The average omnidirectional flux varied from 10 to 16 particles per square centimeter per second during this time, so that the average specific ionization was of the order of 1200.

4) After 2204 hours the ionization and flux declined. The ionization may be described by $e^{-t/\tau}$; τ had three distinct values during the period 23 October, 2204 hours, to 24 October, 2053 hours. At the latter time the ionization was 1080, or 61 percent above normal.

We suggest that this radiation was associated with the flare described. It is interesting to note that, according to the High Altitude Observatory preliminary reports, there were six class-2 flares from 24 August to 8 November, of which only the one on 23 October and one on 7 September at 1535 hours produced type IV radio noise. The flare of 7 September occurred in the eastern hemisphere of the sun and produced no radiation detected by the Mariner II experiment.

The data have not yet been thoroughly analyzed, and at present only preliminary geomagnetic and solar data are available. It is possible to state these tentative conclusions.

1) During the period 31 August to 15 November the radiation detected behind a 0.2 g/cm^2 absorber was approximately constant except for the period 23–24 October. The levels are about those expected for the galactic cosmic radiation at this part of the solar cycle. Measurements were made at ranges 0.5 million to 27.6 million km from the center of the earth during this time.

2) On 23 October, beginning at 1723 hours, the rate of ionization increased to a maximum approximately 26 times background cosmic radiation. Unusually high radiation was still detected at 2053 hours on 24 October. This radiation is probably associated with a class-2 flare and type IV radio noise which occurred on the western limb of the sun prior to the increase. Of six class-2 flares reported by the High Altitude Observatory during the period of observation, only this one produced a detectable increase in radiation (*3*).

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Notes

1. H. V. Neher, private communication.
2. *High Altitude Observatory Preliminary Report of Solar Activity, TR582* (26 Oct. 1962).
3. I thank L. Parker, L. Lewyn, N. Yamane, and J. Shepperd of the Jet Propulsion Laboratory for constructing the instruments described and for integrating them into the Mariner spacecraft. Professor H. V. Neher of the California Institute of Technology and Professor J. A. Van Allen and Mr. L. Frank of the State University of Ohio helped me calibrate the instruments and offered valuable comments on the experiment.

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The Stump-Tailed Macaque: A Promising Laboratory Primate

Abstract. *Members of* Macaca speciosa *have characteristics that make them suitable primates for neuropsychological investigation. They work well in discrimination training, have a varied behavioral repertoire and social interaction, and seem to be at least as intelligent as* M. mulatta. *They are docile and submit readily to laboratory routine.*

The nonhuman primate most commonly used in research today is the rhesus monkey, *Macaca mulatta*. It is readily obtained, is relatively hardy, and has a varied repertoire of behavior. There is now available a large body of normative data concerning its anatomy, development, and behavior. However, the rhesus monkey is belligerent, and this complicates handling. It would therefore be of considerable value to have available a laboratory primate of milder disposition that possesses the advantages of *M. mulatta.*

During studies of somatic and behavioral development in monkeys we have made observations on ten monkeys, of a species commonly known as the stump-tailed macaque, that are of various ages (up to 4 years) and are remarkably docile and manageable. This species thrives in the laboratory, withstands surgical procedures well, and makes an excellent subject for behavioral investigation. In this report we offer a behavioral description of this docile species of macaque.

Anderson (*1*), in his 1878 account of two expeditions to western Yunnan, China, proposed the scientific title *Macaca arctoides* for the stump-tailed macaque. On the other hand, Allen (*2*) placed this monkey within the genus *Lyssodes* along with *M. mulatta* and *M. irus,* and designated the species *macacus speciosus.* In accordance with the modern designation of the popular macaques, we have adopted the scientific name *Macaca speciosa* for the stump-tailed macaque. This species is similar to the Japanese macaque, *M. fuscata,* but should be differentiated from the pig-tailed macaque, *M. nemestrina.*

Macaca speciosa ranges from northern India, Tibet, and western China down through Burma to the Indochina peninsula (*2*). Its natural habitat is said to be hill and mountain regions where temperature may fall below zero (*3*).

Macaca speciosa is a large, red-faced monkey in which the tail is a 1-inch stump. The coat is heavy and varies in color from greenish brown in the adult to chocolate brown in the young. The cheeks vary in pigmentation from bright red to pale pink, and there are black freckled areas around the nose of the adult. Comparison of the crown-rump length and the weight of our ten monkeys with data reported by Van Wagenen and Catchpole (*4*) for *M. mulatta* revealed no consistent differences.

The skull of *M. speciosa* differs in certain respects from that of *M. mulatta. Macaca speciosa* has larger mandible and maxilla and a more pronounced prognathism. Measurements of the cranial cavity reveal that the A-P axis is somewhat shorter than in *M. mulatta,* but the values are within the range of normal variability for *M. mulatta,* as reported by Olszewski (*5*). A gross examination of the fissural pattern on the brain surface revealed no marked differences in the two species. Our studies of the brain to date suggest that the available stereotaxic atlases for *M. mulatta* (*5, 6*) could be employed for subcortical electrode placements in *M. speciosa.*

The salient feature of the behavior of *M. speciosa* is docility toward man. In the home cage, the animal often solicits scratching, stroking, and rubbing from humans by pushing up against the cage bars and extending a limb. If the cage door is opened, the monkey may timidly withdraw but will not seriously resist being picked up. Like the young chimpanzee, the immature monkey may even jump into the handler's arms, clutch tightly, and make pelvic thrusts. Though there is no malice on the part of the monkey, we have found it wise to wear a laboratory coat to avoid being scratched. Pinning the monkey's arms behind its back, an

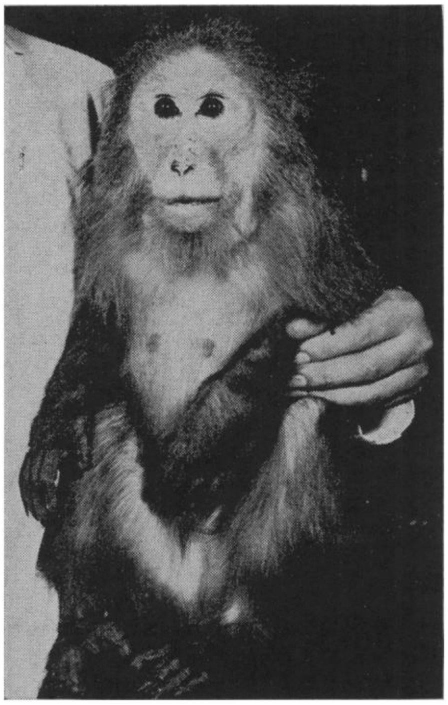

Fig. 1. *Macaca speciosa,* young adult female. Note the placid expression.

essential maneuver when one is catching the adult *M. mulatta,* is never required since, in our experience, *M. speciosa* will not bite. When transported, the 4 year old clings tightly to the handler, but it can be walked and led by the hand. It should be especially noted that the docility is not the result of extensive handling, as is the case when the immature *M. mulatta* is tamed, as it occasionally is.

Despite its unusual docility, *M. speciosa* displays many of the emotional responses characteristic of *M. mulatta,* unaccompanied however by the belligerence and aggression. If suddenly attacked, it will typically show lipsmacking, defecation, and other autonomic responses and a startle-like jerking of the body, but it will not attack or bite in retaliation. In this respect *M. speciosa* behaves very much like individuals of *M. mulatta* that have undergone bitemporal lobectomy. Thus, when frustrated in the learning test situation, *M. speciosa* may shriek and sulk but quickly composes itself. In our observation of monkeys up to 4 years old we have noted no obvious sex differences with respect to docility.

Young adults as well as immature stump-tailed macaques seem to get along well together in group enclosures. Five immature females were housed together over a period of several months. Dominance patterns were established and maintained through nipping, grooming, and other social behavior. No serious biting was observed. The animals were occasionally seen to huddle together, sometimes hugging and rocking in the manner of young chimpanzees. In fact, the similarity to group and individual behavior of chimpanzees was often striking.

The behavior of seven stump-tailed macaques on a number of standard discrimination tests—color, brightness, pattern, and delayed response—was studied. Five of the monkeys were immature; the other two were young adults. All were naive with respect to the experiment. The familiar version of the two-choice discrimination apparatus was used.

The discrimination stimuli consisted of painted plaques. In this preliminary study we were concerned with the docility and tractability of the animals and made no effort to define the limits of learning and memory capacity. Hence we chose problems that were well within the normal abilities of the animals.

The monkeys adapted rapidly to the two-choice situation and learned, usually within one session, to displace one of two plaques to obtain food. No coaxing was needed. All the animals were carried in the arms of the handler, and they experienced little trauma in the process. Acquisition scores did not differ from those previously obtained for a comparable group of *M. mulatta* (*7*). Even the most difficult pattern discrimination (plus symbol versus square) was acquired in no more than 210 trials, with a median for the seven subjects of 110 trials. Delayed response, with 5-second delays, was acquired in one session by five of the seven monkeys. The other two required two and three sessions to reach the criterion of learning. The monkeys worked consistently at the tasks. When there was a run of errors they sometimes shrieked and sulked, but they would quickly recover and return to the task. In all other respects the monkeys behaved in much the same way as *M. mulatta.* The position habit occasionally had to be overcome (*8*).

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Anticholinergic Drugs and the Central Control of Thirst

Abstract. *Atropine and scopolamine were compared with their centrally inactive quaternary analogs, atropine methyl nitrate and scopolamine methyl nitrate, for effects on water and food intake in rats. All drugs inhibited eating, but only the centrally active compounds inhibited drinking. Anticholinergic drugs evidently block drinking by a central effect and eating by a peripheral effect.*

Attempts to test Cannon's "dry throat" theory of thirst by use of anticholinergic drugs such as atropine date back more than 30 years (*1*). Atropine dries the mouth by blocking salivation and therefore should increase the intake of water if the theory is correct. But the results of these drug tests have been more perplexing than enlightening. Instead of increasing the intake of water, atropine decreases it.

A possible explanation of this unexpected result was suggested by the observation that feeding is also inhibited by atropine. Since water intake is closely related to food intake, it was thought that the depression of drinking resulted indirectly from a primary effect on eating, but this idea was not substantiated by work of Schmidt *et al.* (*2*). These investigators found that atropine depressed drinking even in tests in which no access to food was allowed, and they therefore concluded that the effect was not dependent upon food intake.