Primate Information Center, Regional Primate Research Center, University of Washington. Because of this excellent source of references, the present section is devoted primarily to presentation of abstracts of articles of practical or of general interest.

monkeys were later treated for diarrhea, of which 24.1% were *Shigella* positive. The value of routine screening for *Shigella* carriers is questionable and is no longer done at the USAF School of Aerospace Medicine. Drug and antibiotic sensitivity studies on recovered *Shigella* are presented.

A survey of parasites in laboratory primates. Reardon, Lucy V., & Rininger, Bonny F. (Bionetics Res. Lab., Inc., Kensington, Md.) *Laboratory Animal Care*, 1968, *18*, 577-580.

Species of African and Asian simians maintained within a large laboratory colony were examined for endoparasites, exclusive of blood forms. Tables of findings were compiled to show the parasitic species identified, the species of animals in which they were found, and the number of animals of each species found to be infected with each parasite. The data represent the combined findings on male and female monkeys, those of recent acquisition as well as those in residence from 1 to 5 years. The Asiatic simians examined were: bonnet *(Macaca radiata)*, cynomolgus *(Macaca irus)*, and rhesus *(Macaca mulatta)* monkeys. The African simians examined were: African green monkeys *(Cercopithecus aethiops)*, baboons *(Papio cynocephalus)*, and the chimpanzee *(Pan satyrus)*.

Transferable multiple drug resistance in enterobacteria from non-human primates. I. Development and characteristics of resistance in *Shigella flexneri*. Hardy, P. H., Lindsey, J. R., & Melby, E. C. (Dept. Microbiol. & Div. Lab. Anim. Med., Johns Hopkins U. Sch. Med., Baltimore, Md. 21205) *The Johns Hopkins Medical Journal*, 1968, *123*, 29-37.

(1) 515 attacks of acute diarrhea were noted among the 1200 animals residing in the Central Primate Quarters of the Johns Hopkins Medical Institutions from November, 1963, through December, 1966. (2) 139 strains of dysentery bacilli, all *Shigella flexneri*, were isolated from the animals with acute enteric disease. (3) *Shigella* strains isolated at the beginning of the study were sensitive to all antimicrobial drugs, but organisms resistant to one or more antibiotics began to appear in the spring of 1964. With the passage of time there was an increase in both the percentage of dysentery bacilli showing drug resistance and the multiplicity of drugs to which they were resistant. (4) Almost all dysentery bacilli isolated in 1966 were resistant to one or more antibiotics, and by the latter half of that year new isolates were resistant to five drugs --tetracycline, streptomycin, chloramphenicol, ampicillin, and sulfonamides. (5) Almost all the drug resistant *Shigella* could transfer their resistance to *E. coli* by conjugation, and in most instances the full spectrum of resistance was transferred as a unit. (6) The rate of re-

sistance transfer to drug sensitive organisms was inversely related to the number of drug resistance genes carried by the donor. (7) Levels of resistance varied from one strain to another, and with the different drugs, but were sufficiently high in all instances to be of clinical significance. (8) Ampicillin and chloramphenicol resistances were due to specific drug inactivating enzymes; the mechanisms of resistance to the other drugs were not ascertained.

A subclinical outbreak of human rhinovirus 31 infection in chimpanzees. Dick, E. C., & Dick, Claire, R. (Dept. Preventive Med., U. Wisconsin Sch. Med., Madison, Wisconsin 53706) *American Journal of Epidemiology*, 1968, *88*, 267-272.

Until recently only man had been infected with the human rhinoviruses. The author previously reported an experimental infection of chimpanzees with members of this virus group. In the present report a natural infection of chimpanzees with a human rhinovirus is described. The virus, WiCh 38, which is closely related to human rhinovirus type 31, was isolated from the throats of 3 chimpanzees. Antibody to the virus was found initially or developed over one month in 6 other chimpanzees in close proximity. Experimental infection of chimpanzees with tissue culture-grown WiCh 38 was also successful, although, like the natural infection, it was asymptomatic.

FACILITIES, CARE, AND BREEDING

The social and reproductive behavior of *Tupaia montana* in captivity. Sorenson, M. W., & Conaway, C. H. (Dept. Zoology, U. Missouri, Columbia, Mo.) *Journal of Mammalogy*, 1968, *49*, 502-512.

Social and reproductive behavior were studied in a group of 12 mountain tree shrews *(Tupaia montana baluensis)*. Animals were housed as a social group in a large cage from May 1965 to May 1966. Observations through one-way glass windows were made each day. Basic variables of social behavior were recorded. Mountain tree shrews were very social. Certain animals expressed a linear dominance hierarchy although the males ranked number one and two often were co-dominant. Females of *T. montana* exhibited a 9- to 12-day estrous cycle, a 23- to 29-day pseudopregnancy cycle, and a 49- to 51-day gestation period. There was no evidence of a reproductive season. Female mountain tree shrews had fewer pseudopregnancies and more births per individual than did individuals of other species studied in captivity. Also, individuals of *T. montana* were more social than members of other species we studied. Such data point out species specificity and imply that *T. montana* is better adapted to captivity than are other species thus far studied.

Care and raising of newborn Taiwan monkeys *(Macaca cyclopis)* for virus studies. Yang, C., Kuo, C., Del Favero, J. E., & Alexander, E. R. (Reprint requests to Dr. Alexander, Dept. Preventive Med., U. Wash., Seattle, Wash.) *Laboratory Animal Care*, 1968, *18*, 536-543.

The methods used for caging and feeding a small group of newborn Taiwan monkeys *(Macaca cyclopis)* for virus studies are described. The growth and development of 15 artificially-fed baby monkeys and 6 breast-fed baby monkeys were compared. For artificially-fed infants, body weight gain, rectal temperature, teeth eruption, and hematologic values were presented, as were the calorie and protein intake. The body weight of breast-fed infants doubled birth weight after 3 months and tripled by 6 months. The body weight of artificially-fed infants increased more quickly, being double birth weight at 2 months, triple at 5 months, and 4 times birth weight at 1 year. It is concluded that *Macaca cyclopis* infants can be separated from their mothers at birth and raised satisfactorily at least for the first year of life in microbiologic experiments requiring isolation.

ECOLOGY, FIELD STUDIES, AND TAXONOMY

Taxonomic studies of *Cercopithecus mitis* wolf. Booth, Cynthia P. (Tigoni Primate Res. Cen., Kenya) *National Geographic Society Research Reports, 1963 Projects*, Washington, D. C., 1968, 37-51.

The taxonomy of *Cercopithecus mitis albogularis* and *C. m. stuhlmanni* is discussed on the basis of a large collection of specimens and data collected by the author from Kenya, Uganda, Tanganyika and Zanzibar. It is concluded that *kolbi*, *kibonotensis* and *monoides* are synonyms of *albogularis*, and *neumanni* a synonym of *stuhlmanni*. A hybrid swarm between *C. m. albogularis* and *C. m. stuhlmanni* is reported in the Ngorongoro and Lake Manyara area of Tanganyika, and the breeding of hybrids between the two forms in the cages at Tigoni Primate Research Centre is also reported. It is concluded that *albogularis* and *stuhlmanni* are subspecies of the same species, *Cercopithecus mitis*, and the separation of *Cercopithecus albogularis* is not justifiable.

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