DYNAMICS OF BIOLOGICAL NORMS IN MONKEYS

Yu. P. Butnev

From the Sukhumi Medicobiological Station (Director: I. A. Utkin, Candidate Biol. Sci.), AMS USSR

(Received December 24, 1956. Presented by S. E. Severin, Member AMS USSR)

It is desirable, for the solution of certain biological and medical problems, to use monkeys as experimental animals, since their anatomy and physiology are most closely approached to the human. A difficulty encountered in experimental work with such material is that there is a paucity of data concerning the biological norms of different species of monkeys.

It is generally known that many physiological and biochemical indexes vary according to the emotional state of the animal. Because of the extreme lability of nervous processes in monkeys, emotional excitation arising during an experiment may be so intense as to render the data recorded very different from physiological norms [1].

I. A. Utkin and M. I. Kuksova [4] have shown that systematic repetition of the procedure of blood sampling, day after day, under identical conditions, may lead to a marked fall in leucocyte count, as compared with the initial values. These authors consider that the nature of the change in leucocyte count is analogous to the extinction of a conditioned reflex. The fall in the leucocyte count observed after repeated sampling is regarded as being the result of an inhibitory process in the nerve centers responsible for the control of the composition of blood cells. The high leucocyte count observed initially is, in the view of these authors, due to a physiological leucocytosis, evoked by all the stimulating factors associated with the experimental conditions.

The present research was undertaken with the object of ascertaining whether similar effects of those encountered in determining leucocyte count are also found for other biological norms.

EXPERIMENTAL METHODS

The experimental material consisted of adolescent females of the following species: 3 Hamadryad mandrills, 2 Macacus rhesus, 3 marmosets, 1 capuchin, 1 gelada. The animals were taken for experiment twice weekly, before breakfast, on the same days and at the same times, and the manipulations were performed by the same experimenters, in the same order. The minute pulse rate and respiratory rate were measured, as well as the arterial pressure (Korotkov's method); blood samples were taken from the right median vein, and the rectal temperature was taken.

From 10 to 19 examinations were made of each animal. The apes remained in their usual living quarters on the days when they were not being examined.

The blood samples were oxalated (potassium oxalate); sugar was determined in one portion by the Hagedorn-Jensen method, and total cholesterol was determined for 6 apes by M. A. Levchenko's method.

EXPERIMENTAL RESULTS

Repeated blood sampling, under identical conditions, led in all cases to a fall in the blood sugar content (Table 1), and to a definite lowering of the blood cholesterol level (Table 2).

TABLE 1

Changes in Blood Sugar Levels in the Course of Repeated Sampling

Name of ape	Species	No. determin.	Duration observ. period, (days)	Blood sugar in mg %(mean values)	
				first 5 determin.	last 5 determin.
Pion	Mandrill	16	60	93	88
Zher	»	17	60	109	98
Azon	»	19	60	107	87
Artam	Rhesus	17	59	82	73
Slepen	»	18	56	88	83
Beglets	Marmoset	17	63	102	87
Bering	»	17	59	86	83
Erdzhis	»	18	56	107	81
Klaro	Capuchin	10	35	109	93
Kipr	Gelada	10	35	113	108

TABLE 2

Changes in the Blood Cholesterol Level of Apes During the Course of Repeated Sampling

Name of ape	No. determin.	Duration observ. per. (days)	Whole blood cholest., mg %			
			on 1st day	mean of first 5 determin.	on last day	mean of last 5 determin.
Zher	11	38	150	157	102	134
Azon	10	32	146	154	85	133
Artam	11	38	200	189	135	167
Slepen	10	32	207	212	152	201
Bering	11	38	167	173	122	152
Erdzhis	10	32	200	183	92	142

Table 3 presents analogous data for arterial pressure. In 9 cases out of 10 there was a definite tendency towards lowering of pulse pressure, due either to lowering of maximum, or raising of minimum, pressure, or to both factors acting simultaneously. The greatest final changes in pulse pressure were found for the apes Azon, Erdzhis, and Klaro.

In no case did we observe any significant rise in maximum blood pressure over the period of the observations, whereas definite falls in pressure were noted for individual animals. Thus the first readings taken from the mandrill Pion would qualify her for inclusion in the hypertensive group, whereas the last measurements of blood pressure, pulse rate, and respiratory rate fell within the normal range established by G. O. Magakyan [3].

A fall in pulse rate was observed after repeating the procedure under standard conditions in 7 apes.

No upward or downward tendencies were observed for the respiratory rate and the body temperature.

We conclude from our results that many physiological and biochemical indexes measured in the early stages of the observation period reflect the effects of all the stimuli associated with the experimental set-up, which give rise to pronounced orientational and defensive reflexes. The changes found in these indexes as the

TABLE 3

Changes in Blood Pressure of Apes During the Course of Repeated Measurements

Name of ape	No. measurements	Duration observ. per. (days)	Mean values blood pressure					
			of first 5 measure.			of last 5 measure.		
			maxi-mum	mini-mum	pulse	maxi-mum	mini-mum	pulse
Pion	15	56	157	91	66	121	72	49
Zher	11	38	129	62	67	132	64	68
Azon	11	35	162	42	120	159	72	87
Artam	11	39	157	78	79	162	96	66
Slepen	10	32	179	108	71	164	106	58
Beglets	17	63	149	84	65	140	87	53
Bering	11	38	165	93	67	151	100	51
Erdzhis	19	32	226	62	164	201	132	69
Klaro	17	63	156	39	117	156	91	65
Kipr	10	35	172	77	95	160	77	83

measurements were repeated may be ascribed to extinction of the emotional reactions caused by the experimental conditions.

It is possible that the indexes which did not undergo any marked changes during the observation period (body temperature, respiratory rate) are subject to different regulatory mechanisms, in view of their different physiological significance. This question requires further study. The possibility is not excluded that a more prolonged extinction period would have given more pronounced and uniform shifts of the values of all the indexes in all the experimental animals.

Although the experimental animals belonged to various genera and species, and although they were studied in two groups, at different seasons of the year, the systematic repetition of the measurements under standardized conditions gave identical shifts of a number of indexes. Our findings for the changes in leucocyte count a peripheral blood confirm those of L. A. Utkin and M. I. Kuksova [4].

SUMMARY

Various species and genera of monkeys were systematically examined in standard conditions. These repeated investigations were conducted for several weeks in succession. It was found that concentration of sugar and total cholesterin was decreased in the venous blood. These changes should be considered to be the result of decline of emotional shifts which were caused by experimental performance.

LITERATURE CITED

[1] P. B. Bochkarev and O. I. Nikolaeva, Arkh. biol. Nauk SSSR, 33, No. 1-2, 235-236, 1933.

[2] M. A. Levchenko, Lab. Delo, No. 2, 28-30, 1955.

[3] G. O. Magakyan, Proceedings of the Scientific Session on Problems of Hypertension,* pp. 107-111. Tbilisi, 1953.

[4] L. A. Utkin and M. I. Kuksova, Doklady Akad. Nauk SSSR, 108, No. 5, 981-984, 1956.

* In Russian.