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EDITOR'S NOTES

The Newsletter is now being mailed to 1098 persons and organizations.

The paper on vitamin D deficiency by Hunt, Garcia, and Hegsted in the present issue of the Newsletter is of a type that we would like to see considerably more of in the Newsletter. It is a summary of important information that will be published in detailed form elsewhere at a later date.

It is about time that we spelled out the Newsletter policy on nomenclature of nonhuman primates. The following policy statement is based on one which was published in the Appendix of Behavior of Nonhuman Primates (Schrier, Harlow, & Stollnitz, 1965).

In almost any scientific discipline, the results obtained may differ for different species or even different subspecies. Although this is widely recognized, an important implication for research is often ignored. Because the results of a study may depend on the particular primate being studied, it is imperative that the researcher identify his subjects as fully and accurately as possible. All too often, only a vernacular name is mentioned in the report of an experiment. But a vernacular name is not adequate identification; usage varies from time to time. In this Newsletter, as well as in any journal or book, the first time that a particular vernacular name appears, the scientific name of the animal should also be given.

However, as most readers have already discovered, there are marked differences among primate taxonomists in their systems of classification and nomenclature. Any exhortation to use scientific names in identifying primates must be tempered by the knowledge that there is no single authoritative source for primate nomenclature. Fortunately, cases in which the same name is used for different species are now quite rare, but the literature often contains different names for the same species.

To avoid such inconsistencies within the Newsletter, the scientific names used are those given by Fiedler (1956). Fiedler's nomenclature was adopted because it is recent and comprehensive, and also because it conforms in general to the scientific nomenclature familiar to most scientists. An example of a recent and comprehensive system that differs markedly from familiar usage is that of Sanderson (1957), in which, for example, the macaques (usually considered a single genus, Macaca) are classified as a subfamily and split into eight genera.

Other classifications of varying completeness are those by Hill (1953-62), by Simpson (1945), and by Straus (1949).

The use of a consistent nomenclature is necessary, but it doesn't eliminate alternative names from the literature. Some readers may be familiar with names from other nomenclatures, and they may fail to

recognize a familiar species discussed under an unfamiliar name. This is one reason for continuing to use vernacular names in addition to scientific names.

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CONTENTS

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CHIMPANZEE ECOLOGY AND LABORATORY MANAGEMENT[1]

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Introduction

It is a strange thing that, until recently, hardly any field research has been done to improve the condition of chimpanzees as laboratory animals. One of the main aims of Nissen's field study in 1930 was to gather information in order to improve the keeping conditions at the Yerkes Laboratories. He collected, among other things, specimens of 34 plant species belonging to the chimpanzee diet in Guinea. Unfortunately, nearly all this material was destroyed by rats before it had been botanically determined; but, in the 36 years passed since then, nobody has repeated his attempt! Furthermore, no analysis has been published of the carbohydrates, fats, proteins, vitamins, fibres, etc., in chimpanzee foods collected in Africa.

Another aspect of the current unconcern about the condition of chimpanzees as experimental subjects is the way in which they are usually accommodated. In his field study Nissen reported that chimpanzees are much more sensitive to heat than humans. Nevertheless, the chimpanzees at the Yerkes Laboratories at Orange Park never had air conditioning, whereas the humans had. I have been told that, when the Yerkes Laboratories were to be removed, there was much discussion on the question whether Georgia or Louisiana would offer the best climate. However, as far as I know, nobody took the trouble to go to Africa and measure the temperatures at chimpanzee living sites.

When I visited primate research laboratories and zoos in the United States I had the impression that the standards of accommodation, management, and care at some of them were below any level that would be accepted in, e.g., Germany, Great Britain, the Netherlands, or Switzerland. The keepers, who more than anybody else are responsible for the condition of the priceless chimpanzee stock, often belonged to the least-educated class of workers available. (Conversely, a head keeper of apes at a European zoo often knows several foreign languages, and may have a salary higher than a young university graduate or Ph.D.) Chimpanzee living quarters at laboratories in the United States often look as if they had been designed by somebody who was familiar with the needs of pigs and other animals domesticated for thousands of years, but who had no idea

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[1]This research was sponsored by the 6571st Aeromedical Research Laboratory, Aerospace Medical Division, under Contract AF 61(052)-799 through the European Office of Aerospace Research (OA), United States Air Force. Additional support was given by the Werner Reimers Stiftung für Anthropogenetische Forschung.

of what kind of creatures chimpanzees are. The unfavorable opinion expressed here is not only mine. Two years ago a prominent British colleague, Dr. T. Harrisson from Sarawak, wrote me: "My general impression is that the American attitude to apes and primates is entirely different to ours. They treat them with much less respect and kindness. I was particularly appalled at the so-called primate laboratories with all sorts of species crowded together in open, very small cages. Studies are supposed to show basic natural behaviour patterns under conditions of congestion far beyond anything conceived of in...[any] slums or... jails [in all the world]."

There appears to be a fundamental difference between the United States and non-Latin Europe with regard to the evaluation of animal keeping and animal keepers. In Europe (particularly in Germany and Switzerland), zoo people consider good keeping as a vocation, and the keeper is a great authority. It is the keeper who is primarily regarded as responsible for the condition of the animals, and it is he who often receives a high bonus for outstanding breeding results of his animals. In the United States, on the contrary, except at the very best zoos, one often has the impression that the keeper is regarded as some kind of cowboy, and that the veterinarian is regarded as the responsible man. The breeding results obtained in zoos, e.g., at the Basel Zoo, prove that the first policy is the more rewarding one. The background is that, particularly in Central Europe, there is a widespread cultural tradition of keeping and breeding all kinds of animals at home, just because many people love animals and like to have them in their homes.

Yet, there is a growing awareness among American laboratory scientists that there is much wrong with the current care and management practices, and that this seriously affects the validity of many research results. I have never received so much "scientific fan mail," particularly from the United States, as when I published in the International Zoo Yearbook a small paper on "Can lessons from the wild improve the lot of captive chimpanzees?" (Kortlandt, 1960). Furthermore, it was Lt.-Colonel C. Kratochvil (responsible for the chimpanzee colony at the 6571st Aeromedical Research Laboratory, Holloman Air Force Base, N. M.) who asked me to go to Africa again and collect more data from the wild, in order thus to improve the condition of these apes as experimental subjects. The research target was defined as a study of the natural ecology of the chimpanzee and its application to laboratory colonies.

The field work was done during 1964 and 1965 in a wide variety of habitats in 10 countries, ranging from Guinea to Uganda. The complete results will be published after having been fully analyzed. In this preliminary paper only the practical results with regard to laboratory management and animal supply will be summarized.

Recommendations for Laboratory Management

My practical recommendations are based upon the assumption that the best conditions under which animals can be kept in captivity are

those which equal or approximate the wildlife conditions. The correctness of this postulate cannot be scientifically proved, and in some cases it may not be entirely correct, but on the whole it has stood the test of zoo experience with thousands of animal species all over the world.

Habitat.--Chimpanzees live in an extremely diversified array of vegetation types, including humid evergreen lowland forests, montane vegetations up to an altitude of 3000 meters, semideciduous forests, dry and open woodlands extending about halfway into the so-called Sudanian vegetation belt, and very open savanna landscapes where isolated trees stand widely apart from one another. The widespread idea that the chimpanzee is essentially a rain-forest animal is a fairy tale probably caused by the fact that the species is so easily hunted (and consequently mostly exterminated) in open savannas and woodlands, and by the erroneous concept of anatomists that this species is essentially a brachiator. Actually, relics of chimpanzee populations still occur in Sudanian woodlands as far north as 13° in Senegal, 12°20' in Mali, nearly 10° in the Ivory Coast, and 7°10' in the Central African Republic, i.e., 130 to 240 miles from the proper rain-forest belt. However, these apes can live in such regions only if there are some gallery forests that provide shade and coolness during the hot hours of sunny days, and perhaps also some essential food during certain seasons. The optimum habitat appears to be situated in the transitional zone where the rain-forest belt blends into the Sudanian woodland belt, and consists of a mountainous landscape covered by a variegated mosaic of vegetations, including moist as well as drier types of forests, woodlands, and savannas, according to the local conditions of topography, soil, and hydrography. Such a landscape enables the apes to move around and to benefit from the diversity of habitat and food within their wandering range, which may be estimated at 20 to 30 or even 40 square miles. Thus, in laboratories and zoos, diversity of layout of the animal quarters and diversity of food may perhaps be two main clues to keeping chimpanzees in an optimal condition.

Locomotory needs.--Since chimpanzees are specialized long-distance walkers, we cannot expect them to remain in good condition when kept in cages. The appropriate way to give them sufficient space without involving prohibitive costs is to keep them in an open enclosure surrounded by a moat or a wall. In a clay or a peat soil the costs of moats are lowest, and consequently allow one to provide more room at the same costs than in soil where a concrete moat or a wall is required. Moreover, a moat in clay or peat has the advantage over a concrete one that the apes are more reluctant to enter the water, apparently because of the poor footing. In any case the moat should be made in such a way that an ape that has jumped or fallen into it will be able either to get out, or to save itself on an underwater ridge in the middle of the moat, rather than drown. Since adult chimpanzees can jump 2 meters or more, and since they have their nostrils 110 to 130 cm high when standing upright, an underwater slope not steeper than 1:4 would seem to be appropriate, provided

that the structure of the slope is such that an ape which got into the moat would not slip down when trying to get out, even if the slope is grown with algae. The rest of the design of the moat depends on whether one prefers that an animal may get out at the wrong side or should rather by drowned. If a wall is used instead of a moat, it should be at least 4 meters high and have no rectangular corners because these enable sub-adult apes to climb out by stemming their hands and feet against the walls. A great advantage of a large open enclosure is that the amount of work to clean it is very small.

To provide more diversity of possibilities for motor exercise, an undulated terrain with rocks, many trees, etc., would be the most suitable. However, natural rocks with a surrounding clay and peat soil are rare. Therefore a terrain large enough and grown with sufficient trees, so that the apes will not destroy the trees in a few years, may give a good solution. Another solution may be to build something like the monkey rocks current in zoos, with a varied layout and with climbing tools, etc. More playing tools than the current car tire are desirable.

Social needs.--If I remember well, it was either Köhler or Yerkes who wrote: "A solitary chimpanzee is no chimpanzee at all." Nevertheless, most laboratories still keep their chimpanzees solitary, even it this is not necessary for the research involved. Furthermore, most zoo and laboratory directors wrongly believe that it is impossible to keep more than one adult male in one enclosure. This, however, applies only if the enclosure is too small, and perhaps in some cases if the apes have been kept solitary for many years after having attained adulthood. At the Chester Zoo, several adult males and females have been kept together in one large enclosure for many years without any serious difficulties. At the 6571st Aeromedical Research Laboratory, Holloman Air Force Base, I watched the release into one large enclosure of 17 chimpanzees (mainly adults and nearly adults, including several males up to 53 kg) that had previously been kept in separate cages. None was wounded, except for some small scratches and two bites 2 in. long, but in the turmoil two chimpanzees fled into the moat and had to be rescued, and another one had to be taken out because it was too much afraid of social intercourse. My observations suggest that it may perhaps be wiser to release several at a time rather than releasing them one by one. In order to be able to isolate individuals from the group, the best way seems to be to construct a feeding cage to which they have access by means of a corridor provided with a turnstile or other device with which they can easily be trapped.

Peaceful coexistence.--In the wild it is quite obvious that pent-up social tensions do exist in bands which include a large number of adult males and females. These tensions are as a rule harmlessly discharged in intimidation displays, and for the rest the pursued can always run faster than the pursuer. I have never seen any wounds or scars, contrary to what is normal in baboon groups. However, in the wild there are

always plenty of escape routes (bushes, matete grass, etc.). In captivity such escape possibilities should be provided as much as possible, particularly for the females and subadults, e.g., by means of marshy reed bushes, shallow water, sewer pipes to flee into (too narrow for adult males), obstacles, climbing apparatuses with several fleeing routes, branching paths, screens and rocks behind which the socially-subordinate individuals can enjoy privacy, etc. This point is particularly important if the apes have an indoor room to spend the night. Furthermore, intimidation tools for the dominant and subdominant ones are important to provide an outlet for social tensions, e.g., drums, swinging steel constructions, rattling chains, perhaps a big bell, etc. No dead corners should be present.

Climate.--The temperatures to which chimpanzees are exposed in the microclimates of their natural habitats range mostly from about 15 to 20°C (about 60 to 70°F), in some areas up to 25°C (about 80°F) during the day, and in mountainous areas at high altitudes down to 10 or even 5°C (about 50 or 40°F) during the night. Hailstorms and occasional night frosts do not seem to bother them. However, in savanna habitats, they withdraw as a rule into cool ravine and gallery forests as soon as the temperature rises over 23 to 25°C (about 80°F), and they adapt their daily routine in such a way that temperatures above that level are avoided. One should not forget that the "anthropomorphic" temperatures registered by meterological stations in towns or at airfields in Africa are quite different from the "chimpomorphic" temperatures in the gallery forests during the hot hours! Therefore I would recommend that air-conditioning be installed if laboratory chimpanzees are more or less regularly exposed to temperatures over 80°F in the summer months, but no heating seems necessary as long as it does not freeze during the nights in the winter time. Humidity is probably not important, but in dry areas or in dry seasons a device for bathing and showering may perhaps be useful.

Food.--The enormously wide variation of food consumed by chimpanzees in the wild, as well as their habit of choosing another kind of food almost every moment, indicates that they have a greater need for diversity of food than any other primate. Perhaps one of the main causes of bad conditions in captivity is the monotony of the food usually given. Attempts to provide more variation should be made.

Breeding.--Sexual behavior in the wild usually has the character of some kind of "sexual riot," not unlike what is seen in dogs in the street. No signs of sexual jealousy are obvious. Perhaps this social character of sexual behavior exerts a physiologically stimulating effect. In the breeding programs, therefore, it may be recommended to keep the whole group together in one large enclosure. At any rate, this is their natural way.

Demographic bookkeeping.--At present we have no standardized data on natality and mortality rates among chimpanzees in captivity. In

order to have comparable data for all important chimpanzee research laboratories, I would like to suggest that an expert on population research analyze the existing files, standardize them, and compare them with the figures that can be calculated from the population composition at the Beni, Budongo, and Gombe Stream Reserves. In this way we will be more able to find out exactly what is wrong with the care and maintenance in different laboratories.

Intellectual employment.--Chimpanzees in captivity often show many "neurotic" symptoms (dullness, stereotypes, coprophagy, bad temper, maliciousness, etc.). In the wild these symptoms appear not to occur. Furthermore, in the wild, they show an enormous "intellectual" interest in anything unusual. In captivity, this interest necessarily remains largely unsatisfied because in the cage nothing new ever happens. Perhaps this is the main cause of the "neurotic" symptoms. Therefore, more intellectual employment may be necessary to have test animals for psychological experiments in an optimal condition. We should not forget that the brain volumes of the great apes are almost equal to those of the Australopithecines, which, after all, are thought to have been some sort of human beings.

Human Persecution and Future Supply

The main factor determining the absence, presence, or abundance of chimpanzees within their geographical range in Africa is man; particularly human religion. In observant Muslim regions and in some animist regions the natives do not eat chimpanzees. In such regions, if cartridges are too scarce or too expensive to shoot apes that damage crops, and if there is no extensive trade in young chimpanzees for exportation, one finds as a rule that the species occurs abundantly in both forest and woodland savanna areas, and it may even be quite common in very poor savannas where isolated trees are scattered widely apart from one another. Conversely, in regions where the natives do eat chimpanzees, and/or where animal dealers are active, and where guns and cartridges are sufficiently available, chimpanzees have become either rare or exterminated as a rule, except in areas practically uninhabited by man. In savanna countries they are, of course, much more easily exterminated than in forest countries, but even the rain forest does not afford an effective protection against hunters with guns. There probably exists no other African mammal that can be exterminated as easily as the chimpanzee, except maybe the gorilla. The causes are: (1) Chimpanzees vocalize regularly and very loudly so that every hunter knows their whereabouts. (2) They are easily spotted when foraging in the tree tops. (3) They reproduce very slowly. (A computation based upon the population composition shows that, on the average, a female chimpanzee attaining puberty must become about 30 years old to produce sufficient offspring to perpetuate the species.) Fortunately, they apparently learn to vocalize much less in regions where they are regularly hunted, but this is still insufficient to save them from decimation.

Particularly in the postwar years, the decline in the chimpanzee population has become alarming. The main causes of this general decline are: (1) Most tribes in southern Sierra Leone, in Liberia, and in the area from the western Ivory Coast to the Kivu mountains eat chimpanzee meat. (2) African blacksmiths throughout West Africa manufacture cheap shotguns from water pipes. (3) Guns can be bought almost without restriction in the French-speaking countries and in Liberia. The time when the possession of a shotgun was a white man's privilege is long past. Only in the Congo of Leopoldville and in East Africa is the situation entirely different. The former colonial rulers in these countries successfully prevented the African population from possessing firearms in numbers of any importance, and the hunting regulations were fairly successfully enforced. It is largely owing to these circumstances that both countries have their present wealth of wildlife. It is also these circumstances which have prevented chimpanzee dealers almost entirely from operating in the eastern Congo and in East Africa.

The overall damage caused to the chimpanzee population by dealers should not be overestimated. If we assume that the chimpanzee population surviving in Africa to date amounts to perhaps some hundreds of thousands (which seems plausible), and if we assume that at least some percentage of them are shot and consumed annually (which seems plausible too), it would seem that they are eaten probably by tens of thousands annually. Compared with these figures the total exportation figures (though not exactly known) are of relatively little importance. It is hunting for consumption, rather than for exportation, that endangers the species with extinction, or at least with decimation, in most of its remaining geographical range. Timber exploitation of the rain forest is probably the most detrimental factor, first because the timber workers have guns to get their meat, and secondly because the forest is opened up for hunters and settlers by the timber-transport roads. There is no prospect that conservation measures can do anything against this. Only cattle breeding for meat production, or seizure of all firearms for political reasons, could help. As long as neither of these two conditions is fulfilled, no wildlife conservationist can seriously object to the exportation of young chimpanzees from those countries in which their mothers are killed and eaten by thousands. If the orphaned youngsters were not exported, they would be consumed too.

In countries where chimpanzees are not regularly eaten, however, the consequences of chimpanzee capturing and exportation may be quite serious from a conservation point of view, and even disastrous from a purely scientific point of view. The normal procedure is that a native hunter shoots a mother, and, if the youngster happens to survive, keeps it for some time at his home, then sells it to a friend or to a merchant, who in his turn sells it to somebody else, etc., until eventually, if it has not yet died, it is exported. According to the estimates of white dealers in Africa, one may assume that, on the average, at least two, perhaps three mothers are shot to obtain one young. Furthermore, according to the statistics of the Institut Pasteur in Guinea, one-quarter of the young die within the first 4 or 5 months after purchase,

mainly during the first few weeks. We may assume that perhaps another quarter die between capture and purchase. With purely commercial dealers the figures are probably worse because they have no medical and veterinary staff as a rule. It follows that, to obtain one surviving young chimpanzee at a scientific laboratory or a zoo in Europe or America, at least four, and perhaps six mothers have to be killed in Africa. Furthermore, one may expect that the exported animals have been infected with all the contagious and intestinal diseases occurring in all the villages they have passed through. And these creatures are then chiefly used for medical research!

To demonstrate the effect on the wild population resulting from this way of obtaining laboratory and zoo chimpanzees, let us consider the situation in two countries where they are not usually eaten: Guinea and the Muslim part of Sierra Leone.

Guinea.--No exportation figures are known. However, the Institut Pasteur was probably the main buyer and exporter. No figures are available for the total amount of purchases and exportations by the Institut during the 43 years of its existence, but it is known that of the 296 chimpanzees that passed through the Institut between 1950 and 1956 exactly 100 died, and we may assume that a number approximately equal to the difference were exported, i.e., 30 annually. Before the war, and after 1960, the figures were lower, and during the war no exportation was possible. Thus we may roughly estimate that, in the 43 years of its existence, about 3,000 to 4,000 mothers were shot on behalf of this institute, i.e., a number equaling all mothers of a population of about 15,000 chimpanzees, probably most of the mothers that lived in the entire southwestern area of Guinea south of the Fouta Djalon. From my population-composition data, I estimate that one mother produces perhaps 5 to 8, maybe even 10 offspring, not counting those that die at a very early age. It follows that about 15,000 to 30,000, maybe even 40,000 potential young chimpanzee lives in the wild were sacrificed by the Institut Pasteur to export about 700 laboratory chimpanzees. Moreover, this institute was not the only exporter.

The devastating effect was quite obvious in 1960, when I visited western Guinea for the first time. I asked the Institut Pasteur to show me some chimpanzee nests. For a full day we drove around by jeep everywhere in the entire region, visiting the most remote and inaccessible hamlets, and asking everybody about chimpanzees, but it was always the same story we heard: "Formerly there were many chimps here, but now there aren't any more," or: "Formerly one always heard their calls, but at present they are heard only in the rainy season, when nobody enters the bush." Only at sunset, at an out-of-the-way site, about 36 km from the Institut, we found somebody who could show us a few nests.

From about 1959 onwards, the government of the Guinean Republic gradually suppressed the activities of the Institut Pasteur because it was considered to be a remnant of colonialism. Moreover, when Mr. Sampil was appointed Inspecteur Général of the Service des Eaux, Forêts,

Chasses et Pêches, he did not grant any hunting or capturing licenses for chimpanzees, except for capturing by means of drugs or traps. Furthermore, cartridges became scarce, owing to importation restrictions, so that chimpanzees were rarely shot anymore when they caused damage to the crops.

The result was that the apes gradually reappeared to some extent. In 1965, when I was driving around in western Guinea, people in the villages along the roads could show me nests and/or foraging traces, and I was even successful enough to see a few glimpses of chimps. Apparently the apes had not yet been entirely exterminated in the region and had now come out of their hiding-places. Still, their numbers are far below what is suggested by Nissen's description of 1930, but, at any rate, some observational field work has become possible again.

Whether or not this situation will continue to exist depends primarily on the government of the Republic of Guinea. At the same time, however, scientists can do much in this matter. If subsidizing institutions insisted that no laboratory research would be done with chimpanzees imported from Guinea, or from any other country where these apes are not eaten, and if zoos would adopt a similar code, the problem of how to preserve the future possibilities of field research would be solved. Sufficient numbers can definitely be bought from countries where they would otherwise be eaten. To be quite frank: a scientist who at present buys a chimpanzee from a country where they are not eaten and where field work is possible, unless he is sure that it has been captured by means of a drug or a trap, is like a scientist who pollutes the water of a fishery-research lake.

Sierra Leone.--This country grants 150 exportation licenses annually for chimpanzees captured in Sierra Leone, plus an unknown number of duty-free transit licenses for chimpanzees imported (i.e., smuggled, as a rule) from Guinea and Liberia. This implies that about 600 to 900 mothers are shot annually, i.e., 6,000 to 9,000 per decade. Moreover, it is quite possible that chimpanzees captured in Sierra Leone are transported to a Customs Office and declared as "transit goods."

There cannot be any doubt that the present exportation rate is much higher than the wild stock can afford. The northwest half of Sierra Leone is Muslim country, but, according to the information I collected, chimpanzees are practically never heard nor seen anymore. Also, it must be taken into account that Sierra Leone is a very heavily savannized country and has a carrying capacity of at most a few tens of thousands of chimpanzees, probably even fewer, i.e., almost certainly fewer than 10,000 mothers. (Area of the country: 74,000 km^2.) It follows that the present exportation rate fully explains the decrease of the species in the past 10 or 15 years. The various figures and estimates correspond exactly with one another. This justifies the conclusion that, if the present exportation rate continues, chimpanzees will probably be exterminated in Sierra Leone within a couple of years, at most a decade. Only a very drastic reduction of the exportation licenses, e.g., to 30

per year, may rescue them. It is interesting to note that one of the two main chimpanzee dealers in Sierra Leone already intends to establish a trade in another country.

This account may suffice to outline the problem, though it could be extended with data on other countries. In Dahomey, for example, according to the Service des Eaux, Forêts et Chasses, chimpanzees were probably exterminated a few years ago. In the Gagnoa-Bouafle area in the central part of the Ivory Coast, according to Pfeffer[2], whose estimate was based upon a techinque of "shining" the animals at night, the total mammal population was reduced to 10% in only 10 years, and the toll may have been even greater for chimpanzees. Yet, for the time being, none of the subspecies is seriously endangered by total extermination, and there is still a good stock of the subspecies Pan troglodytes troglodytes in the hinterlands of Gabon and of the Congo of Brazzaville.

In another way, however, there is a trend towards imminent danger. The steady extension and refinement of medical research involves a continuously growing demand for chimpanzees for laboratory research. At the same time the sources are rapidly being depleted in four of the six main exportation countries. Consequently, within the next 10 to 15 years or so, we may expect a fairly sudden drop in the total exportation figures. At the same time, the recent successes with transplantation of chimpanzee tissues into human patients may perhaps lead to an explosive increase of the demand. Nobody can predict what will happen, but we have to consider the possibility. If so, the prices will rise as high as what people can afford to save a patient from imminent death. In that case any attempt at protection of the remaining wild stock will become entirely illusory.

At present it is still impossible to breed chimpanzees in sufficient numbers in captivity. Even at reputed zoos which want and try to breed them, it seems that, to maintain the stock, more chimpanzees must be bought than are born. This indicates that, under zoo conditions, in spite of good veterinary care, the mortality is much higher, and/or the natality is much lower, than could be. Under natural conditions in the wild, mortality and natality balance one another, of course; in spite of predation, poisonous snakes, accidents, etc., and without any veterinary attendance. Obviously, much is wrong in the customary practices and standards of chimpanzee management at zoos and laboratories. This implies at the same time that there must be much wrong in the physical and/or psychological condition of the chimpanzees which are used as experimental subjects in research, and that such research may thereby be invalidated. At any rate, for the time being, there is no prospect of meeting the demand for chimpanzees for research purposes by breeding them in captivity.

The only straightforward way to redress this state of affairs is to

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[2] P. Pfeffer, personal communication, 1965.

find out why they do so much better in the wild. Since they can survive in the wild under extremely varying conditions of habitat, temperature, humidity, etc., it should be possible to breed them in large numbers as domesticated laboratory animals. We only have to find out what is wrong with our current practices of management. What we need is large-scale ecological field work. This can be done only in regions where the apes are not too shy. Therefore, scientific institutions that buy their research chimpanzees from countries where such field work is still possible commit a scientific crime. The medical interests involved in chimpanzee ecology are too great to tolerate the prospect that this branch of research will be undone by the commercial suppliers of mainly medical research laboratories.

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OBESE NONBREEDING VERVET MONKEY

I have a pair of vervet monkeys (Cercopithecus aethiops), of which the female is excessively fat and is not breeding. I would be glad to give the pair to anyone who would like to investigate this condition. Failing that, could anybody make some other good use of this pair of vervets, which are of no use to Tigoni's breeding collection? (Freight costs must be paid by receiver.)

The vervets were raised by hand, are well adapted to captivity, and are now just over 5-1/2 yr. old. The obese female is the second specimen I have had in which excessive fat has been accompanied by lack of breeding, the earlier one also being a hand-raised female vervet. I do not attribute the excessively fat condition to diet or other features of captivity, as large numbers of similarly treated monkeys are normal and are breeding, including hand-raised animals. Glandular imbalance seems a possibility.--Cynthia Booth, Tigoni Primate Research Centre, P. O. Box 114, Limuru, Kenya.

VITAMIN D DEFICIENCY IN NEW WORLD MONKEYS[1]

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It has long been recognized that disease of the skeletal system is a common and important malady of several species of New World monkeys. The disease occurs either as rickets, osteomalacia, or osteodystrophia fibrosa, depending on the age of the animal, the duration of the disease, and probably also the species of primate. A variety of inappropriate terms have been applied to the disease complex and several causes have been suggested ranging from nutritional imbalance to viral. However, little to no experimental evidence exists to support any of the proposed mechanisms.

We have observed osteodystrophia fibrosa in cebus monkeys (Cebus albifrons), cotton-topped marmosets (Leontocebus oedipus), white-lipped tamarins (Leontocebus nigricollis), and mystax marmosets (Leontocebus mystax) fed rations containing "supposedly" adequate vitamin D, calcium, and phosphorous. The cebus monkeys were maintained for 24 months on a purified diet containing 2,000 I.U. vitamin D_2/kg, 0.8% calcium, and 0.46% phosphorous.[2] At the end of this time advanced osteodystrophia fibrosa was observed. The disease was characterized by distortion of the limbs, multiple fractures, characteristic histopathological lesions of osteodystrophia fibrosa, and exceptionally high serum alkaline phosphatase levels. No abnormality was seen in serum calcium or phosphorous. The marmosets were fed Purina Primate Chow containing 2,200 I.U. vitamin D_2/kg, 0.98% calcium, and 0.55% phosphorous. After 8 to 12 months on this diet, skeletal disease developed; the disease was similar to, but less advanced than, that seen in the cebus.

The substitution of vitamin D_3 at 2,000 I.U./kg for the vitamin D_2 in the cebus diet and the supplementation of the marmoset diet with 500 I.U. vitamin D_3/week per os resulted in reversal of the disease process as evaluated by clinical picture, roentgenograms, serum alkaline phosphatase, and histopathological examinations.

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[1] To be published in detail as a separate report.

[2] Vitamin D_2 is manufactured by plants from provitamins in the plant; animals obtain this vitamin by eating such plants. Vitamin D_3 is derived from provitamins already in the skin of the animals. Exposure to ultraviolet light in sunlight or other sources results in the conversion of the provitamins in the skin to vitamin D_3.

In addition, we have also observed osteodystrophia fibrosa in squirrel monkeys (Saimiri sciureus) maintained on rations containing vitamin D_2 without a source of vitamin D_3. However, we have not encountered this disease entity in squirrel monkeys receiving vitamin D_3 via either diet or sunlight.

These data demonstrate that the physiological activity of vitamin D_2 and D_3 differ in several species of New World primates. Either vitamin D_2 is not effective or the currently-accepted adequate levels are too low.

* * *

NATURAL RABIES IN A LABORATORY MONKEY*

Dr. M. Abdussalam, Veterinary Public Health, Division of Communicable Diseases, World Health Organization, Geneva, recently furnished us information on a case of rabies in a laboratory monkey in England.

Rabies is a rare disease in Great Britain. Since 1911 there have been six cases of human rabies, and from 1921 the disease has been confirmed in 23 dogs and one leopardess. In all instances, infection was acquired out side the country.

A female adult rhesus monkey (Macaca mulatta), one of a consignment of 33 collected from various sources in India, received on November 15, 1965, by air, became ill 47 days after its arrival in the laboratory. The animal cowered in the back of the cage and bit its fingers and hands. Four days later the self-inflicted wounds were so severe that the monkey had to be killed. Obvious paralysis, aggressiveness, and aversion to drinking were not observed during this period.

A laboratory diagnosis of rabies was made on the evidence of eosinophilic cytoplasmic inclusion bodies found in the neurones of the hippocampus and by intracerebral inoculation of monkey brain and submandibular salivary gland material into mice. Identification of viruses isolated from the brain and the salivary gland was carried out by the serum neutralization test in mice. Further intracerebral passage in mice confirmed it to be a strain of rabies virus.

The available evidence suggests that the incidence of natural rabies in imported monkeys is extremely low, but the possibility of further cases is to be expected in view of the increased use of monkeys for research, vaccine production, and other purposes.

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*An abstract of a report to be published in Lancet. This abstract appeared in CDC Veterinary Public Health Notes, May, 1966. (Prepared by the Veterinary Public Health Section, Epidemiology Branch, Communicable Disease Center, U. S. P. H. S., Atlanta, Georgia.)

SAIMIRI REPRODUCTION INFORMATION EXCHANGE

At a conference on reproduction in squirrel monkeys, held in March 1965 at Winston-Salem, N. C., an informal communication system was established to facilitate the rapid dissemination of observations and ideas to people concerned with breeding this species. It was felt that it would be useful to have an informal exchange of material to be published later and of material too preliminary, tentative, or trivial for publication, but nevertheless of interest to those concerned. Participation in this Saimiri Reproduction Information Exchange is limited, mainly to retain the informal nature of the communications.

The exchange seems to have served a useful purpose during its first year of existence. The current mailing list includes 29 laboratories in 4 countries, and 7 of these have submitted a total of 14 items for distribution. Since it is probable that there are people involved in the reproduction of squirrel monkeys who are not on our list, we are publishing this note with the following excerpts from our first mailing:

> Scope: "Reproduction" will be interpreted to include care and management of adult and infant squirrel monkeys, as well as behavior, anatomy, and physiology pertaining to their reproduction.
>
> Membership: The exchange is for the use of those who have been or are presently active in squirrel monkey reproduction studies. Membership will be on a departmental basis with each department involved in this field designating one member to receive the mailings; it will be his responsibility to distribute them appropriately within the department.
>
> Operation of the Exchange: It must be clearly understood that this is not a newsletter. There will be no editing, no deadlines, and no special forms involved. Any member at any time may communicate his findings, questions, or suggestions rapidly to the entire group by typing his material on ordinary bond paper and sending it to the undersigned. It will be photocopied and mailed promptly upon receipt. There are no charges involved.
>
> Quotation: Since the exchange is simply a means of conveniently multiplying personal communications, the communications distributed have the status of private communications and can be quoted as such in the literature.

Anyone engaged in breeding squirrel monkeys is invited to join the group by sharing with us h i s methods and experiences.--Thomas H. Clewe, M. D., Dept. Ob-Gyn, Vanderbilt Medical School, Nashville, Tenn. 37203.

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

Books

International zoo yearbook. Vol. VI. Jarvis, Caroline (Ed.) London: Zoological Society of London, 1965. (Order from: Publications Dept., The Zoological Society of London, Regent's Park, London NW1, England. Cost is $18.50.)

This year the book includes the following articles among others: Nutrition of the sifaka, Zanzibar red colobus at Antwerp Zoo, Cercopithecus hybrid at Kumasi Zoo, Breeding the white-tailed colobus, Breeding records of lar gibbons, Birth of a siamang, Acclimatisation of tropical monkeys in the Moscow area, Coprophagy in apes, and An epizootic of monkey pox at Rotterdam. The photographic section includes several photographs of the very rare snub-nosed monkey (Rhinopithecus roxellanae) in Chinese zoos and the recently discovered new species of langur, the white-headed langur (Presbytis leucocephalus), from Kwangsi in China.

Disease

Herpes-T, Herpesvirus tamarinus. Cooper, R. W. (Primate Res. Colony, Inst. Comp. Biol., Zoological Soc. San Diego, San Diego, Calif.) Laboratory Animal Digest, 1966, 2, 10-13.

Acanthocephala (Prosthenorchis elegans) infection in squirrel monkeys (Saimiri sciureus). Middleton, C. C. (Vivarium, Bowman Gray Sch. Med., Winston-Salem, N. C.) Laboratory Animal Digest, 1966, 2, 16-17.

Endoparasites of laboratory animals. Estes, R. R., & Brown, J. C. (USAF Sch. Aerospace Med., Brooks Air Force Base, Texas) Aeromedical Review, 1966, 1-66, vii, 59 pp.

Rickets and osteomalacia in squirrel monkeys (Saimiri sciureus). Bullock, B. C., & Bowen, J. A. (Bowman Gray Sch. Med., Wake Forest Coll., Winston-Salem, N. C.) Federation Proceedings, 1966, 25, 533.

Physiology and Behavior

Collection of biomedical study materials from baboons in East Africa: preliminary report. Kalter, S. S., Kuntz, R. E.,

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*Many of the references in this section have come from the Unverified Primate References prepared by the Primate Information Center, Regional Primate Research Center, University of Washington.

Al-Doory, Y., & Katzberg, A. A. (Dept. Microbiol., Southwest Found. Res. & Educ., San Antonio, Texas 78206) Laboratory Animal Care, 1966, 16, 161-177.

Oxygen uptake in squirrel monkeys (Saimiri sciurea). Malinow, M. R., & Wagner, R. (Visiting Professor, Cardiovascular Physiol., Oregon Reg. Primate Res. Center, Beaverton, Ore. 97006) Laboratory Animal Care, 1966, 16, 105-108.

Implanted electrodes for electronystagmography in the squirrel monkey. Cutt, R. A., Keels, E. W., Litvin, M., & Wolfson, R. F. (Otological Res. Lab., Presbyterian Hosp., Philadelphia, Pa.) Journal of Applied Physiology, 1966, 21, 715-717.

Vitamin D requirement of New World monkeys. Hunt, R. D., Garcia, F. G., & Hegsted, D. M. (New England Reg. Primate Res. Center, Box J, Southboro, Mass. 01772) Federation Proceedings, 1966, 25, 545.

Ultrasound and phakometry measurements of the primate eye. Young, F. A., Leary, G. A., & Farrer, D. N. (Primate Res. Center, Washington State U., Pullman, Wash.) Tech. Report No. ARL-TR-66-5, 6571st Aeromedical Research Laboratory, Holloman Air Force Base, New Mexico.

Facilities, Care and Breeding

Primate management and therapeutics. New, A. E. (U.S. Naval Aerospace Med. Inst., U.S. Naval Avn. Med. Cen., Pensacola, Fla.) Small Animal Clinician, 1966, 16, 448-451.

Tree shrews: unique reproductive mechanism of systematic importance. Martin, R. D. (Max-Planck Inst. für Verhaltenphysiologie, Seewiesen und Erling-Andechs, Germany) Science, 1966, 152, 1402-1404.

The primate behavior laboratory of Brown University. Schrier, A. M. (Primate Behav. Lab., Psychology Dept., Brown U., Providence, R. I. 02912) American Journal of Psychology, 1966, 79, 124-127.

A method for determining expected parturition date of rhesus monkeys (Macaca mulatta). Hutchinson, T. C. (Animal Dept., Sch. Med., U. Florida, Gainesville, Fla.) Laboratory Animal Care, 1966, 16, 93-95.

The feeding of baboons, Papio cynocephalus and P. doguera. Koehn, C. J. (Dept. Biochem., Section Nutrit., Southwest Found. Res. & Educ., P. O. Box 2296, San Antonio, Texas 78206) Laboratory Animal Care, 1966, 16, 178-184.

Methods and techniques of manipulating laboratory primates. Hall, A. S. (Oregon Reg. Primate Res. Center, Beaverton, Ore. 97006) Laboratory Animal Digest, 1966, 2, 3-5.

Transportation and acclimation of monkeys. Pietrzyk, J. (Polish Acad. Sci., Res. Ctr.-Lab. Animals-Breeding, Lomna-Las dist. Nowy Devor, Poland) Zwierzeta Laboratoryjne, 1965, 3, 93-114.

Use of plegomazin in monkeys before transportation. Pietrzyk, J. (Polish Acad. Sci., Res. Ctr.-Lab. Animals-Breeding, Lomna-Las dist. Nowy Devor, Poland) Zwierzeta Laboratoryjne, 1965, 3, 115-124.

Instruments and Techniques

Biomedical uses of computers, with some comments on their use in a regional primate research center. Robichaux, E. J. (Delta Reg. Primate Res. Center, Tulane U., Covington, La.) Journal of the American Veterinary Medical Association, 1965, 147, 1527-1529.

COMMITTEE OF SCIENTISTS FOR USE OF PRIMATES IN MEDICAL RESEARCH ESTABLISHED IN NEW YORK

A group of over 25 investigators who are using primates for biomedical research in the New York City area met at the Cornell University Medical College on May 19, 1966. The purpose of the meeting was to discuss problems of mutual interest to primate researchers.

A formal "Statement" was adopted which established the group as the Committee of Scientists for the Use of Primates in Medical Research. The Statement outlined some of the special problems of primate research and urged the creation of a Laboratory for Experimental Medicine and Surgery in Primates in the New York vicinity. The principle objective of the laboratory would be to support the intramural research programs of sponsoring institutions and other appropriate medical investigators. The laboratory would: (a) provide space, facilities, animals, and technical staff for the use of authorized investigators, (b) obtain, examine, condition, certify, and deliver healthy primates for use by the laboratories of the sponsoring institutions, and (c) obtain and provide appropriate materials, biologicals, sera, organs, etc., to appropriate investigators. A secondary objective would be an ongoing research program in primatology at the laboratory itself.

Edward I. Goldsmith, of the Department of Surgery, The New York Hospital--Cornell Medical Center, was elected Chairman of the Committee and was asked to appoint a steering committee to assist him in taking the necessary steps toward creating the above-mentioned laboratory.

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NEW PRODUCTS AND SERVICES

Marmoset Food: A special complete food for feeding marmosets is now available. This formulation was prepared especially for research colonies and requires no supplementation of any type. It is available in cases of 48 one-pound cans.--Theracon, Inc., P. O. Box 1493, Topeka, Kansas 66601.

Stainless Steel Drinking Dispensers: We have recently designed and are manufacturing two types of all-stainless-steel drinking dispensers. Our H6600 unit is a two-piece quick-disconnect unit that permits the disconnection of the valve dispenser without disrupting the central water supply. Our H5500 unit is our standard dispenser. All units are non-dripping and maintenance free, and constructed of materials that permit sterilizing.--The Fieldstone Corporation, Hardco Scientific Division, 6811 Grace Avenue, Cincinnati, Ohio 45227.

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