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A SURVEY OF DISEASES AMONG 100 FREE-RANGING BABOONS (*PAPIO URSINUS*) FROM THE KRUGER NATIONAL PARK*

E. E. McCONNELL(1), P. A. BASSON(2), V. DE VOS(3), BETTY J. MYERS(4) and R. E. KUNTZ(4)

Abstract

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The pathological and parasitological findings from 100 free-ranging chacma baboons are described. One of the most striking discoveries was a heretofore unknown coccidian parasite, *Isospora papionis*, and even more important than its presence in the small intestine was its occurrence in skeletal muscles. Serological and histopathological evidence of toxoplasmosis was found in several animals. Other previously unknown parasites encountered included two mites—*Rhinophaga elongata*, an unusually long mite that produced small granulomas in the nasal mucosae, and *Pneumonyssus vocalis*, a mite found in the laryngeal ventricles. A new species of filarid, *Tetrapetalonema papionis*, was found in the subcutis and intermuscular fascia.

New records for the chacma baboon of known parasites were *R. papionis*, a mite found only in the maxillary recess, where it stimulated a polyplike growth, and, in the skeletal muscles, cysticerci of *Taenia crocutae*, a tapeworm of hyaenas (*Crocuta crocuta* and *Hyaena brunnea*).

Apart from the pathological changes associated with the above parasites, another important finding was numerous cases of "capture myopathy", a syndrome that resembles Meyer-Betz disease of man. One of the most severe diseases encountered was pulmonary acariasis (*P. mossambicensis*), which at times caused large foci of suppurative pneumonia and diffuse pleuritis. The mite pigment was also found in draining lymph nodes. The most serious diseases of the liver were cytomegaly, which was similar to that produced by mycotoxins in other animal species, multiple granulomatous foci caused by *Hepatocystis simiae* and microgranulomas caused by ova of *Schistosoma mattheei*. Adult schistosomes were also found in the mesenteric vessels.

The most important lesion in the central nervous system was an axonal hamartoma, which was found in two cases and involved a large portion of the brain stem. Also of note were a meningioma in the falx cerebelli, a few examples of non-suppurative encephalitis and several cases in which neurons in the medulla oblongata had been replaced by a globular eosinophilic mass.

Other tumours found were a fibroma in the subcutis of the face and a basal cell carcinoma in the skin on the back. Both were of local importance only. Developmental anomalies included an accessory spleen, ectopic pancreatic tissue in the duodenum, thymic tissue embedded in the thyroid and parathyroid and microcysts in the thymus, parathyroid and adenohypophysis.

Arteriosclerosis of limited severity was found in the aorta and coronary and renal arteries of many of the older baboons (males and females). Another vascular change related to previous pregnancy was sclerosis of the ovarian and uterine vessels. Degenerative changes were found in the central arteries of germinal follicles in various lymph nodes and the spleen.

Other noteworthy findings included the presence of spargana in the skeletal muscles; ranula formation of the ducts of the glands of Ebner; para-ovarian cysts; large intranuclear inclusions in the submandibular salivary gland compatible with those produced by cytomegalovirus and intranuclear inclusions in the epididymis. Various gastro-intestinal parasites were found and their corresponding lesions are described. Selected bacterial studies for shigellae and salmonellae were negative, as were intradermal tests for tuberculosis and serological tests for leptospirosis and brucellosis.

The brain, heart, spleen, liver, lungs and kidneys were mass measured and were compared to the body mass. In all age groups the heart varied the least when expressed as per cent body mass. The brain was the most variable in this regard but changed the least in total mass.

Contents

Introduction

Baboons have recently become a very important source of biological data, especially as a result of their increasing use as a biomedical tool in comparative medical research. The main reasons are their close anatomical and physiological relationship to man, their relatively low cost and their almost unlimited availability compared with the other large experimental non-human primates, such as the chimpanzee. Consequently, detailed studies involving various biological disciplines have recently been attempted on the baboon. Except, however, for a few investigations of behaviour and parasitic diseases in East African baboons, *Papio cynocephalus*, by Vagtborg (1963, 1965, 1967a & b) and Kuntz, Myers & Moore (in press), plus one pathology survey (Kim, Eugster & Kalter, 1968), very little is known of the disease spectrum of these animals in the wild state.

(1) Major, USAF, VC, Geographic Pathology Division, Armed Forces Institute of Pathology, Washington, D.C.—Temporary Assignment, Section of Pathology, Onderstepoort
Present Address: Chief, Pathology Branch, 6570th AMRL (THP), Wright-Patterson AFB, Ohio 45433.

(2) Section of Pathology, Onderstepoort

(3) Regional Veterinary Laboratory, Skukuza, Kruger National Park

(4) Division of Microbiology and Infectious Diseases, Southwest Foundation for Research and Education, San Antonio, Texas. 78284

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This is particularly true of *P. ursinus*. Major studies have only dealt with its behaviour (Stoltz & Saayman, 1970; Saayman, 1971) and its use as an experimental model in organ transplant studies (Groenewald, 1969). As an adjunct to these latter studies, specific disease entities have been examined, but to date there has been no extensive study of the general pathology of the chacma baboon. The purpose of this communication is to present the findings of a survey of the indigenous diseases of the feral chacma baboon as it occurs in the Republic of South Africa and in particular the Kruger National Park (KNP).

Study Area

The KNP comprises some 891 000 hectares in the north-eastern Transvaal lowveld between 22° 19′ to 25° 32′ latitude south and 31° 01′ to 32° 02′ longi tude east. The southern and northern boundaries are formed by the Crocodile and Limpopo rivers, respectively. Other important rivers flowing through the Park are the Sabi, Olifants, Letaba, Shingwidzi and Levubu plus their tributaries. The eastern boundary follows the northern extension of the Lebombo mountain range on the border between the Transvaal and the neighbouring territory of Mozambique (Portugese East Africa). The western boundary is for the most part artificial and is demarcated by a barbed wire game fence along most of its 500 km course.

Elevation ranges from about 200 m above sea level at Crocodile Bridge to slightly over 500 m in the vicinity of Pretoriuskop. Going northwards there is a slight increase in altitude, reaching over 480 m at Punda Milia, then it falls again abruptly to about 300 m at Pafuri. In general, the landscape is slightly undulating with frequent small rocky outcrops or *koppies* rising in tumbled masses above the surrounding country.

Climatic conditions vary according to the altitude and topographical features within the area. Rainfall totals fluctuate from year to year but in general they range from less than 500 mm per annum on the flats between the Olifants and Shingwidzi rivers to over 700 mm in the neighbourhood of Pretoriuskop. A summary of the monthly precipitation records for widely distributed meteorological stations throughout the Kruger Park is provided in Table 1. Over 90% of the annual precipitation falls between October and April, mainly in heavy downpours. This is particularly important in the ecology of the area, for conditions in this season are lush, in contrast to those in the harsh, dry period of the winter and spring.

Great variations in temperature are also experienced, the extremes ranging from near freezing point in the winter to well over 38 °C in the shade in summer. On the whole, however, winter temperatures are mild with few frosts. The impact of the high summer temperatures is intensified by the accompanying relatively high air humidity index, as indicated by the climatographic data for Skukuza (Fig. 1).

The vegetation of the KNP conforms admirably to a description of the "bushveld" as given by West (1955): "In semi-arid rainfall Africa, the undisturbed virgin veld is typically perennial, tufted or bunch grassland, studded with various woody plants in the form of trees, shrubs and bushes. The amount of bush, in relation to grass, varies enormously from open veld, in which the wooded growth is absent, through parkland, where the trees and shrubs are sparsely scattered in grassland, to dense bush or thickets in which the grasses are quite unimportant". The components of this system are, however, further organized in an intricate mosaic of vegetation types, allowing for subdivision and an ecological differentiation of game habitats for the KNP (Pienaar, 1963). A simplified version of these habitats, with special reference to the requirements of the baboon, is shown in Fig. 2.

Study Animal

The chacma baboon* is widely distributed in suitable habitats throughout Southern Africa. Its range extends from the Cape Peninsula to about the latitude of the Zambezi, where its place is taken by an allied species. Typical of the South African scene, the chacma is usually encountered near rocky cliffs and boulder-strewn hillocks where it takes refuge at night and when disturbed.

In the eastern Transvaal lowveld, and especially in "free-ranging" country like the KNP, however, this baboon's essentially terrestrial way of life has been modified. Besides the larger rocky outcrops the riparian forest zones along the banks of nearly all permanent or semi-permanent streams, with their rich crops of fruit, berries, etc., also provide ideal living conditions for large numbers of baboons. In such areas they behave like the yellow baboon (*Papio cynocephalus*), which inhabits the forests rather than the mountains.

Distribution

To assess the distribution pattern and abundance of the baboon in the KNP, the model of the zoogeography of this species as compiled by Pienaar (1964) was used, augmented slightly by figures obtained from a subsequent annual game census. During this census all tourist, patrol and firebreak roads were traversed daily for 5 consecutive days and the numbers and exact location of all large mammals, including baboon troops, were recorded. Foot patrols were instituted in extremely rough country where no roads exist, thus ensuring thorough coverage of the area. Although some troops were conceivably missed, with consequent underestimation of the true total, the map that has been compiled (Fig. 3) should reflect the baboon distribution within the KNP reasonably accurately. The 273 distinct troops that were recognized and counted represented 5 100 individuals, in troops of less than 10 to slightly more than 100 animals (mean 19) (Fig. 2 & 3). The greatest densities were found along established streams, with their associated forest growth, and round waterholes and rest camps.

* Although there is considerable controversy regarding the taxonomy of African baboons, *P. ursinus* is the name commonly in use in South Africa when referring to the chacma baboon, which is considered a subspecies of *P. cynocephalus* by other workers (Napier & Napier, 1967).

TABLE 1 Average rainfall for selected localities in the Kruger National Park

Locality	S. Latitude	E. Longitude	Altitude (metres)	Period (years)	Average rainfall in millimetres												
					Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year
Malelane	25°28′	31°30′	305	20	94,9	93,8	74,4	39,1	17,2	9,2	6,8	5,9	23,2	43,9	113,1	93,5	615,0
Crocodile Bridge	25°22′	31°54′	215	22	114,1	106,0	65,4	51,1	22,2	10,0	10,6	7,5	28,7	37,9	96,2	85,0	634,7
Pretoriuskop	25°10′	31°16′	600	22	134,3	110,7	93,8	52,4	22,1	9,1	14,0	13,4	31,5	47,7	107,6	108,1	744,7
Skukuza	24°59′	31°36′	262	46	104,8	96,8	75,8	33,8	15,9	6,5	9,7	8,1	22,8	34,2	82,6	84,7	575,7
Tshokwane	24°47′	31°52′	245	23	89,0	94,3	77,9	46,6	13,3	9,4	10,1	5,4	23,7	25,4	94,5	102,9	592,5
Satara	24°24′	31°47′	273	28	99,5	103,6	64,5	33,4	12,6	9,9	9,7	7,4	21,7	27,9	78,4	89,0	557,6
Letaba	23°51′	31°35′	215	22	76,1	75,7	69,8	30,7	9,2	5,6	13,3	2,7	15,3	24,3	57,1	97,3	477,1
Phalaborwa	24°00′	31°06′	336	30	86,3	90,3	65,6	30,2	8,0	6,5	10,3	2,1	10,8	24,5	66,5	79,5	480,6
Shingwidzi	23°07′	31°26′	265	14	61,1	89,4	31,9	37,9	5,4	5,9	3,0	3,8	6,3	28,8	48,2	107,6	429,2
Punda Milia	22°41′	31°01′	462	28	129,4	94,0	95,7	38,6	6,7	7,2	8,2	4,5	10,3	22,7	67,4	95,9	580,6
Pafuri	22°27′	31°19′	305	35	90,8	74,2	48,2	19,6	4,0	6,1	1,2	4,5	5,5	17,0	58,1	90,5	420,4

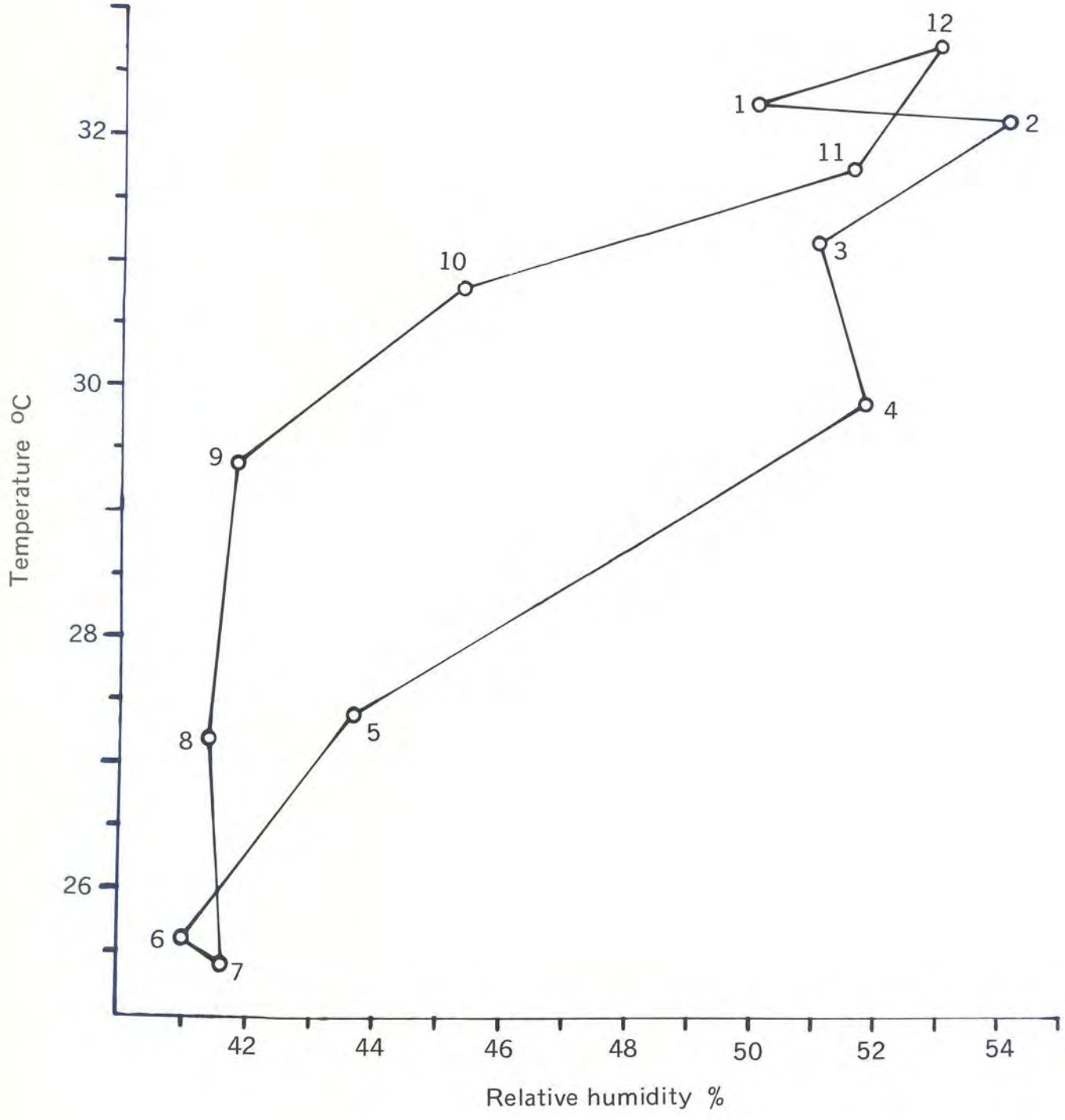


FIG. 1. Climograph depicting average monthly relative humidity at 14h00 of each day and monthly mean of daily maximum temperature for Skukuza, Kruger National Park. Data extend over 9 year period ending in 1970

FIG. 2. A map of the Kruger National Park, depicting the main baboon habitats
Thick lines—rivers and river beds with riparian forest zone in immediate vicinity
Inverted V's—heavily wooded hilly and mountainous areas
Stippling—long grass savanna woodland and tree savanna with *Terminalia sericea* and *Dichrostachys cinerea* as the dominant tree species
Diagonal hatching "/" —mixed *Combretum—Acacia* tree woodland
Horizontal hatching—*Acacia nigrescens—Sclerocarya caffra* tree savanna
Diagonal hatching *Acacia nigrescens* areas of scrub mopanie
Vertical hatching—sand veld
Unmarked area—Mixed mopani—*Combretum* woodland

Interspecific interactions

A network of tourist roads, mostly near watering points and watercourses, has brought man into semi-contact with many baboons, especially along the Skukuza—Lower Sabi route by the Sabi river, where the highest densities of these animals in the KNP occur. Along well-travelled roads they have become completely accustomed to traffic, soon learn to beg for food, and may become completely dependent on this source of nourishment.

High densities of baboons are also found near human habitations (Fig. 3), where they scavenge in open offal dumps. This habit is also quickly acquired, as shown by the rapidity with which it develops around temporary camping and working sites in the veld. Thus the degree of contact between humans and baboons in the KNP favours the development of a zoonotic nidus. Initially the chain of inter-specific infections was directed only towards the baboon. Since the KNP started contributing baboons for biomedical research, projects. however, this chain can now also be directed back towards the handlers, creating a potential zoonotic hazard.

Baboons frequently forage for food near antelopes, especially impala (*Aepyceros melampus*). Game seems to be very tolerant of their presence in spite of the fact that baboons occasionally attack, kill and consume their young. Though it is popularly believed that the leopard is the chief predator of the baboon, experience in the KNP nominates the lion in this role (Pienaar, 1966). This predator-prey association apparently has a long evolutionary history, allowing ample opportunity for the development of communal disease conditions.

FIG 3. Distribution of the baboon (*Papio ursinus*) in the Kruger National Park. Relative abundance is indicated by the intensity of shading. Black spots indicate the location of troops sampled

Intraspecific interactions

Free-ranging baboons are socially integrated into a system of troops (Stoltz & Saayman, 1970) with an intricate social behaviour pattern involving much contact between individuals. The data on interaction between troops in overlapping home range areas, however, seem to be conflicting. Bolwig (1959) describes violent fighting when troops of chacma baboons meet, but Stoltz & Saayman (1970) observed no physical contact in the antagonistic behavioural pattern between two groups. Stoltz & Saayman (1970) also found no evidence that interchange between

troops takes place. One would therefore expect that the social intratroop interactions would allow for a high degree of communicability of diseases within a group, whilst intertroop aggression would act as a limiting factor to their spread to neighbouring groups.

Materials and Methods

A total of 100 baboons was captured in the KNP during 5 field trips, each lasting 5 days, made at different seasons between November 1969 and October 1971 (Table 2). On each trip a group of 20 baboons was obtained by selecting animals of various ages and both sexes from several areas of the park (Fig. 2). In each locality an effort was made to get samples from different troops (total 29) and of animals which had: (1) a fair amount of direct contact with man, such as "beggars" obtaining at least some of their diet from illegal tourist offerings; (2) indirect contact, such as those living near tourist camp trash heaps or near the park borders adjoining inhabited areas; and (3) little or no contact with man. No attempt was made to select sick animals.

TABLE 2 Dates of baboon collections

Group number	*Date and season*
Group 1 (B1–B20).....	24–28 Nov. 69 (early summer)*
Group 2 (B21–B40).....	13–17 April 70 (autumn)*
Group 3 (B41–B60).....	8–12 June 70 (winter)*
Group 4 (B61–B80).....	30–2 Dec. 70 (summer)
Group 5 (B81–B100).....	18–22 Oct. 71 (spring)

* A severe and extended drought preceded these periods

Method of capture

With the exception of those from Shingwidzi and Punda Milia (see below), the capture methods for each group were similar. These methods involved the use of either a trapping cage or a "Cap Chur" pistol loaded with a dart containing phencyclidine hydrochloride.†

Trapping was done with portable steel cages in which various fruits and/or vegetables were placed as bait. The cage door was either dropped by an automatic release device connected to the bait or manually by an attendant hidden at some distance. In the northern end of the park where contact with man is less frequent, the baboons had to be lured by baiting the cages for several days prior to the field trip to allow them to get used to the device. Phencyclidine hydrochloride was used in those areas where the animals were accustomed to man, such as along well-travelled roads or near rest camps. The dose was approximated according to body mass (± 2,5 mg/kg); however, it was usually calculated on the high side to prevent the animal from escaping. Because the baboons, particularly the older animals, associated the official KNP trucks with capture, it soon became necessary to use civilian clothes and cars. Even the pistol eventually had to be enclosed in a paper bag so as to resemble a tourist offering.

† Sernylan (Parke-Davis)

Necropsy procedures:

After sedation the baboons were transported to the Regional Veterinary Laboratory, Skukuza, where they were housed in individual cages prior to the post-mortem examination. This period varied from a maximum of 5 days to as little as a few hours. In this way a ready supply of animals was available at all times.

Unless still under anaesthesia, immediately prior to the post-mortem examination, the animals were re-anaesthetized with phencyclidine hydrochlor de They were then examined, mass measured and blood smears were prepared from a small incision in the ear. All baboons were killed by cervical exsanguination. Care was taken, whenever possible, to prevent inhalation of blood. Blood samples and oral and and rectal swabs for various microbiological determinations were collected at this time.

The eyes were removed immediately, usually within 3–4 minutes after death, and were placed in 10% v/v unbuffered formalin. A routine necropsy was then performed except for the following: (1) Specific lymph nodes (submandibular, bronchial, infrascapular, mesenteric, and periportal) were placed in separate marked plastic bags perforated to allow for adequate fixation; and (2) specific muscles (*masseter, longissimus dorsi, triceps* and *quadriceps*) were prepared in a manner similar to the lymph nodes.

Major organs were mass measured and subsequently expressed as a function of the body mass (BM) (Table 3). They were removed as follows:

1. Lungs—the bronchi were severed where they entered the lungs after removal of the oesophagus and mediastinal connective tissues.
2. Heart—the pericardium was removed and major vessels were transected at the base. Remaining blood was removed by opening both ventricles.
3. Spleen—the omentum was removed at its splenic attachment. Vessels were severed at the level of the spleen.
4. Liver—vessels were severed at the hilus and the gall bladder was opened, draining all contents.
5. Kidneys—vessels and the ureter were severed at the hilus. All perirenal fat and tissues were removed with the exception of the capsule, which was left intact. The mass of each kidney was measured independently.
6. Brain—the spinal cord was transected at the level of the foramen magnum. The dura mater and hypophysis were removed and not included in the masses. Cranial nerves were severed close to their origin from the brain. Body masses (and corresponding organ masses) were grouped into three categories: (1) juvenile (less than 3 kg), (2) adolescent and (3) adult (see sections on Male and Female Reproductive System for an explanation of how this was determined). In turn, the latter two groups were subdivided according to sex.

TABLE 3 Organ masses compared to sex and total body mass (given as %BM bg. number in following line)

Baboon number and sex	Total body mass	Lungs	Heart	Spleen	Liver	Kidney (R)	Kidney (L)	Brain
	kg	g	g	g	g	g	g	g
B1 Male.....	29,55	195,0	135,0	34,0	615,0	45,0	42,0	195,0
		0,659	0,457	0,115	2,081	0,152	0,142	0,659
B2 Male.....	23,64	206,0	111,8	44,6	359,5	32,8	30,4	181,6
		0,871	0,473	0,188	1,521	0,139	0,129	0,768
B3 Female.....	3,64	24,5	20,6	6,0	85,5	9,3	8,5	140,6
		0,673	0,566	0,165	2,349	0,255	0,234	3,910

Baboon number and sex	Total body mass	Lungs	Heart	Spleen	Liver	Kidney (R)	Kidney (L)	Brain
	kg	g	g	g	g	g	g	g
B4 Male.....	28,18	210,6	130,5	30,9	619,0	40,6	40,4	187,0
		0,747	0,463	0,110	2,197	0,144	0,143	0,664
B5 Female.....	2,05	17,3	15,3	3,9	65,9	6,5	6,7	147,0
		0,844	0,746	0,190	3,215	0,317	0,327	7,415
B6 Male.....	15,91	137,6	76,4	20,8	383,5	31,8	32,9	169,6
		0,865	0,480	0,131	2,410	0,200	0,207	1,066
B7 Male.....	4,09	35,4	24,6	10,0	97,8	9,7	9,4	152,2
		0,866	0,601	0,244	2,391	0,237	0,230	3,716
B8 Male.....	24,32	186,2	114,7	27,5	380,0	40,1	41,3	173,0
		0,766	0,472	0,113	1,563	0,165	0,170	0,711
B9 Female.....	13,18	87,4	51,8	14,6	254,7	28,6	29,1	151,7
		0,663	0,393	0,111	1,924	0,217	0,221	1,151
B10 Male.....	4,09	37,7	21,9	6,3	115,4	10,9	10,4	149,3
		0,922	0,535	0,154	2,822	0,267	0,254	3,650
B11 Male.....	2,73	32,5	15,8	7,7	80,3	8,9	8,0	168,2
		1,190	0,577	0,282	2,941	0,326	0,293	6,161
B12 Male.....	4,55	29,6	27,0	9,5	130,8	11,0	11,6	189,5
		0,651	0,593	0,209	2,875	0,242	0,258	4,165
B13 Male.....	4,55	30,5	26,2	6,2	101,4	10,9	10,9	166,0
		0,670	0,576	0,136	2,229	0,240	0,240	3,648
B14 Female.....	17,27	126,3	64,3	17,3	319,6	28,1	27,0	154,0
		0,731	0,372	0,100	1,851	0,163	0,156	0,892
B15 Male.....	23,64	174,3	97,3	36,5	444,0	33,7	35,5	184,7
		0,737	0,412	0,154	1,878	0,143	0,150	0,781
B16 Male.....	29,98	226,2	134,1	32,0	511,6	45,6	44,8	196,0
		0,778	0,461	0,110	1,759	0,157	0,154	0,674
B17 Male.....	23,64	193,2	139,6	37,6	435,8	39,7	42,3	204,8
		0,817	0,591	0,159	1,843	0,168	0,179	0,866
B18 Female.....	4,09	24,5	19,3	7,7	96,4	10,0	10,0	151,3
		0,599	0,472	0,188	2,357	0,244	0,244	3,699
B19 Female.....	13,86	83,1	83,1	43,4	11,5	298,7	28,9	151,8
		0,600	0,313	0,083	2,155	0,209	0,209	1,095
B20 Male.....	28,64	190,5	140,9	32,8	465,8	41,3	41,3	169,4
		0,665	0,492	0,115	1,656	0,144	0,144	0,591
B21 Male.....	30,00	157,8	147,4	25,0	435,4	38,4	35,2	177,4
		0,526	0,491	0,083	1,451	0,128	0,117	0,591
B22 Male.....	25,91	183,6	133,1	25,5	507,5	40,5	44,3	197,0
		0,709	0,514	0,098	1,959	0,156	0,171	0,760
B23 Female.....	10,00	58,1	44,2	15,8	211,8	16,4	17,0	139,2
		0,581	0,442	0,158	2,118	0,164	0,170	1,392
B24 Male.....	1,28	13,5	5,2	3,6	26,9	2,7	2,7	132,7
		1,056	0,407	0,243	2,105	0,211	0,211	10,382
B25 Female.....	12,27	61,3	49,4	16,9	242,5	25,7	27,2	151,0
		0,500	0,407	0,138	1,976	0,209	0,222	1,231
B26 Male.....	25,00	196,3	133,4	29,6	439,4	39,7	38,1	184,9
		0,785	0,534	0,118	1,758	0,159	0,152	0,740
B27 Male.....	28,18	291,5	125,0	38,5	410,3	42,4	37,9	215,4
		1,034	0,444	0,137	1,456	0,150	0,134	0,764
B28 Female.....	15,00	79,5	57,1	11,2	237,2	27,6	27,5	153,0
		0,530	0,381	0,075	1,581	0,184	0,183	1,020
B29 Male.....	1,28	19,6	6,6	3,6	30,6	2,7	2,7	145,9
		1,461	0,516	0,243	2,394	0,211	0,211	11,416
B30 Female.....	14,55	101,5	53,2	10,0	309,8	27,7	26,6	154,3
		0,698	0,366	0,069	2,129	0,190	0,183	1,060
B31 Male.....	30,54	229,6	180,2	29,4	465,2	39,1	39,4	198,2
		0,752	0,590	0,096	1,523	0,128	0,163	0,649
B32 Male.....	27,73	226,0	122,8	44,4	518,6	51,0	49,9	187,0
		0,815	0,443	0,160	1,860	0,184	0,180	0,674
B33 Male.....	13,18	90,3	63,9	23,6	292,4	27,7	27,7	192,9
		0,685	0,485	0,179	2,219	0,210	0,210	1,464
B34 Female.....	2,98	19,6	12,7	8,6	68,4	5,3	5,0	133,3
		0,658	0,426	0,289	2,295	0,178	0,168	4,473
B35 Male.....	28,64	210,9	151,4	29,1	488,3	43,3	42,5	210,9
		0,736	0,529	0,102	1,705	0,151	0,148	0,736
B36 Male.....	26,82	183,8	134,0	33,1	480,0	39,6	41,0	191,0
		0,685	0,500	0,123	1,790	0,148	0,153	0,712
B37 Male.....	21,36	189,6	67,5	21,2	387,0	30,9	31,2	173,2
		0,888	0,316	0,099	1,812	0,145	0,146	0,811
B38 Male.....	26,82	183,0	138,6	35,3	548,1	41,6	39,1	170,6
		0,682	0,517	0,132	2,044	0,155	0,146	0,636
B39 Male.....	24,09	189,1	124,5	38,3	437,5	40,6	40,0	176,5
		0,785	0,517	0,159	1,816	0,169	0,166	0,733
B40 Male.....	20,45	109,1	73,9	28,6	409,8	30,0	30,0	173,4
		0,533	0,361	0,140	2,004	0,147	0,147	0,848
B41 Female.....	13,64	187,2	63,0	8,9	445,3	35,6	35,6	1,670
		1,372	0,426	0,065	3,265	0,257	0,257	1,224
B42 Male.....	29,09	264,0	123,4	29,9	635,0	51,4	48,5	172,6
		0,908	0,424	0,103	2,183	0,177	0,167	0,593
B43 Female.....	16,64	*	71,5	11,0	449,7	31,6	32,0	141,8
			0,430	0,066	2,703	0,190	0,192	0,852
B44 Male.....	5,45	32,3	25,8	7,9	146,7	10,1	9,0	149,3
		0,593	0,473	0,145	2,691	0,185	0,165	2,739

Baboon number and sex	Total body mass	Lungs	Heart	Spleen	Liver	Kidney (R)	Kidney (L)	Brain
	kg	g	g	g	g	g	g	g
B45 Female.....	12,73	86,7	652,0	11,2	351,0	26,4	27,4	146,8
		0,681	0,512	0,088	2,757	0,207	0,215	1,153
B46 Male.....	24,55	169,5	147,4	25,2	539,2	40,0	40,0	192,0
		0,690	0,600	0,103	2,196	0,163	0,163	0,782
B47 Male.....	30,00	216,0	156,0	42,0	578,9	40,8	40,6	196,2
		0,720	0,520	0,140	1,930	0,136	0,135	0,656
B48 Female.....	1,78	17,3	8,0	3,6	66,4	4,2	4,1	122,8
		0,972	0,449	0,202	3,730	0,230	0,230	6,899
B49 Male.....	30,91	195,3	160,2	38,6	690,0	41,7	42,2	179,4
		0,632	0,518	0,125	2,232	0,135	0,137	0,580
B50 Male.....	20,00	143,8	103,5	23,5	578,0	32,5	34,0	175,1
		0,719	0,518	0,118	2,895	0,163	0,170	0,876
B51 Male.....	18,18	113,5	84,8	18,1	517,0	29,5	32,0	177,2
		0,625	0,466	0,100	2,843	0,162	0,176	0,975
B52 Female.....	12,72	89,0	50,6	12,0	451,0	24,0	23,3	152,7
		0,699	0,397	0,094	3,543	0,189	0,183	1,200
B53 Male.....	31,14	221,0	171,4	31,0	539,3	39,7	38,0	184,2
		0,710	0,550	0,100	1,732	0,127	0,122	0,592
B54 Female.....	11,82	68,2	40,0	17,0	324,5	22,9	21,0	143,7
		0,577	0,338	0,144	2,745	0,194	0,178	1,216
B55 Female.....	13,64	95,0	56,6	16,1	367,0	30,2	27,3	147,0
		0,696	0,415	0,118	2,691	0,221	0,200	1,078
B56 Female.....	3,18	20,6	15,7	6,4	100,0	7,9	8,1	135,5
		0,648	0,494	0,201	3,145	0,248	0,255	4,261
B57 Male.....	21,82	245,5	94,0	23,0	456,0	37,7	38,5	182,4
		1,121	0,431	0,105	2,090	0,173	0,176	0,836
B58 Female.....	12,27	184,0	41,0	12,8	357,0	24,6	23,8	146,0
		1,500	0,334	0,104	2,910	0,200	0,194	1,190
B59 Female.....	15,45	98,5	56,5	21,7	438,0	34,5	33,0	150,0
		0,638	0,366	0,140	2,835	0,225	0,214	0,971
B60 Male.....	5,68	39,8	27,5	7,8	145,5	14,5	14,1	148,5
		0,701	0,484	0,137	2,562	0,255	0,248	2,614
B61 Female.....	10,68	83,6	47,5	24,0	220,5	19,2	19,0	162,3
		0,783	0,445	0,225	2,065	0,180	0,178	1,520
B62 Male.....	26,36	275,4	130,0	34,7	492,8	41,0	39,7	181,5
		1,043	0,493	0,132	1,869	0,156	0,151	0,689
B63 Male.....	10,00	75,2	63,8	19,0	231,7	22,5	23,9	189,3
		0,752	0,638	0,190	2,317	0,225	0,239	1,893
B64 Male.....	28,64	196,5	174,0	47,0	454,6	50,3	46,8	206,0
		0,686	0,608	0,164	1,587	0,176	0,163	0,719
B65 Female.....	16,02	114,4	75,2	21,3	306,8	27,0	26,6	180,0
		0,714	0,469	0,133	1,915	0,169	0,164	1,124
B66 Male.....	10,45	75,4	57,1	23,1	225,6	23,1	22,2	175,7
		0,722	0,546	0,221	2,159	0,221	0,212	1,681
B67 Female.....	20,45	125,0	100,1	31,2	413,7	31,8	30,4	162,4
		0,611	0,489	0,153	2,023	0,156	0,147	0,794
B68 Male.....	5,45	45,0	31,8	7,2	137,8	11,1	11,1	170,0
		0,826	0,583	0,132	2,528	0,204	0,204	3,119
B69 Female.....	14,09	76,1	*	16,7	347,2	22,8	22,1	146,6
		0,540		0,119	2,464	0,162	0,157	1,040
B70 Female.....	8,18	46,6	43,2	20,0	199,8	15,9	16,9	165,6
		0,570	0,528	0,244	2,443	0,194	0,207	2,024
B71 Female.....	16,36	73,5	94,2	22,1	433,3	33,7	33,1	170,0
		0,449	0,576	0,135	3,328	0,206	0,202	1,039
B72 Male.....	30,45	240,0	237,4	44,6	462,5	45,9	47,8	214,0
		0,788	0,780	0,146	1,519	0,151	0,157	0,703
B73 Male.....	32,50	186,5	197,0	62,5	558,0	38,0	37,5	193,6
		0,574	0,606	0,192	1,717	0,117	0,115	0,596
B74 Female.....	9,55	25,5	55,5	15,3	203,0	18,0	17,5	187,3
		0,790	0,581	0,160	2,126	0,188	0,183	1,961
B75 Male.....	32,73	257,1	187,9	38,7	438,7	35,5	35,5	180,0
		0,786	0,574	0,118	1,340	0,108	0,108	0,550
B76 Male.....	19,09	122,0	92,0	35,0	302,9	32,6	29,7	187,0
		0,639	0,482	0,183	1,587	0,171	0,156	0,980
B77 Male.....	5,00	38,2	20,3	9,8	110,5	10,4	10,1	166,5
		0,764	0,406	0,196	2,210	0,208	0,202	3,330
B78 Male.....	37,27	241,0	209,5	60,6	549,8	47,9	45,5	221,9
		0,647	0,562	0,163	1,475	0,129	0,122	0,595
B79 Male.....	3,40	24,7	18,0	6,7	98,4	7,6	7,3	166,0
		0,726	0,529	0,197	2,894	0,224	0,215	4,882
B80 Male.....	13,41	105,6	66,1	26,8	262,3	24,0	23,3	194,2
		0,787	0,493	0,200	1,956	0,179	0,174	1,448
B81 Female.....	14,55	108,9	68,1	26,8	369,5	32,0	34,0	154,2
		0,748	0,470	0,184	2,540	0,220	0,234	1,060
B82 Female.....	16,36	116,4	63,3	29,1	340,0	36,5	36,0	186,2
		0,711	0,387	0,178	4,208	0,223	0,220	1,138
B83 Male.....	8,64	67,5	47,5	22,0	203,4	17,3	18,7	182,5
		0,781	0,550	0,255	2,354	0,204	0,216	2,112
B84 Male.....	3,18	18,4	14,0	*	85,6	8,0	8,0	144,8
		0,579	0,440		2,692	0,252	0,252	4,553
B85 Male.....	3,18	22,3	18,0	9,3	70,3	7,0	7,1	162,6
		0,701	0,566	0,929	2,211	0,220	0,223	5,113

Baboon number and sex	Total body mass	Lungs	Heart	Spleen	Liver	Kidney (R)	Kidney (L)	Brain
	kg	g	g	g	g	g	g	g
B86 Male.....	29,09	282,0 0,969	176,0 0,605	39,5 0,136	543,0 1,867	37,8 0,130	39,6 0,136	183,8 0,632
B87 Female.....	12,27	78,6 0,641	66,3 0,540	25,3 0,206	280,0 2,282	28,5 0,232	25,0 0,204	163,6 1,333
B88 Male.....	26,36	203,7 0,773	168,5 0,639	48,0 0,182	566,5 2,149	47,5 0,180	45,4 0,172	176,5 0,670
B89 Female.....	14,09	86,0 0,610	55,5 0,394	18,0 0,128	273,5 1,914	24,3 0,172	25,1 0,178	154,3 1,095
B90 Female.....	13,64	79,2 0,581	43,8 0,321	10,9 0,080	240,0 1,760	19,6 0,144	18,3 0,134	158,2 1,160
B91 Female.....	10,91	69,2 0,654	51,4 0,471	23,0 0,211	243,2 2,229	24,0 0,220	22,5 0,206	172,0 1,577
B92 Male.....	30,45	200,0 0,657	137,0 0,450	32,0 0,105	356,0 1,169	42,8 0,141	41,5 0,136	188,7 0,620
B93 Male.....	29,09	218,0 0,749	124,0 0,426	38,3 0,132	429,0 1,475	43,6 0,150	42,5 0,146	157,0 0,540
B94 Male.....	23,64	146,5 0,620	131,5 0,556	27,9 0,110	353,2 1,494	33,6 0,142	34,0 0,144	197,5 0,835
B95 Female.....	12,27	74,1 0,604	47,8 0,390	15,9 0,130	300,7 2,451	54,5 0,444	52,0 0,424	166,4 1,356
B96 Male.....	1,82	19,0 1,044	11,2 0,615	4,7 0,258	42,4 2,330	4,9 0,269	4,8 0,264	158,2 8,692
B97 Female.....	17,73	88,0 0,496	65,0 0,367	13,5 0,076	302,4 1,706	32,8 0,185	31,5 0,178	170,7 0,963
B98 Female.....	14,09	100,9 0,716	59,0 0,419	22,6 0,160	290,9 2,065	33,6 0,238	31,4 0,223	153,0 1,086
B99 Male.....	5,00	33,7 0,674	24,5 0,490	8,3 0,166	192,4 3,848	12,9 0,258	12,9 0,254	157,3 3,146
B100 Male.....	1,82	12,8 0,703	8,3 0,456	3,9 0,214	42,0 2,308	3,3 0,181	3,1 0,170	104,4 7,714

		Lungs %BM	Heart %BM	Spleen %BM	Liver %BM	Kidney (R) %BM	Kidney (L) %BM	Brain %BM
Average (AV).....		0,746	0,488	0,150	2,323	0,191	0,188	2,147
Range (RG).....		0,449– 1,500	0,313– 0,780	0,065– 0,292	1,169– 4,208	0,108– 0,444	0,108– 0,424	0,540– 11,416
Males (63)	AV.....	0,774	0,515	0,155	2,070	0,179	0,177	2,017
	RG.....	0,526– 1,461	0,316– 0,780	0,083– 0,202	1,169– 3,848	0,108– 0,326	0,108– 0,293	0,540– 11,416
Females (37)	AV.....	0,697	0,442	0,143	2,428	0,211	0,207	1,828
	RG.....	0,449– 1,500	0,313– 0,746	0,065– 0,289	1,581– 4,208	0,144– 0,444	0,134– 0,424	0,794– 7,415
Males & Females (8) (0–2,99 kg)	AV.....	0,991	0,524	0,240	2,224	0,240	0,234	7,894
	RG.....	0,658– 1,461	0,407– 0,746	0,158– 0,289	0,202– 3,215	0,178– 0,326	0,168– 0,327	4,473– 11,416
Adolescent males (15) (3,00–12,99 kg)	AV.....	0,729	0,534	0,191	2,586	0,229	0,227	3,357
	RG.....	0,579– 0,922	0,476– 0,638	0,132– 0,255	2,215– 3,894	0,185– 0,267	0,165– 0,258	1,681– 5,113
Adolescent females (8) (3,00–10,99 kg)	AV.....	0,662	0,500	0,194	2,354	0,212	0,210	2,543
	RG.....	0,578– 0,790	0,442– 0,581	0,158– 0,225	2,065– 3,145	0,164– 0,255	0,179– 0,255	1,392– 4,261
Adult males (43) (>13,00 kg)	AV.....	0,753	0,508	0,135	1,851	0,153	0,153	0,753
	RG.....	0,526– 1,125	0,316– 0,780	0,083– 0,200	1,169– 2,895	0,108– 0,210	0,108– 0,210	0,540– 1,464
Adult females (26) (>11,00 kg)	AV.....	0,692	0,412	0,118	2,452	0,208	0,203	1,097
	RG.....	0,449– 1,500	0,313– 0,576	0,065– 0,206	1,581– 4,208	0,144– 0,444	0,134– 0,424	0,794– 1,356

The brain was fixed by immersing it in 100% unbuffered formalin to which tap water was added until it floated at approximately mid-level. In most cases this approximated a 50% dilution. Some of the brains were subsequently placed in 10% v/v buffered formalin after 2–7 days. With the exception of the eyes, all other tissues (35–45 per case), were fixed in 10% v/v buffered formalin.

All specimens were collected within 30–45 minutes after death. Tissues prone to rapid autolysis such as the eye, endocrine glands, gastro-intestinal organs and liver were collected first.

Parasites and tissues for parasitological examination were collected as follows:

1. Gastro-intestinal (GI)—Examples of all macroscopically visible metazoan parasites were collected and killed in warm 5% buffered formalin, labelled according to the organ of origin and preserved in 70% v/v ethanol to which enough glycerine was added to make a final dilution of 3% v/v of this fluid. Submacroscopic parasites were collected by using mucosal scrapings from the duodenum, ileum, caecum and colon and these were fixed in 10% buffered formalin. Five g of faeces were collected from the rectum of each animal and were fixed in 10% buffered formalin. The results of the examination for parasites are shown in Table 4.

2. Helminths from sites outside the GI tract (mainly from skeletal muscle, fascia and subcutaneous tissues) and several tape worm cysts were fixed *in situ* in 10% buffered formalin. Other cysts were opened and the contents handled in the same manner as the macroscopically visible GI parasites. Muscle and filarids were treated in the latter manner.

3. Respiratory system mites—Mites from the upper respiratory tract and lungs were collected and preserved in the above ethanol-glycerine mixture and labelled as to origin. Additional specimens of lung mites were collected at a later date from formalin-fixed lung tissue.

The materials from categories 1 and 2 were forwarded to the Parasitology Department, Southwest Foundation for Education and Research, San Antonio, Texas, USA, where they were handled as follows. The presence of parasitic protozoa, commensals and helminths, based on the presence of eggs, was determined by a study of faecal material from the upper sediments in undisturbed vials by a direct technique. Half of the remaining faecal sample was subjected to the formalin-ether concentration technique (Ritchie, 1948). Samples were studied both with and without iodine stain.

Helminths were processed by standard techniques to allow for identification. Cestodes were stained in Erhlich's haematoxylin and nematodes were cleared in a phenol or lactophenol solution.

The pulmonary and nasal mites were sent to the Parasitology Department, South African Institute for Medical Research, Johannesburg, for identification.

Specimens for selected virological examination were obtained from Group I (B1–B20) and Group III (B41–B60). Group I samples were from blood, pharyngeal and rectal swabs and submandibular salivary gland. Group III samples included the above plus specimens of heart, lung, spleen, liver, kidney, urine, small and large intestine and brain. Miscellaneous material from selected cases of the other three groups was obtained when warranted by an unusual post-mortem finding or for a specific study. These specimens were subsequently returned to the Polio Research Institute, Johannesburg (Group I) or the Virology Section, Onderstepoort (Group III and miscellaneous). The results of this latter study will be presented in a separate paper.

Selected samples for bacteriological investigation were collected from all baboons. The primary objective was to determine a carrier state of Gram-negative enteric bacteria of possible zoonotic potential. The results of this study were published separately (De Vos, Van Niekerk & McConnell, 1973).

Tissues for histopathological examination were returned to the Pathology Section, Onderstepoort, where they were trimmed, embedded in paraffin wax, sectioned at 4–6 μm and stained with haematoxylin and eosin (HE). Other specialstains were employed as necessary.

TABLE 4 Prevalence of intestinal parasites and commensals

Parasite or commensal	Normal location	Number of positives		
		Necropsy	Histopath.	Faeces(1)
Nematodes				
Streptopharagus armatus	Stomach and small intestine	57/100	ND	25/99
Abbreviata caucasica	Stomach and small intestine	21/100	ND	10/99
Trichostrongylus colubriformis	Small intestine	24/100	21/100	19/19
Strongyloides spp	Small intestine	4/100		4/99
Strongyle eggs (2)	Small intestine	ND	ND	78/99
Ternidens deminutus	Small intestine	3/100	ND	(2)
Oesophagostomum bifurcum	Large intestine	82/100	ND	(2)
Cestodes				
Bertiella studeri	Small intestine	26/100	ND	12/99
Trematodes				
Schistosoma mattheei	Small and large intestine	6/100	ND	1/99
Protozoa				
Isospora papionis	Small intestine	ND	3/100	0/99
Entamoeba spp. (3)	Large intestine	ND	ND	18/99
Entamoeba coli	Large intestine	ND	ND	12/99
Iodamoeba spp	Large intestine	ND	ND	8/99
Balantidium spp	Large intestine	ND	47/100	52/99

(1) Faecal samples determined by sedimentation and concentration
(2) Include developing eggs and eggs containing larvae which were of overlapping size, e.g. *Ternidens*, *Oesophagostomum*, hookworms, etc.
(3) Various types of amoeba of uncertain identity
ND—Not determined during this phase

Results and Discussion

External lesions

Lesions readily observed on examination prior to the post-mortem examination were rare. Those present were usually attributable to minor trauma experienced during capture and during recovery from anaesthesia or were self-inflicted while in captivity prior to post-mortem examination. The commonest lesions were bruises and contusions of the skin over bony prominences, especially of the forehead. These were sometimes caused by falls against the cage bars during recovery from the anaesthetic. They were mainly the result, however, of efforts to escape and of thrashing movements in the cages. There was a definite behaviour difference in regard to age and sex in this respect. It appeared that the mature females and young adult males were more excitable after capture than the juveniles (both sexes) and older dominant males. The females and less-dominant males would thrash about the cage for long periods and were always apprehensive, while the large (older) males seemed to accept the situation more readily. The latter would often sit in a corner eyeing discriminately every part of the cage, periodically moving to a suspected weak spot in an attempt to escape. In other words, the old males seemed much better adapted to stress than other members of the troop. This is understandable when one considers that these old males, in their role as defenders of a troop, are more often exposed to, and therefore more used to, stressful situations.

Scars in the skin were frequently observed, especially in older individuals, usually on the face, forearms, legs and shoulders. These probably resulted either from fights with other members of the group or were caused by thorns or other similar environmental hazards (see *Skin*). Marais (1971), in his classic studies of the chacma baboon in northern Transvaal, stated that intratroop conflict was common, although serious injury from these fights was rare. In a recent behavioural study in various areas including the KNP, Saayman (1971) also described a great deal of intratroop aggression, especially among adult males, which sometimes resulted in severe wounds.

There was one case (B62) of a severe ulcerative cheilitis of the upper lip, which had been eroded to the external nares (Fig. 4). Microscopically, this consisted of a purulent ulcerative lesion extending a short distance into the subcutis. Special stains (bacterial) showed this lesion to contain a mixture of numerous bacteria, both Gram-positive and Gram-negative rods and Gram-positive cocci. It bore some resemblance to a Buruli ulcer (Connor & Lunn 1966), but no acid-fast organisms could be demonstrated.

Other external lesions are described under *Skin* and *Bone*.

Skin

One hundred were examined macroscopically and microscopically. Diseases *per se* of the skin were rare. In two cases (B12 and B93) adult "bont" ticks (*Amblyomma hebraeum*) were found macroscopically; one had a single tick in the ear canal and the second had three in the folds of the anus. The lack of ticks is logical when one considers how much time baboons spend grooming one another. Kummer & Kurt (1965) have shown that free-living Hamadryas baboons (*Papio hamadryas*) spend an average of 11,0 to 28,1% of their waking time grooming and another 5,8 to 29,2% being groomed. Thus, even a very small insect would be observed, removed and probably eaten during these procedures. This was confirmed by Kuntz & Myers (1967) and Kuntz, Myers & Moore (in press), who also found a low level of tick infestation in their series of baboons from Kenya. They recorded *Amblyomma* sp., *Ixodes rasus, Rhipicephalus appendiculatus* and *R. pulchellus*. *A. hebraeum* has been recorded previously from chacma baboons by Hoogstraal & Theiler (1959).

The skin of the hands and feet was removed from several animals and all had many small remnants of thorns buried in the subcutis. These were commonest on the volar and planter surfaces. Microscopically they appeared as typical foreign-body granulomas with multinucleated giant cells and other macrophages surrounding the article, along with abundant eosinophiles and moderate fibroplasia (Fig. 5 and 6). Even though the hands and feet of baboons have a very thick keratinized covering, there are numerous opportunities for penetration and embedding of various plant awns or thorns. In fact, the occurrence was so frequent that if a foreign-body-type granuloma was observed in the subcutis, this etiology was immediately suspected.

Frank dermatitis was found only in a few old individuals. This was represented by localized alopecia, especially on top of the head, accompanied by mild scaliness and light grey appearance. Microscopically all that was seen was mild hyperkeratosis extending into the adjacent hair follicles, plus some some atrophy of the associated adnexal glands. The exact etiology was not observed; the lack of marked dermal reaction suggests that this may merely be a result of old age, as in other old primates.

In 86 animals examined 66 (76,7%) were parasitized by a filarid (*Tetrapetalonema papionis*) (Chitwood, McConnell, Basson & De Vos, in press). Only the young were not infested. These filarids were usually slightly coiled like snakes and remained attached to the skin when they were removed. They were translucent (female) or transparent (male) hair-like worms of almost the same colour as the subcutaneous connective tissues and therefore difficult to detect (Fig. 7). They were commonest in the subcutis along the midline of the back and were also frequently seen on the legs in the subcutis and in the superficial outer and intermuscular fascia (Fig. 29). In such positions they were readily visible because they contrasted with the subjacent red muscle. Invasion of muscle proper was never observed (Fig. 30).

Microscopically there was little evidence of host reaction to the filarid other than a few eosinophiles and macrophages (Fig. 8 and 9). The parasite was located in the subcutis, never reaching the dermis. Microfilariae were diligently sought in the skin but were never found. The only microfilariae observed were in the mucous glands of the posterior pharynx (Fig. 123 and 124), where they elicited a mild focal mononuclear response with lymphocytes and plasma cells predominating. It is not absolutely certain that these were immature forms of the subcuticular filarid but since it was the only filarid found in this group of baboons they probably were. The finding of these microfilariae was probably fortuitous since this location should be a dead-end for transmission. Most filarids are transmitted by biting or sucking insects and insect vector transfer from this location is inconceivable unless the life cycle of this parasite is remarkably different from that of other filarids. Further work is therefore needed to elucidate this problem.

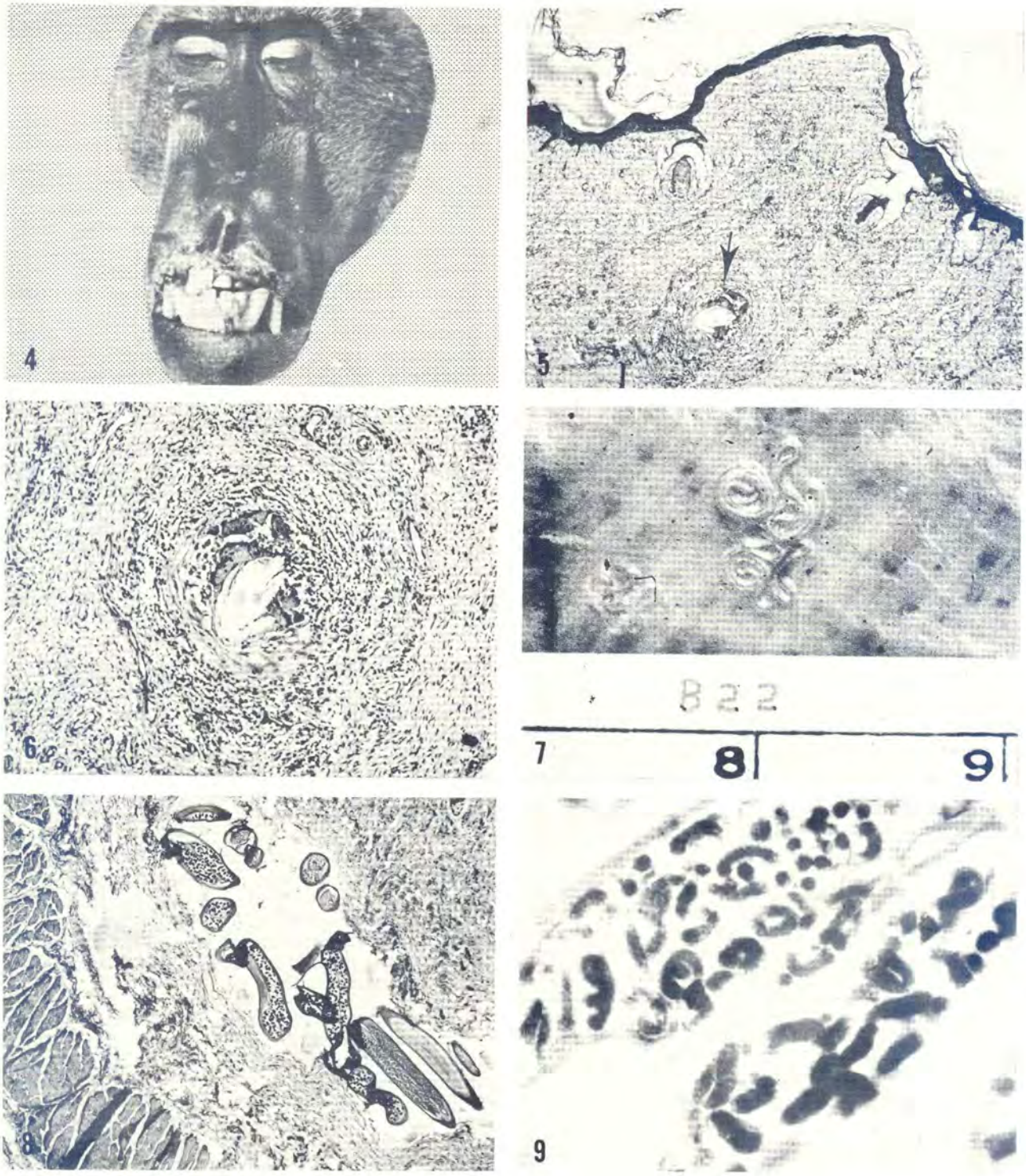


FIG. 4–9
4. B53 showing ulcerative cheilitis of the upper lip
5. Section of foot from B9 showing phytogenous foreign body granuloma (arrow) in dermis. HE×30
6. Higher magnification of above foreign body. Note the multinucleated foreign body giant cells. HE×75
7. Underside of skin from B22 showing subcutaneous location and shape of the filarid, *Tetrapetalonema papionis*. ×2
8. Section of *Tetrapetalonema papionis* in subcutis. Note that there is little reaction to the parasite. HE×30
9. Higher magnification of a portion of the filarid showing gravid uterus containing numerous microfilariae. HE×500

A very unusual parasitic lesion observed in the subcutis of B91 appeared as minute (1,0×0,55×0,5 mm) oval nodules arranged in linear chains of 6 to 10. Microscopically they were fibrous encapsulated nodules of the hypodermis containing a slightly mineralized nematode of undetermined origin.

There was 1 case (B88) of cutaneous neoplasia. It was a circular flat black lesion of the dermis approximately 10 mm in diameter. The cut surface was bluish-black with a dense fibrous texture. Microscopically it was composed of cords of small dark cells resembling those of the stratum basale (Fig. 14 and 15). Interspersed between these cords was a rich fibrovascular stroma with numerous melanocytes. It was classified as a basal cell carcinoma as described by Moulton (1961).

Another baboon (B93) had a fairly large egg-shaped subcutaneous mass (4×2×2 cm) on the side of the face, just anterior to and below the left eye (Fig. 10 and 11). It appeared well circumscribed, was easily removed and did not appear to have altered the subjacent bone. It cut easily and the cut surface had a white glistening appearance. Microscopically it was homogeneous throughout, consisting of small fibrocytes admixed in a matrix of collagen and reticulin fibres (Fig. 12 and 13), typical of a fibroma.

Neoplasms of primates are considered rare, especially among "freeliving" animals (Garner & Brown, 1967; Chapman, 1968). The above 2 examples were both benign and would not have caused any ill effects. An animal with malignant neoplasia would undoubtedly be eliminated quickly by predators and would therefore rarely be observed under natural conditions.

Skeletal muscle

One hundred were examined macroscopically and microscopically. One of the most interesting findings in this study was focal areas of muscle degeneration and necrosis (28 cases). These were scattered through the skeletal musculature, particularly in the flexors and extensors of the forearms, upper arms (*biceps brachii*), shoulder (*supraspinatus, infraspinatus* and *subscapularis*), thigh (*gluteus superficialis, gluteus medius* and *quadriceps femoris*), psoas and sacrococcygeal muscles. They were only rarely found in the back muscles (*longissimus dorsi*) and never in those of the head and neck.

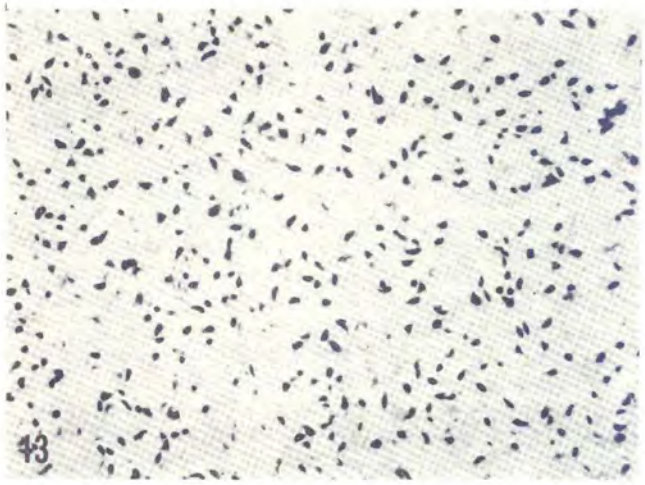
The earliest observable lesions were fairly well delineated slightly pale areas in the muscle with occasional haemorrhages. These were found in animals caught 1–2 days prior to post-mortem examination. In baboons captured 4–5 days prior to necropsy, however, the lesions were more pronounced, characteristically well-defined white areas. Only portions of a given muscle were affected. (Fig. 16 and 17). The texture was softer than normal, but the adjacent muscle appeared normal in all respects.

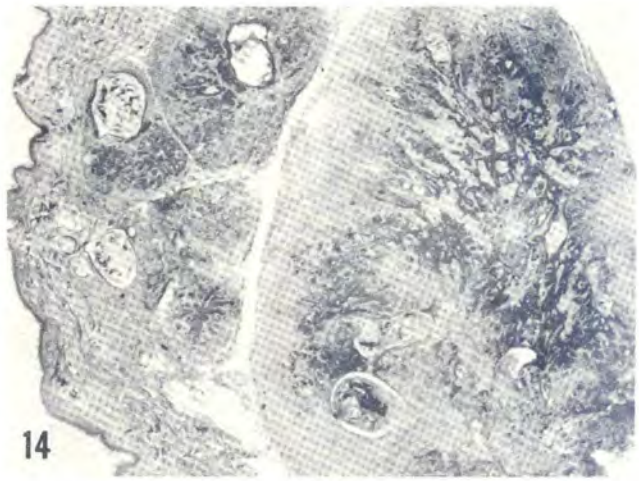
Microscopically, the earliest lesions consisted of focal bundles of swollen muscle fibres showing loss of cross-striation, some rarefaction and pallor. The more severely affected fibres showed fragmentation and lysis. Their nuclei were slightly enlarged but usually not necrotic. Some fibres were still normal (Fig. 18, 19 and 20) and often only one segment of the muscle cell was affected. The lesion of 2–3 days' duration (post-capture) was similar except that there was infiltration of a few neutrophiles, eosinophiles and macrophages along the endomysium and into the necrotic material (Fig. 21, 22 and 23). This was followed by an increase of inflammatory cells with macrophages predominating. There were also many sarcolemmal nuclei arranged in rows parallel to the muscle fibre. Fine granular mineralization was found in some of the necrotic muscles. In other areas it was denser and surrounded by multinucleated giant cells. More advanced lesions observed in this study were of 4–5 days' duration (post-capture). These were well demarcated with an abrupt change to normal tissue (Fig. 24). The lesion was almost completely replaced by macrophages and to a lesser degree sarcolemmal proliferation, except for a few unaltered original muscle fibres (Fig. 25 and 26). Polymorphonuclear leukocytes were less evident at this stage. The original muscle fibres could still be identified in many cases as 2 parallel longitudinal collapsed strings of nuclei (Fig. 27), which often appeared to enclose a cord of macrophages. There was one case where a sarcocyst was caught up in the process and it also showed necrosis (Fig 28). Basophilic areas of regeneration could be found scattered throughout.

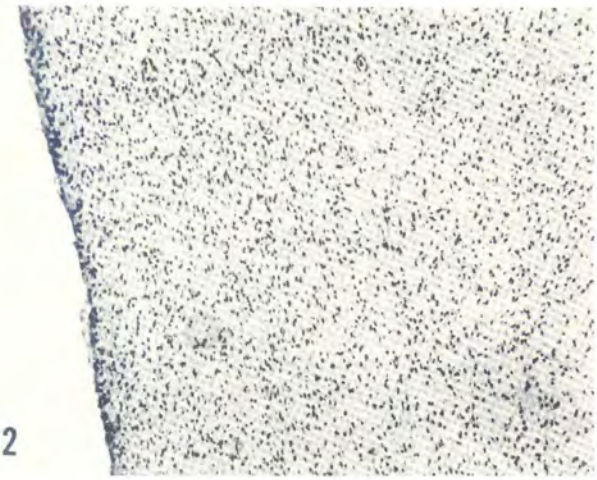
The final resolution of the myopathy was not observed since the oldest lesion was only of 5 days' duration. In the older lesions, however, a few fibroblasts were found along with the regenerative process.

Several questions remain unanswered, not the least being the aetiology of the lesion. It closely resembled the condition in various wild antelopes described as muscular dystrophy and "capture myopathy" or "overstraining disease" (Van Niekerk, 1963; Jarrett, Jennings, Murray & Harthoorn, 1964; Young, 1966; Young, 1967; Ebedes, 1969, and Basson, McCully, Kruger, Van Niekerk, Young, De Vos, Keep & Ebedes, 1971) and compared to "idiopathic paroxysmal myoglobinuria" (Meyer-Betz disease) in a monkey, *Macaca arctoides* (Seibold, Roberts & Wolf, 1971). In the above animals it was related to the stresses of capture, especially long distance chasing, immobilizing drugs or a marked change in environment. Chasing can be eliminated as a cause in this study since the baboons were lured into and caught in baited cages or darted with a fast-acting immobilizing drug. The possibility of its being related to drugs can probably be eliminated too because it was also found in animals which received no drugs until just before euthanasia. A combination of stresses, including capture, fear and a radical change of environment, is the most plausible explanation. It was interesting to note that juvenile baboons were less prone to the stress syndrome. This may be related to the fact that they seemed to accept being caged much better than adults. Some adults were very excitable during the caging period and were constantly pulling at the bars in an attempt to escape. Unfortunately this behaviour was not regularly recorded; there were some indications, however, that the more fearful, restless and excitable baboons were more prone to muscular lesions.

The muscle groups involved (mainly of the limbs) were those of high contractile activity, which suggested that hyper- and prolonged contraction could have caused the lesions. The microscopic changes were suggestive of an intrinsically derived lesion. Its rather focal nature within a given muscle suggested that it may be related to hypoxia, with resultant anaerobic glycolysis and lactic acid build-up as in anaerobic myoglobinuria of horses (Jubb & Kennedy, 1970). This was substantiated by the fact that the most severe example of muscle necrosis occurred in a baboon with myoglobinuric nephrosis. An explanation as to why more cases did not reveal kidney lesions can probably be found in the inadequate mass of muscle involved.







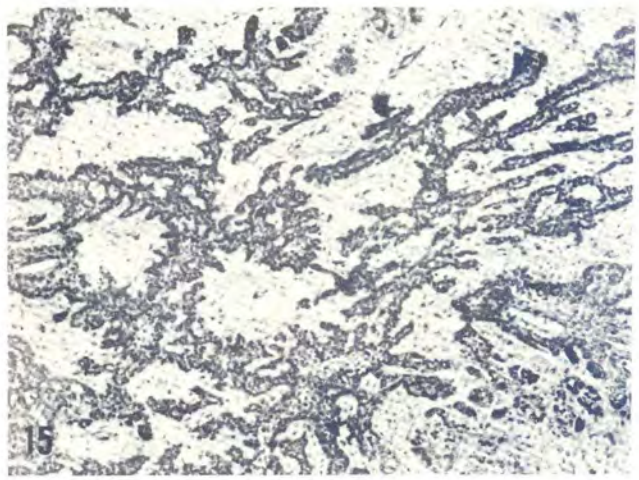
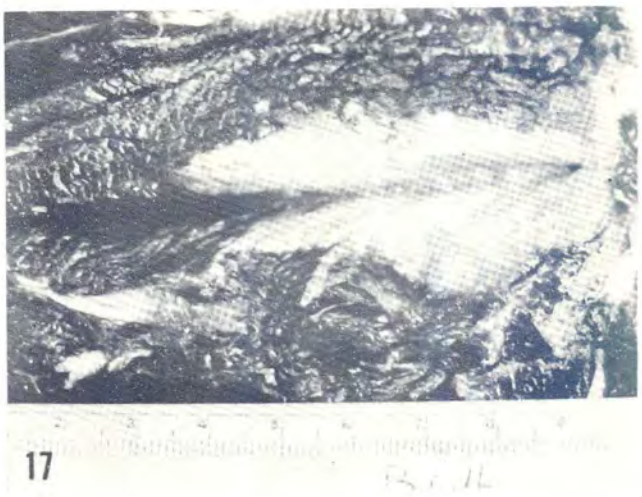
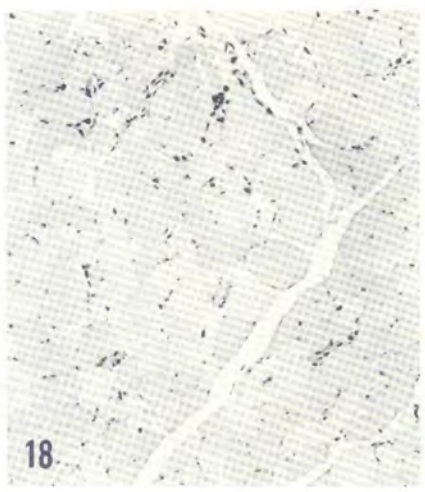
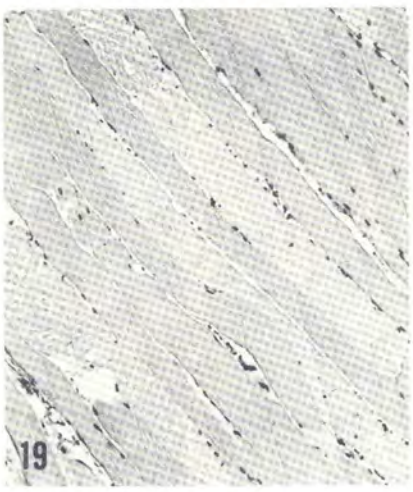
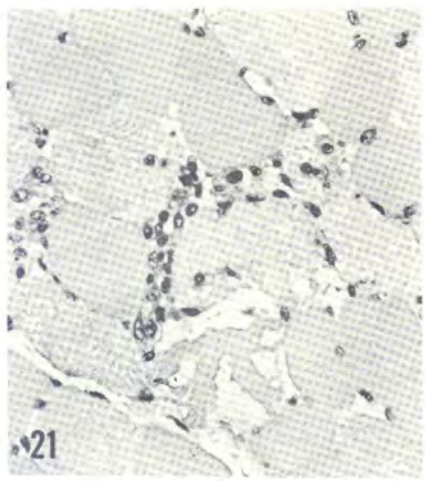


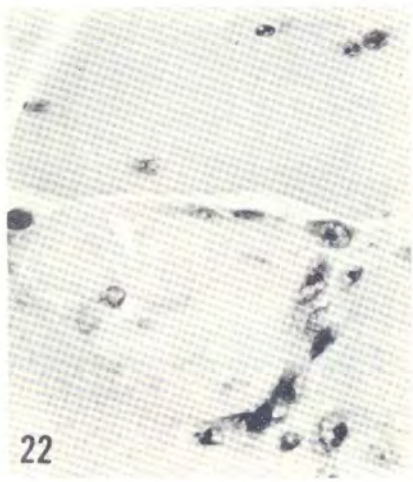
FIG. 10–15. 10. Face of B93 after removal of skin showing a tumour in the preorbital area
11. Closer view of tumour showing white glistening cut surface. ×1,5
12. Section of tumour shown in Fig. 10 and 11. The neoplasm was uniformly composed of loose fibrous connective tissue (fibroma). HE×75
13. Higher magnification showing uniform fibrous nature of the tumour. HE×200
14. Section of skin from B88 showing a well circumscribed basal cell carcinoma in the dermis. HE×12
15. Higher magnification of a portion of the neoplasm showing typical serpentine appearance of epithelial cords. HE×75











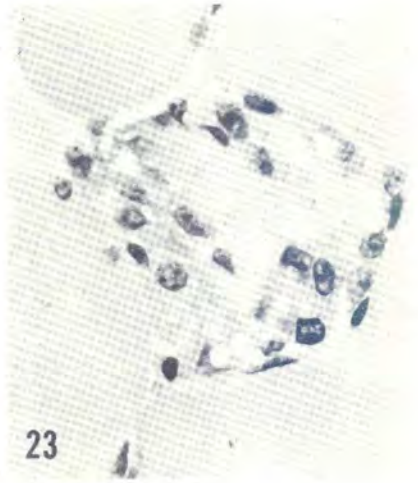


FIG. 16–23. 16. Focal area of muscle necrosis (capture myopathy) within the subscapularis (arrow) of B64
17. Closer view of Fig. 16
18. Cross section of muscle with capture myopathy of 24 to 48 h duration showing normal and pale degenerated fibres (B41). HE × 75
19. Longitudinal section of a similar lesion (B97). HE × 75
20. Higher magnification of Fig. 19 showing normal fibre in middle surrounded by necrotic ones on both sides. Note that there is no inflammatory reaction at this stage. HE × 200
21. Cross section of necrotic muscle of 2 to 3 days post-capture showing early infiltration of inflammatory cells. Unaffected fibres are identified by cross striations. HE × 200
22. Higher magnification showing peripheral location of inflammatory cells. HE × 500
23. Slightly more advanced lesion than Fig. 22. Macrophages are invading the necrotic tissue. HE × 500

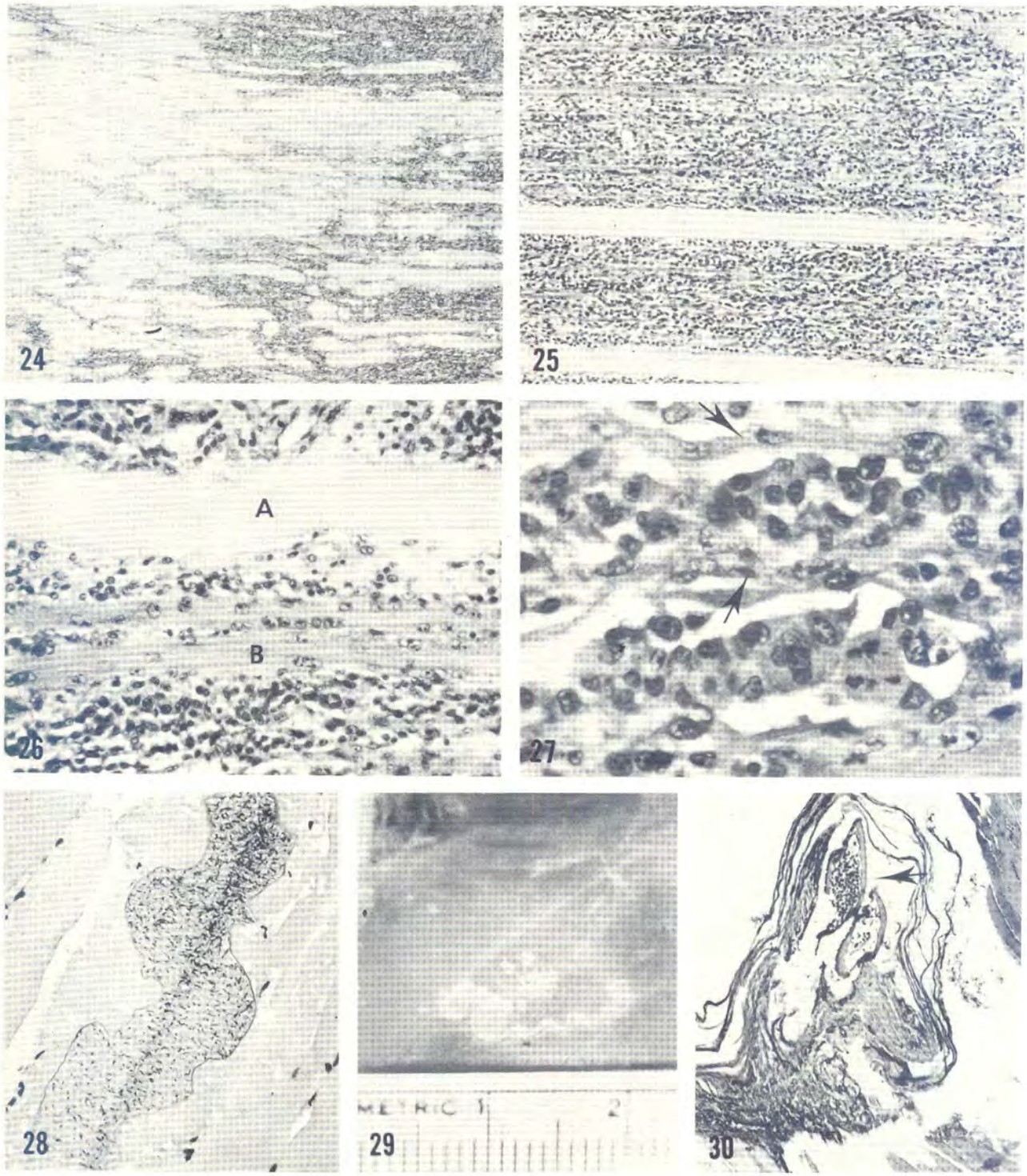


FIG. 24–30. 24. Edge of lesion of 4 to 5 days' duration. Note abrupt change from normal (left) to abnormal (B87). HE × 30
25. Necrotic tissue is replaced by inflammatory tissue except for a few unaffected fibres. HE × 75
26. Higher magnification showing normal fibre (A), regenerating fibres (B) and macrophages and inflammatory cells. HE × 200
27. Section showing two rows of sarcolemmal nuclei (arrows) surrounding a cord of macrophages. Note the mitotic figure at lower right corner. HE × 500
28. Section of affected fibre containing a necrotic sarcocyst (B94). HE × 200
29. *Tetrapetalonema papionis* in muscle fascia (B16)
30. Section of muscle containing *Tetrapetalonema papionis* (arrow) which is surrounded by a thin fibrous capsule (B88) HE × 30

The heart was also involved, since 8 animals (28,6%) had focal areas of necrosis in the myocardium (see *Heart*). This lesion was found only in baboons showing "capture myopathy". Another lesion that appeared to be related to the syndrome was haemorrhage and/or atrophy of the adrenal cortex, found in 10 of the 28 cases (35,7%). The appearance of intracytoplasmic hyaline globules in the cytoplasm of cells in the cortex (zona fasciculata) and medulla was noted in 5 cases. These may also have been related to the muscle lesions.

Further studies are required to determine the exact pathogenesis of this syndrome. Should capture myopathy be related to idiopathic paroxysmal myoglobinuria (Meyer-Betz disease) of man, then the free-ranging baboon would be an excellent model for study of the disease since it occurs with a rather high predictability.

Helminth parasites in the muscles were rather common findings. As described previously (see *Skin*), a high percentage of animals had a *Tetrapetalonema* sp. in the subcutis. These filarids were also found frequently in the intermuscular fascia, especially of the legs (Fig. 29), where they caused little host response (Fig. 30).

Cysticerci of *Taenia crocutae* were found in 6 mature baboons (3 males and 3 females), 5 of them from the Pretoriuskop area and the 6th from Shingwidzi (over 200 km away). The cysts were oval and uniform in size (10 × 5 × 5 mm) with an enclosed single white scolex (Fig. 31 and 32). They were usually found in the leg muscles, both deep within and on the surface. From 1–6 were recorded per individual, but some could have been missed. Microscopically, they caused little or no reaction, being merely space-occupying lesions (Fig. 33). There was a delicate fibrous capsule and a very few mononuclear inflammatory cells within or near each.

The definitive hosts of *T. crocutae* are the spotted hyaena (*Crocuta crocuta*) and the brown hyaena (*Hyaena brunnea*), both of which are found in KNP. Similar cysticerci have been found in various species of antelopes, many of which occur in KNP (Verster, 1969). It is doubtful whether the baboon plays a very important role in the life-cycle of this cestode. It seems more likely that antelopes are the more important intermediate hosts. To our knowledge, this is the first record of cysticerci of *T. crocutae* in baboons.

Sparganosis was diagnosed in 2 adults (1 male and 1 female) from Pretoriuskop. In both the spargana were contained in cysts found in the gluteal muscles. Each cyst (15–20 mm diameter) contained the long (150–200 mm) white ribbon-like sparganum larva (Fig. 34). Microscopic examination revealed a thin but well developed fibrous capsule containing a few lymphoid nodules within its substance (Fig. 35 and 36). The overall effects on the muscle were minor. Sparganosis has been observed once before in the chacma baboon (Schwartz, 1928) and in other species of baboons, *Papio hamadryas* (Myers & Kuntz, 1965), *Papio anubis neumanni* (Kuntz & Myers, 1970) and *Papio cynocephalus* (Kuntz *et al.*, in press).

Sarcosporidiosis was found in 47 baboons. After the first 20 animals had been examined an attempt was made to determine whether the parasite had a predilection site. Beside the tongue and heart, portions of *longissimus dorsi, masseter, quadriceps femoris, triceps brachii* and diaphragm were obtained from the last 80 animals. The incidence in these varied as to the specific skeletal muscle affected with a total of 22 positive cases, 16 for the tongue, and 3 for the heart; this represented, however, a total of 36 different animals, i.e. sections from several muscles were needed to determine the true incidence. It was evident, therefore, that neither the tongue nor the myocardium was of much value in determining the level of sarcosporidiosis. Kim *et al.* (1968) found an incidence of 31,3% in baboons from East Africa.

Some of the Sarcosporidia in the baboons were unlike the others in that macroscopically they appeared as fine white threads apparently running the entire length of the affected muscle (Fig. 37 and 38). It was not uncommon to find some over 10 cm in length. Microscopically, apart from their length, these parasites were similar to those found in other animals (Fig. 39 and 40). However, the possibility that they belong to a different species should be considered because they are so much longer.

The recent studies by Rommel, Heydorn & Gruber (1972), Heydorn & Rommel (1972) and Rommel & Heydorn (1972) have shown that *Sarcocystis* of sheep is probably a coccidian parasite with an interspecific life-cycle similar to *Toxoplasma gondii*.

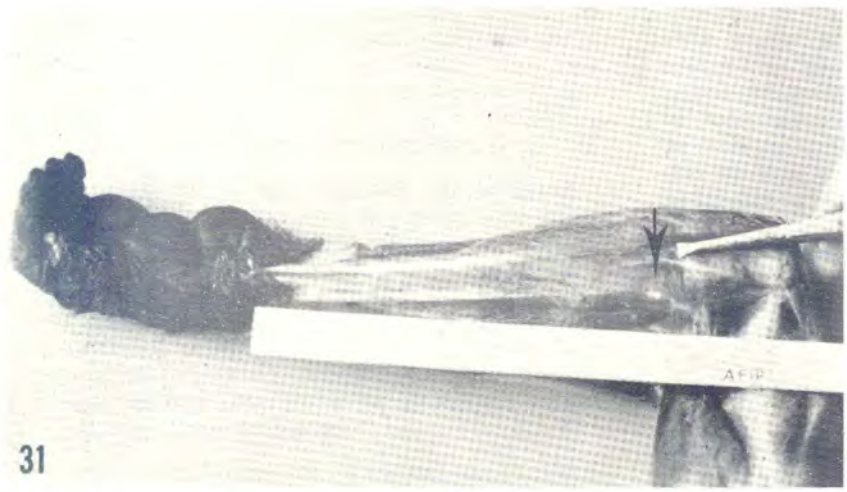
Oocysts of *Isospora papionis* were found in the skeletal muscle of 3 adult males (B1, B39 and B42) (McConnell, Basson, Thomas & de Vos, 1972). The affected muscles were the *longissimus dorsi* and *quadriceps* in B1 and B42 and the *masseter* in B39. They appeared as various developmental stages of sporulating oocysts and were restricted to the endomesial and perimesial connective tissues (Fig. 41). They usually stimulated a mild mononuclear inflammatory response with plasma cells predominating. The sarcolemma was intact and not demonstrably affected by the oocysts or inflammatory response. For a discussion of this coccidium see *Small Intestine*.

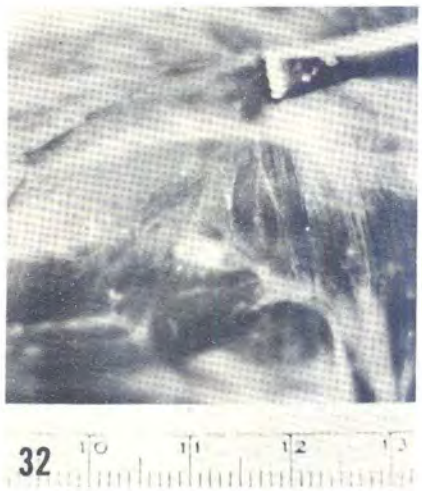
Toxoplasma sp. cysts were found in the skeletal muscles in B57 There was no inflammatory response in the area of the cyst. A discussion of toxoplasmosis is presented under *Heart*.

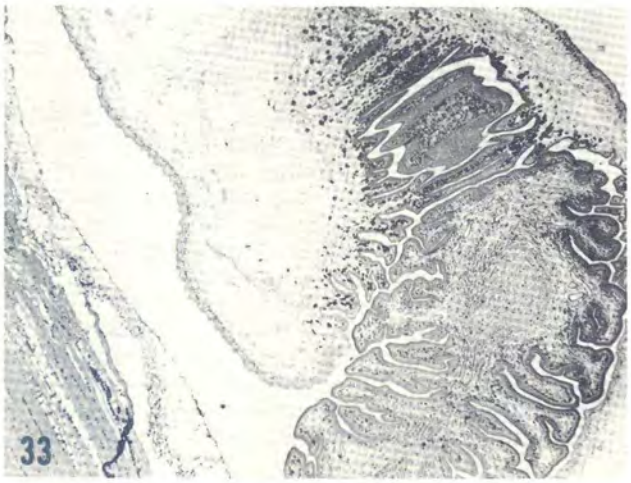
Bones and Joints

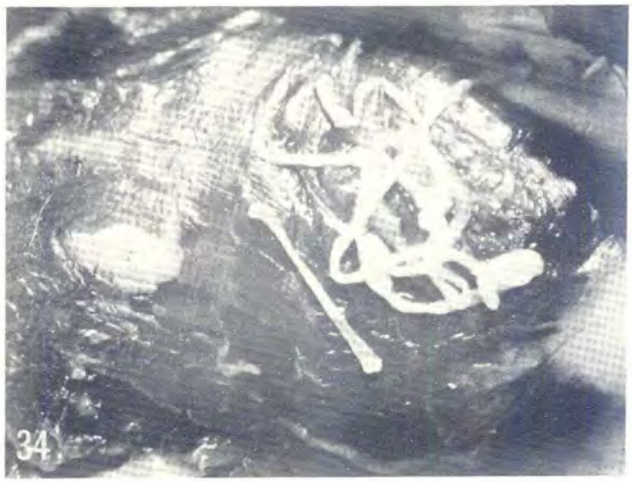
One hundred were examined macroscopically and microscopically. There were only 4 baboons with bone or joint lesions. One adult female (B58), had a lesion in the left elbow joint consisting of flattened, widened medial and lateral condyles of the humerus. The opposing surfaces of the radius and ulna showed similar changes and both joint surfaces were eburnated. There was considerable lateral movement, probably due to damage to the lateral ligaments.

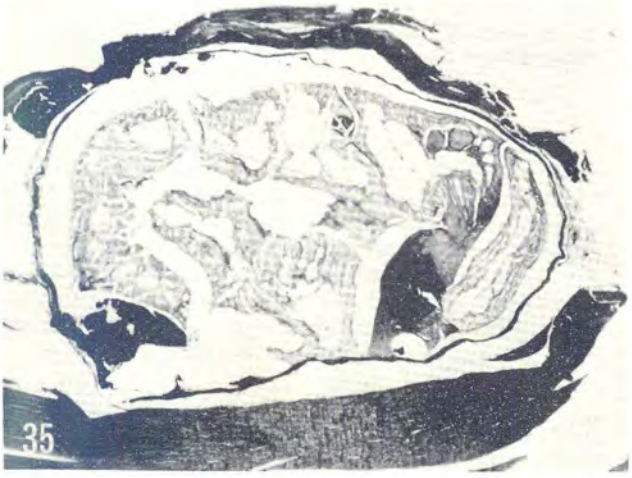
The other bone lesion (B88) was an old healed fracture of the right femur. The affected bone was approximately 5 cm shorter than the opposite femur. This had resulted in a shortening of the entire leg and thigh muscles with about a 30° flexion of the knee joint, which could not be extended until the thigh muscles were severed. The femur itself showed a diagonal fracture just proximal to the midshaft. The 2 ends over-rode each other about 3 cm, with a large bony callus surrounding the area. Bramblett (1967) found bone fractures in virtually all old individuals in his study of the East African baboon (*P. cynocephalus*). Many of these involved the bones of the digits and, since these were not examined in detail in the present study, this may explain the discrepancy in findings.











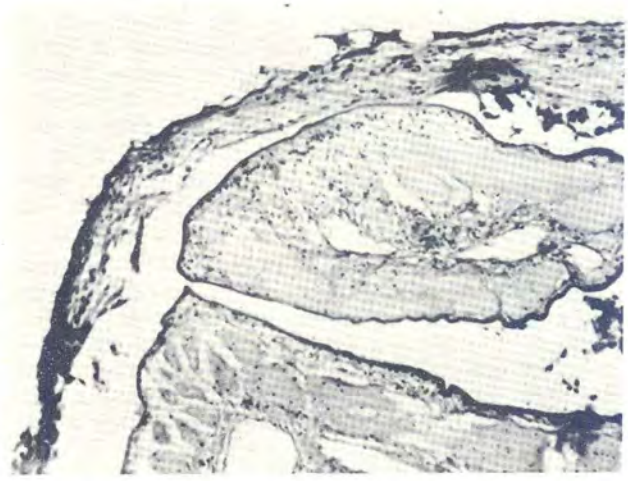


FIG. 31–36. 31. Forearm of B66 showing a cysticercus of *Taenia crocutae* (arrow)
32. Closer view of above
33. Section showing the scolex within the cyst. Note there is little reaction in the adjacent muscle. HE × 30
34. Sparganosis in the gluteal muscles of B69. Unopened cyst on left. A single long tape worm was removed from cyst on the right
35. Section of a sparganum cyst showing larva cut through several points. HE × 12
36. Higher magnification of Fig. 35 showing thin fibrous capsule surrounding the parasite. HE × 75

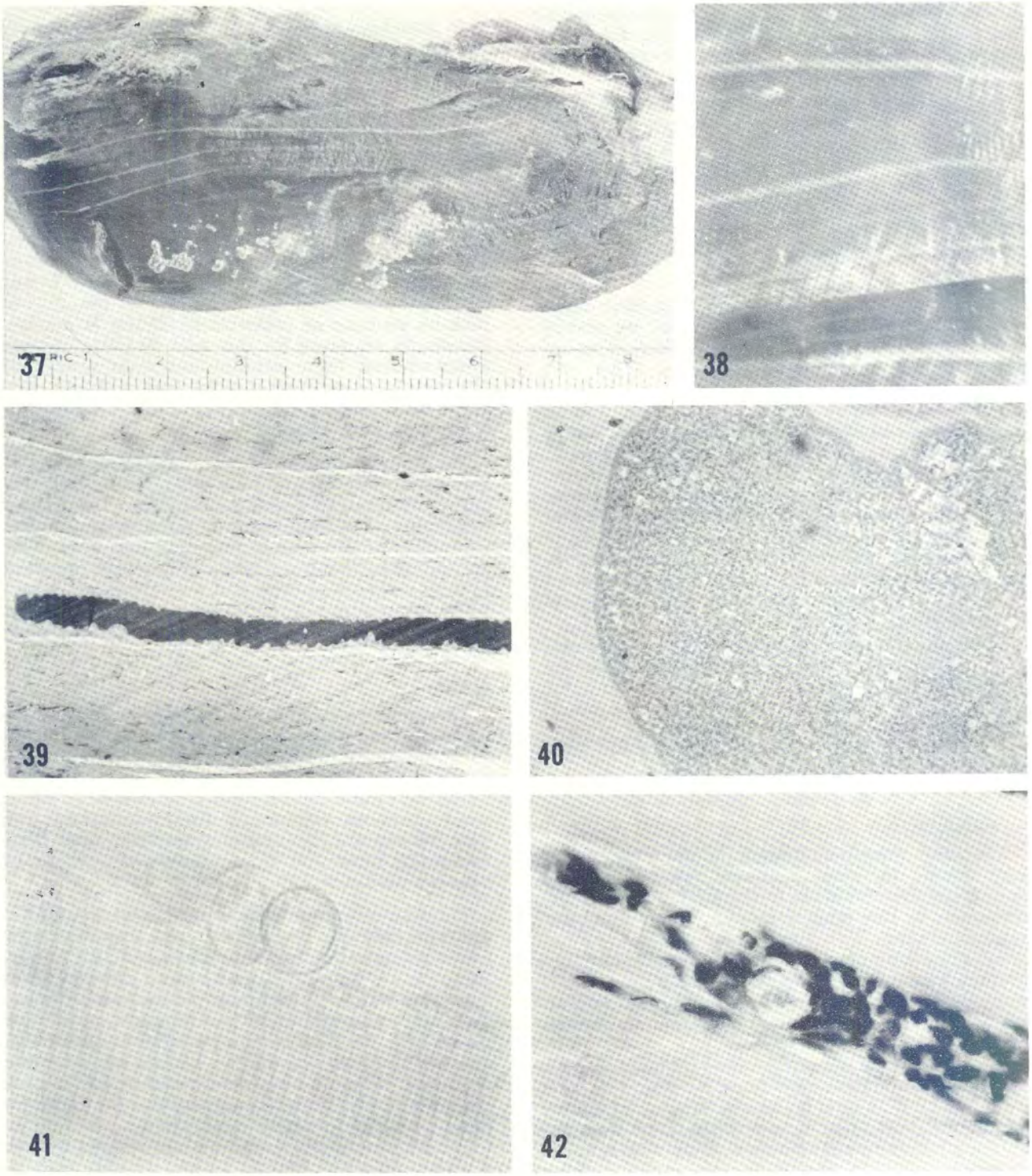


FIG. 37–42. 37. Thigh muscle of B93 showing extremely long sarcocystis which appear as white threads
38. Closer view of above. ×3
39. Longitudinal section of B93 showing exceptionally long length. HE×30
40. Cross section of same case showing typical morphology of a sarcocystis. HE×750
41. Thin portion of unstained muscle with a sporulated oocyst of *Isospora papionis* at edge of fibre. Note that the sarcolemma appears intact. ×1 200
42. Section of muscle showing another sporulated oocyst of *I. papionis* within an inflammatory infiltrate. HE×500

Another lesion was in an older adult male (B72). His right knee joint was enlarged, mainly due to an oedematous swelling of the peri-articular connective tissues. About 5 ml of yellow gelatinous material was found within the joint cavity. There was no concurrent bone lesion. This was interpreted as being the result of a recent bruise.

In 1 animal a portion of rib was missing, being replaced by a fibrous scar with a flattened bullet of unknown caliber lying free in the scar tissue. The lung adjacent to the lesion was adhered to the thoracic wall. Apparently the bullet shattered the rib which was then resorbed. This baboon was from the Pretoriuskop camp area, only a few km from the border of the KNP.

Blood

Smears from 100 baboons were examined. These were examined independently by 2 of us, special emphasis being placed on the presence of blood parasites and erythrocyte dyscrasias. The only abnormality observed was rare erythrocytic stages of *Hepatocystis simiae* in 3 cases (B62 to B64). Specific identification was based on hepatic lesions (see *Liver*). The parasitized erythrocytes were slightly enlarged, had a uniformly blue stippled appearance and contained a small (1–2μm diameter) red ring-shaped body within a clear vacuole (Fig. 85). They resembled gametocytes as shown by Garnham (1966). Two of the infected animals also showed polychromatophilia and anisocytosis. Kuntz *et al.* (in press) have shown *H. kochi* to be quite common in some batches of *P. cynocephalus* captured in Kenya.

No attempt was made to evaluate the haemoglobin, total erythrocytes and leukocytes or leukocyte differential counts.

Bone marrow

A portion of rib or sternum was examined from all cases. No abnormalities were observed.

Respiratory system

Nasal cavity

The most prominent lesions in the nasal cavity were caused by nasal acariasis. Affected animals came from different areas of the KNP, as far as 300 km apart, so this is apparently a fairly widespread parasitic disease. Two species of mites were found: *Rhinophaga elongata* is a recently described species (Coffee, Van Aswegen, McConnell & Basson, 1971) and this is the first time that *Rhinophaga papionis* has been observed in the chacma baboon. Six animals were infected with both species.

R. elongata were found in 17 of 84 animals (20,3%), comprising 12 males and 5 females varying in mass from 3,4 to 37,3 kg (Fig. 43 and 44). An interesting feature was that 11 of these animals came from the Pretoriuskop area, out of a total of only 16 baboons collected, i.e. the animals in this group had an incidence of 68,7% compared with 8,8% for those in the rest of the KNP.

The lesions caused by both mites have been described in detail (McConnell, Basson & De Vos, 1971). *R. elongata,* which is an unusually long mite, produced a focal inflammatory lesion at its point of attachment (Fig. 45). There was hyperplasia of the mucosa, mixed inflammatory infiltrate, cystic changes of mucosa glands, penetration of the subjacent bone (Fig. 46) and, in 2 cases, evidence of secondary mycotic infection. The lesions occurred at various sites in the nasal fossae, from the internal nares to as far posterior as the area of the superior conchae. Similar lesions have been described by Kim & Bang (1970) in baboons imported from Kenya into the United States, although the mite was not identified.

R. papionis was unusual in 2 respects: 1st its very restricted environment, and 2nd, the nature of the lesion. The adults of this mite were found exclusively in the maxillary recess (Fig. 47 and 48), although an occasional immature form was observed crawling about the posterior olfactory region. The adults stimulated a polyp-like lesion of the mucosa which in some cases entirely filled the maxillary recess (Fig. 49 and 50). The core of the polyp was composed of myxomatous-vascular tissue admixed with scattered eosinophiles, plasma cells, and lymphocytes (Fig. 51). The overlying epithelium was thickened with areas of squamous metaplasia (Fig. 52). *R. papionis* was consistently observed on the surface of the mucosa with no evidence of penetration. Of the 71 animals specifically examined for this mite 50 (70,4%) were found affected. These included both sexes, young and old animals, from all areas of the park, although only 2 out of 16 animals (12,5%) from the Pretoriuskop camp area were infested.

The finding of mites in the very young suggests that infestation occurs soon after birth, probably during nursing and grooming activities. The relative immobility of adult *R. papionis* and almost complete immobility of *R. elongata* suggested that both mites are spread by immature forms. *R. papionis* appeared to feed only on mucus and/or superficial debris, while microscopically *R. elongata* showed evidence of haemophagia with erythrocytes clearly visible in its digestive tract.

Larynx

The larynx was examined in 37 animals. *Pneumonyssus vocalis,* a new species of mite (Coffee & McConnell, 1971), was found in 12 (32,4%), 8 males and 4 females, mostly adults, with a mass range of 8,2 to 37,3 kg. Again there was a definite troop predilection: 11 out of the 16 baboons obtained in the Pretoriuskop area were infested and the remaining specimen came from Shingwidzi (over 300 km to the north), where 14 baboons were collected.

These mites were located in the lateral and medial ventricles only (Fig. 53 and 54), where they stimulated a mild inflammatory lesion in the mucosa (McConnell, Basson & De Vos, 1972). There was a mild epithelial hyperplasia with infiltration of plasma cells, lymphocytes and eosinophiles in the subjacent connective tissues (Fig. 55). The mites were relatively immobile, attached firmly to the mucosa, but did not penetrate the tissue. When forcibly detached they could move only very slowly; this again suggests that the immature forms probably spread by direct contact, as with the other members of this genus that are thought to have a direct life-cycle (Baker, Evans, Gould, Hull & Keegan, 1956).

Trachea

One hundred were examined macroscopically, 30 microscopically. The only macroscopic lesions were small pinpoint white nodules on the mucosal surface in B50. Microscopically, these consisted of focal aggregations of lymphocytes in the mucosa just under the epithelium. They did not appear to be caused by direct irritation but were rather hyperplasia of pre-existing lymphoid nodules in this area in apparently normal animals.

Several of the older baboons showed fine white streaking of the tracheal rings. Microscopically this was mineralization (not ossification) of the medial portion of the tracheal cartilage (Fig. 56). It was also found in the cartilage surrounding the larger bronchi in many of these animals.

Lungs

One hundred were examined macroscopically and microscopically. There was considerable variation in lung masses; the mean was 0,746% of BM (range =0,449–1,500) (Table 3). In the very young (<3 kg) the lungs were significantly heavier, measuring approximately 30% more than those of the adults (in terms of % BM). The high incidence or pulmonary disease among the baboons in this study probably accounted for the variation in lung masses, those with large areas of consolidation being invariably heavier. Lung mass, therefore, would have very little value in determining live mass.

Two baboons (B41 and B43) had approximately 5 ml of clear straw-coloured fluid in the thoracic cavity. In both there was marked fibrous pleuritis and pulmonary acariasis, which was believed to be the cause (see below).

Acariasis was by far the greatest cause of pulmonary lesions. Forty-three animals had pleuritis of varying severity: in some cases it was so severe as to cause numerous adhesions between the visceral and pleural surfaces (Fig. 57). Often the various lobes were firmly adhered to each other by strands of dense connective tissue. All cases with pleuritis also contained mite lesions, which were thought to cause the pleuritis. Occasionally, there was evidence of direct attachment of a mite nodule to the parietal pleura, which helped to confirm the above observation.

The mite nodules were easily discernible macroscopically. They were usually grey-brown, slightly raised above the surface, and varied from 2–10 mm in diameter (mean about 5 mm) (Fig. 58). Occasionally, the nodules were bright red to brownish-red, resembling areas of haemorrhage. They were more numerous in the diaphragmatic lobes, especially on the costal surface. When incised they had a slightly dense fibrous texture and were fairly well delineated from the surrounding lung. Close observation of individual nodules revealed a small central cavity containing the mite. In the 25 cases in which these were identified specifically, all proved to be *Pneumonyssus mossambicensis*. In the 6 cases where mites were obtained in the trachea and larger bronchi, all were immature forms. These immature mites moved rapidly compared with the sluggish adults removed from the lung lesions.

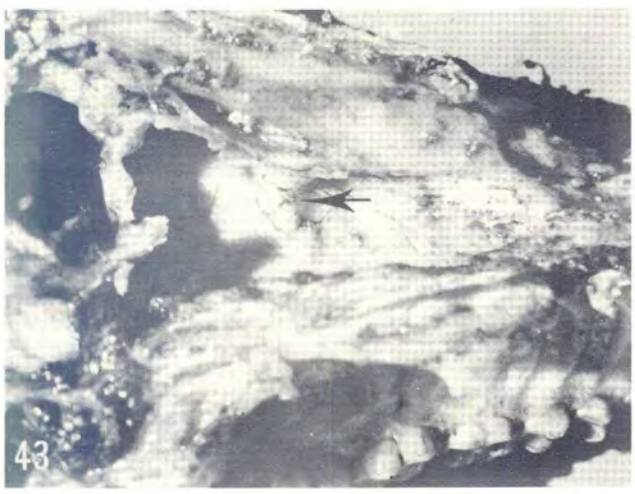
Microscopically, the lung mite lesions were fairly uniform in morphology, varying only in severity. The mite was usually lying in a small cavity or was immediately surrounded by haemorrhagic and cellular debris (Fig. 59 and 60). The digestive tracts of most were filled with erythrocytes, suggesting that blood represented a large part of their diet. The lining (if one existed) of the cavity was composed of flat squamous cells which were hyperplastic in some areas, resembling stratified squamous epithelium (Fig. 60 and 61). Surrounding this there was hyperplasia of smooth muscle (Fig. 62 and 63) and a focal inflammatory reaction of a mixed type, with especially large numbers of eosinophiles. Admixed were many histiocytes containing hemosiderin-like pigment and also a grey anisotropic pigment (Fig. 63). These pigments were found in macrophages in the peri-bronchial lymphoid tissues which were hyperplastic. The pigments were compatible with those described by Innes, Colton, Yevich & Smith (1954) in their studies of *P. simicola* in rhesus monkeys and were therefore also probably breakdown products of blood that had been digested by the mites. Microscopically, these seemed to be more acute lesions with less inflammatory response. The hypertrophic arteritis described by Woodard (1968) as being a part of pulmonary acariasis was also observed in this study but only in those vessels within the lesion itself (Fig. 64).

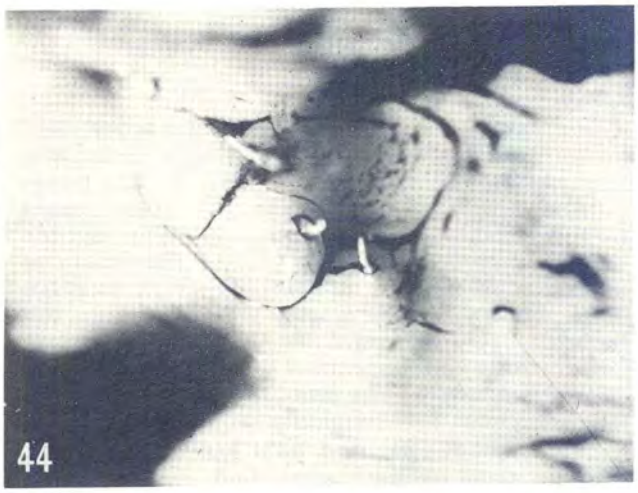
The life-cycle of this particular mite has not been studied but it is thought to be direct, as is postulated for other members of this genus (Baker *et al.*, 1956). The findings in our study support this hypothesis and also suggest that infestation is usually by immature forms (nymphs), since these were the only stages found in the trachea and bronchi and were much more mobile than the adults. Similar observations in monkeys were made by Lapin & Yakovleva (1963). Again, nursing and grooming activities would provide ample opportunity for the spread of this mite. *P. congolensis, P. mossambicensis* and *P. santos-diosi* have been found in baboons from Kenya. Long term studies on *Papio cynocephalus* in captivity have indicated that a lung mite infection may persist for several years after the hosts have been transferred from their natural habitat (Kuntz *et al.*, in press).

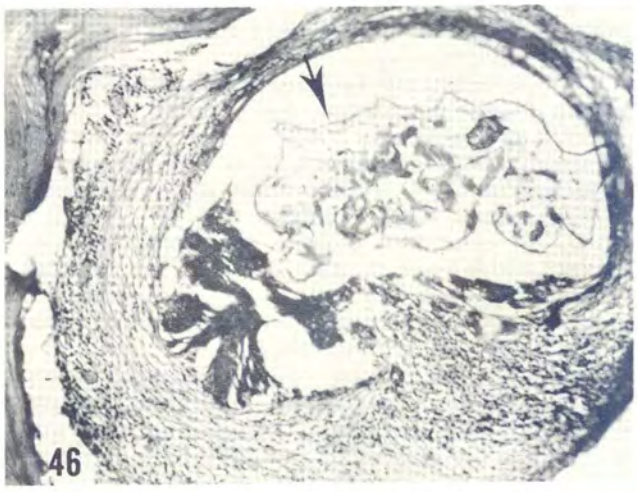
There was macroscopic evidence of lung mite infestation in 56 animals but 60 were found infected upon microscopic examination, i.e. gross examination does not always reveal the disease. It shows that the disease is widespread in baboons of the KNP. Kim *et al.* (1968) also found a high incidence (84,5%) in East African baboons. Routine medical examinations and quarantine procedures would probably be of little use either for recognizing the infestation or eliminating it. This is true for all the respiratory mites, including those of the nasal cavities and larynx.

One interesting finding was a fairly low incidence of lung mites in the baboons from near Pretoriuskop (B65–B80). This suggested that certain troops may have a lower incidence and that when choosing animals for pulmonary studies it might be advantageous to first sample representatives of different troops in the hope of finding a group free or at least relatively free of the disease. Overall, it is felt that baboons from the KNP would have limited value for pulmonary research because of these mites. The only practical way of having a colony of baboons free from lung mites appears to be by building up a closed colony composed of surgically derived foetuses, as has been done with rhesus monkeys (Knezevich & McNulty, 1970).

Two baboons (B15 & B39) had large brown-grey consolidated nodules (3–5 cm diameter) in the lung that microscopically looked like mite lesions but were larger and more purulent. Eosinophiles were still prevalent throughout. This suggested that the small mite lesions may be prone to secondary bacterial infection and rarely may be, at least indirectly, the cause of death. This is supported by other investigations in which death of other non-human primates has been ascribed to these parasites (Hamerton, 1938; Grzimek, 1951; Frank, 1962).







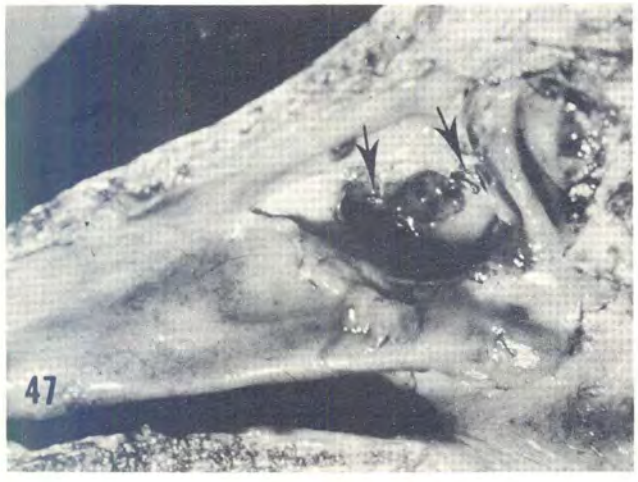


FIG. 43–48. 43. Nasal fossa of B53 showing nodules (arrow) caused by *Rhinophaga elongata*
44. Closer view showing the long mites projecting from the nodules. ×2
45. Section through a nodule showing mite penetrating the mucosa. HE×30
46. Cross section of mite (arrow) within cancellous bone. HE×75
47. View of maxillary recess which contains two mites (*Rhinophaga papionis*) (arrows)
48. Closer view of recess which contains three adults and one larva (arrow). ×6

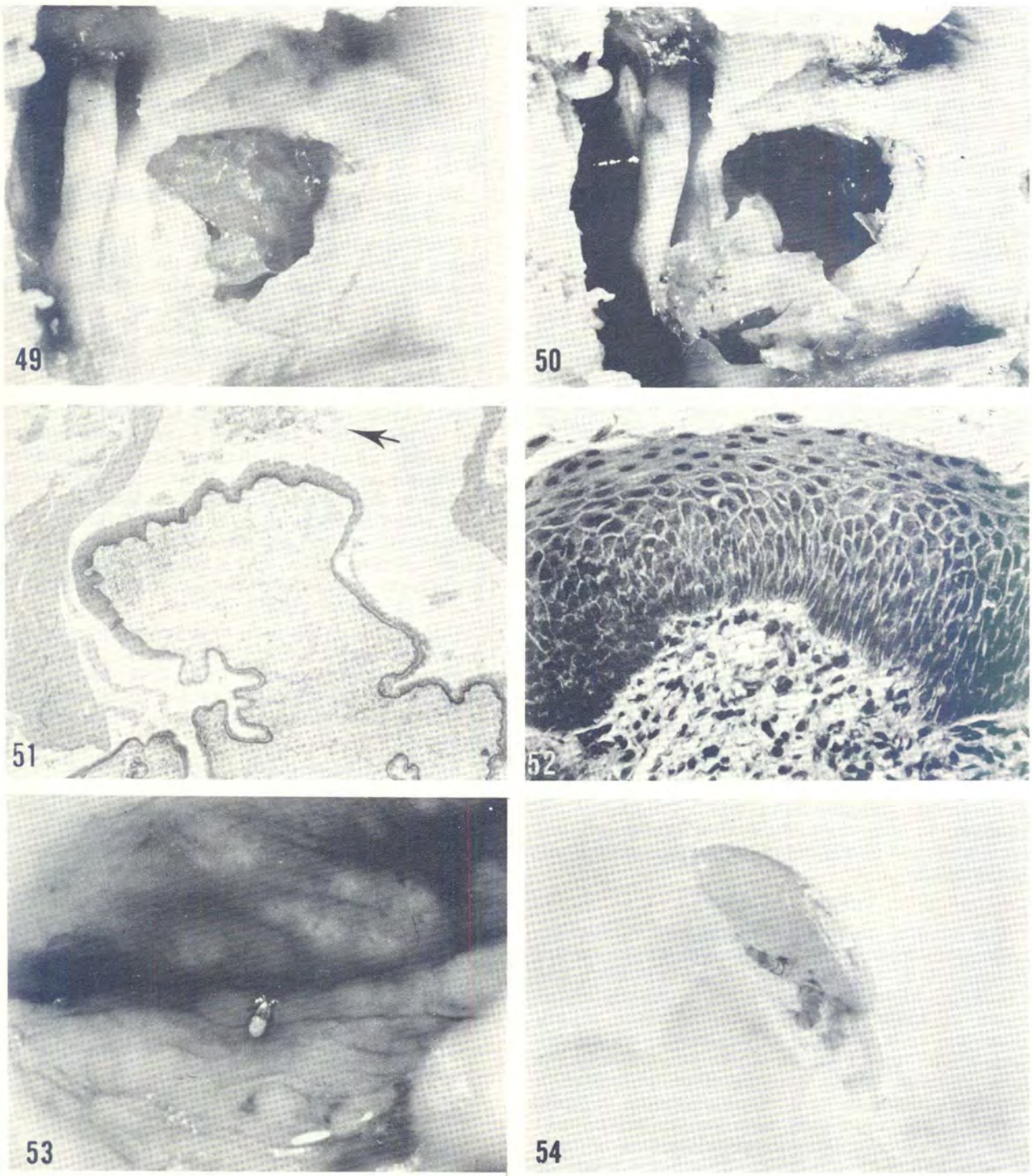


FIG. 49–54. 49. Maxillary recess which is filled by myxomatous polyp. ×2
50. Same as Fig. 49 except that polyp has been everted out of the recess toward the lower left corner. ×2
51. Section through polyp with *Rhinophaga papionis* on surface (arrow). HE×30
52. Epithelial surface of polyp showing stratified squamous metaplasia. HE×350
53. An example of *Pneumonyssus vocalis* near the base of a lateral laryngeal ventricle. ×3
54. Closer view of *P. vocalis* on mucosal surface. ×25

Focal areas of haemorrhage were observed in 24 animals. They were usually peracute, with blood filling poorly circumscribed areas of the lung parenchyma. They were commoner in the ventral and anterior portions of the apical lobes. From their appearance and location they were in most cases presumed to be the result of inhalation at the time of death. As noted previously, lung mites occurred in a few of the haemorrhagic areas, but these were always accompanied by at least a few inflammatory cells.

Many baboons (65) showed diffuse areas of interstitial thickening of the interalveolar septae by fibrous connective tissue and lymphocytes, plasma cells and a few granulocytes. Since the vast majority of these animals also showed evidence of lung mite infestation, this was thought to be the cause.

Bronchial lymph nodes

One hundred were examined macroscopically and microscopically. The most consistent lesion (75 cases) was caused by the presence of varying amounts of pigment in the medullary macrophages (Fig. 65 and 66). In some cases these macrophages entirely filled the medulla, partially obscuring the normal architecture. This pigment was similar to that found in the lung, with the greyish-black anisotropic type predominating. The amount of pigment appeared to be in direct proportion to the severity of the pulmonary acariasis and it was therefore thought to result from the mite infestation. There were also accumulations of refractile acicular crystals compatible with silicosis. Such accumulations were directly correlated with age, far more being observed in older animals, as would be expected because much of the soil is sandy and there are long periods of drought with large amounts of wind-borne dust. A few of these cases also showed a mild infiltrate of eosinophiles, which were probably related to the pigments mentioned here, especially the mite-derived material.

There was one case (B32) of an unidentified metazoan parasite within the lymphoid tissue, causing a moderate, granulomatous type of inflammatory reaction. In two cases the centres of the germinal centres showed hyalinization similar to that observed in the spleen.

Heart and aorta

One hundred specimens were examined macroscopically and microscopically. The mass of the heart varied from 0,316–0,780% BM with a mean of 0,488% BM (Table 3). Males consistently had a slightly higher figure in heart-% BM but, unlike other organs, there was little variation in this ratio with age. In fact, of the organs measured, the heart showed the least variation and it may therefore be helpful in estimating the mass of a chacma baboon. A figure of 0,4–0,6% organ-body mass for the heart would have resulted in a fairly accurate estimate of body mass in 93% of the baboons. This figure would be less reliable whenever debilitating disease or a severe cardiopathologic condition occurs, and may be invalid in the case of baboons in captivity, which are usually heavier than free-living ones.

A mild hydropericardium (5–15 ml), associated with moderate lymphocytic myocarditis, was found in 6 animals. The fluid was clear and straw-coloured.

Small white nodules (1–2 mm in diameter) were found either subepicardially or deeper in the myocardium of 3 animals and proved to be foci of disseminated mononuclear myocarditis. Similar lesions of very mild to moderate focal disseminated lymphocytic interstitial myocarditis were found microscopically in another 39 baboons (Fig. 67), usually near the endocardial surface. In those cases with moderate involvement, a similar lymphocytic reaction was often noticed in other organs, particularly the liver, kidneys and sometimes the brain. The lack of granulocytes suggested the possibility of a subclinical viral infection. The high incidence of these lesions would discourage the use of these baboons for myocardial studies of an infectious nature. Localized chronic adhesive epicarditis with concurrent lymphocytic myocarditis was found in 1 old male (B36).

Sarcocystis sp. were found in the hearts of 2 animals (see *Skeletal Muscle*).

Cysts containing trophozoites of *T. gondii* were found in the hearts of 4 baboons (B49, B57, B65 and B66). They appeared to be within the myocardial fibres (Fig. 68 and 69) and had not elicited any inflammatory response, despite foci of unassociated lymphocytic myocarditis elsewhere. The cysts were PAS-positive and stained well with Giemsa, but were negative with MacCallum and Goodpasture's stain. Similar cysts were found in the brains of 3 baboons and in the skeletal muscle of 1. The Sabin-Feldman dye test, complement-fixation test and indirect fluorescent antibody test on these sera were positive for all 4. Sera from another 90 animals (total 94) were tested as above and 7 more positives (total 11) were found, but no cysts were observed histopathologically in these cases. For a detailed report on this finding see McConnell, Basson, Wolstenhome, De Vos & Malherbe (1973).

Toxoplasmosis has been observed in baboons only once previously (Levaditi & Schoen, 1933) in a captive animal orginally from East Africa. This finding indicates that baboons are potential carriers of the disease, even when captured from natural habitats.

Another interesting finding was the presence of unusually large myocardial nuclei compared with those of other species of animals. This was especially evident in the papillary muscles and subendocardially in the ventricles (Fig. 70). It was noticed even in the very young animals and hence is considered normal for baboons. In 10 cases, however, these nuclei were exceedingly large and were accompanied by a hydropic change and acute necrosis of the myocardium (Fig. 71). These 10 animals showed lesions of capture myopathy and the change may therefore have been related to this condition (see *Skeletal Muscle*).

Varying amounts of a fine granular brownish pigment compatible with lipofuscin were found in the cytoplasm of the myocardial cells (Fig. 70). These accumulations were in an elongated triangular shape with the base at the pole of the nucleus. Although it was more pronounced in old individuals it was found in all ages, and both sexes of animals.

The coronary arteries showed subintimal arteriosclerotic thickening in 19 of 95 baboons where sections of this artery were available. It was found in 14 males and 5 females, all of which were sexually mature. The lesion consisted of a dense, slightly hyperchromatic, basophilic fibrillar material that accentuated the space between the endothelium and the internal elastic lamina (Fig 72). It appeared to be unevenly distributed and was slightly more evident near branches of the artery. In the more advanced lesions the internal elastic membrane was fragmented and reduplicated. There was no evidence of mineralization or medial change in any case. It varied in severity