TABLE 1. Blood Levels of ACTH, 11-HCS, Adrenalin, Noradrenalin, and Insulin in Animals over 8 Years of Age during Physical Exercise (M ± m)

Time of experiment, min	Arterial blood levels				
	ACTH, microunits/ml (n = 15)	11-HCS, nmoles/liter (n = 12)	Adrenalin, nmoles/liter (n = 7)	Noradrenalin, nmoles/liter (n = 7)	Insulin, microunits/ml (n = 7)
17	27,06±5,02	375,2±9,7	5,18±0,71	9,84±2,95	17,05±2,05
20	24,16±3,08	306,2±7,5	5,25±1,14	5,51±4,33	19,1±2,1
27	42,56±6,44	322,8±9,4	5,13±1,15	13,16±5,59	21,5±4,0
32	33,96±4,72	350,4±7,5	4,54±1,29	8,19±3,57	28,8±4,83*
40	37,13±4,10	375,2±8,3	7,75±1,07	9,18±3,57	27,3±3,04
47	29,23±2,56	353,1±7,7	3,24±0,54	31,46±8,89*	23,8±4,02
52	33,35±3,14	350,4±7,4	4,74±0,80	12,15±8,04	22,8±3,02
60	28,17±5,10	333,8±6,9	7,75±1,09	9,20±3,61	29,8±8,99
70	24,75±4,10	320,0±5,5	7,78±1,09	10,50±6,77	28,8±4,75*

Legend. Here and in Tables 2-4: *P < 0.05 compared with original value (17th minute of experiment); n denotes number of animals. Physical exercise undertaken from 30th to 50th minutes of experiment.

TABLE 2. Blood ACTH and 11-HCS Levels during Physical Exertion after Intra-Arterial Injection of PGE_2 into Intact (I) and Dexamethasone-"Blocked" Animals (II) over 8 Years Old (M ± m)

Time of experiment, min	Arterial blood levels			
	ACTH, microunits/ml		11-HCS, nmoles/liter	
	I (n=15)	II (n=12)	I (n=11)	II (n=12)
17	14,76±0,70	4,24±0,40	236,2±0,3	110,7±7,53
20	26,82±4,44*	5,13±0,44*	187,5±4,2*	92,5±7,50
27	18,12±2,29	6,00±0,45*	264,0±7,8	109,2±14,8
32	20,75±4,30	4,37±0,51	203,4±3,7*	82,7±7,54
40	12,74±1,09	3,63±0,26*	267,0±7,9	66,7±11,70
47	10,71±0,92*	4,46±0,29	274,0±5,2*	62,7±9,0*
52	16,52±3,55	3,97±0,27	270,5±7,8*	62,5±8,7*
60	14,16±2.03	3,18±0,19*	252,4±8,9	95,2±19,2
70	12,24±2,01	3,27±0,17*	258,4±8,4	92,5±15,0

TABLE 3. Blood Adrenalin and Noradrenalin Levels during Physical Exercise after Preliminary Intra-Arterial Injection of PGE_2 into Intact (I) and Dexamethasone-"Blocked" Animals (II) over 8 Years Old (M ± m)

Time of experiment, min	Arterial blood levels				
	adrenalin, nmoles/liter		noradrenalin, nmoles/liter		insulin, micro-units/ml
	I (n=7)	II (n=6)	I (n=7)	II (n=6)	I (n=7)
17	5,01±0,16	4,64±0,26	4,71±0,44	6,07±0,33	30,0±2,42
20	8,08±0,96	5,73±0,15*	0,44±0,26*	8,70±1,13	31,3±2,75
27	7,88±1,14	4,53±0,35	0,19±0,15*	7,33±0,29*	33,0±4,17
32	7,49±0,53	1,44±0,68*	0,34±0,19*	8,73±1,18*	34,3±1,11*
40	6,62±0,38	4,06±0,45	0,96±0,36*	7,07±0,07*	33,0±2,03*
47	6,35±0,14	1,10±0,44*	1,92±0,51*	8,45±0,26*	38,5±3,20*
52	5,94±0,11	7,60±0,76*	2,09±0,43*	10,08±1,92*	40,0±2,72*
60	6,49±0,49	4,90±0,31	2,04±0,53*	6,72±0,15	34,5±1,12
70	6,91±0,34	5,09±0,33	2,01±0,67*	6,44±0,38	37,3±2,90

thalamo-hypophyseo-adrenal system (HHAS) was estimated from the levels of ACTH and 11-HCS in the animals' arterial blood. The control for the series of experiments with injection of PGE_2 consisted of experiments with intra-arterial injection of 10 ml of 0.9% NaCl, which showed that such an injection does not change the dynamics of the test parameters. Physical exercise consisted of running for 20 min on a treadmill at a speed of 3 m/sec. The results were subjected to statistical analysis by Student's test.

EXPERIMENTAL RESULTS

Dynamic loading of dogs over 8 years of age was not accompanied by activation of the adrenocortical, glucocorticoid, or sympathoadrenal systems after the first few minutes (Table 1), evidence of the protective character of the neurohumoral stage of regulation of physiolog-

TABLE 4. Blood Glucose, Serotinin, and MAO Levels during Physical Exercise after Preliminary Intra-Arterial Injection of PGE_2 into Intact (I) and Dexamethasone-"Blocked" Dogs (II) over 8 Years Old (M ± m)

Time of experiment, min	Arterial blood levels					
	glucose, nmoles/liter		serotonin, μmoles/liter		MAO, nmoles/liter·h	
	I ($n=5$)	II ($n=6$)	I ($n=7$)	II ($n=6$)	I ($n=8$)	II ($n=8$)
17	3,83±0,28	3,17±0,3	1,59±0,39	1,42±0,3	541,9±10,6	632,8±8,0
20	4,27±0,4	3,26±0,2	3,12±0,7*	1,04±0,3	566,1±9,2*	703,9±25,5*
27	4,20±0,6*	3,23±0,3	2,32±0,6	2,62±0,5	541,2±13,1	668,6±10,9*
32	4,29±0,6	3,72±0,3	1,94±0,5	1,81±0,5	536,2±8,8	723,6±38,6*
40	3,07±0,4	3,33±0,3	2,41±0,8	0,97±0,2	569,0±19,0	696,2±25,8*
47	4,28±0,1	3,68±0,2	1,46±0,4	2,49±0,6	571,5±16,8	639,6±15,0
52	2,97±0,3	3,23±0,7	2,84±0,7	1,71±0,6	571,1±18,4	562,1±6,4*
60	3,21±0,4	2,90±0,4	1,50±0,4	1,00±0,2	570,1±18,9	537,3±8,0*
70	3,52±0,3*	2,89±0,4	2,00±0,5	0,88±0,2	619,4±25,5	667,1±9,8*

ical functions, preventing pathological changes. The absence of a phase of activation of adrenergic mechanisms and elevation of the insulin level (Table 1) are evidence of the predominantly cholinergic character of the regulatory mechanisms after the first few minutes of physical exertion in older dogs. This fact was one factor in the explanation of the character of response of the old animal to exogenous PGE_2, factors connected mainly with adrenergic processes. Exogenous PGE_2 caused temporary activation of ACTH 2 min after the beginning of its injection (Table 2). However, elevation of the blood ACTH level did not lead to changes in the blood 11-HCS concentration in the old dogs (Table 2). Exogenous PGE_2, after intra-arterial injection, caused an increase in the blood level of adrenalin (Table 3) and serotonin (Table 4), but did not change MAO activity (Table 4). The greater decrease in the noradrenalin concentration in response to injection of PGE_2 in the blood of old animals (Table 3) than in middle-aged animals [9] is connected with age changes in sensitivity of the membrane to the action of PG at the postsynaptic and presynaptic level [12, 13]. The animals undertook physical exertion 13 min after receiving the injection of PGE_2. The altered hormonal background led to even greater predominance of the cholinergic phase of regulation over the adrenergic phase, and this was expressed both in behavioral reactions and in a significant increase in the insulin concentration of the dogs after the first few minutes of running. The noradrenalin level remained significantly lowered (Table 3) throughout the period of exercise and for 20 min of the recovery period.

Dexamethasone, as a specific inhibitor of the central neuroendocrine complex [5], lowered the ACTH level 4 h after its injection (Table 2) but did not change the basal adrenalin level, and it increased the noradrenalin (Table 3) and MAO (Table 4) concentrations in the blood of dogs aged 8-9 years. The dynamics of parameters of the HHAS after injection of PGE_2 and during physical exercise by "blocked" dogs was similar in character to changes in the steroid hormone levels in intact dogs aged 8-9 years (Table 2). Dexamethasone, however, prevented intervention of PGE_2 probably at the synaptic membrane level and stimulated liberation of noradrenalin into the blood stream, a high level of which was maintained during physical exercise also (Table 3). Without lowering the basal blood adrenalin level in the old animals, dexamethasone promoted increased consumption of this amide by the tissues in the initial stage of exercise, and this led to a sharp decline in the circulating blood level of the amine (Table 3). Elevation of the adrenalin and glucose levels in the arterial blood of the old animals toward the middle of the running period indicated activation of compensatory mechanisms controlling carbohydrate metabolism during muscular exertion.

PGE_2, injected intra-arterially both into dogs with functionally depressed HHAS activity and into animals with additional inhibition of their ACTH activity by dexamethasone, temporarily raised only the blood ACTH level. Injection of PGE_2 did not change the cholinergic character of regulatory processes in intact old animals during physical exertion, as shown by the absence of a rise of blood pressure, by marked tachycardia, and by dyspnea of the dogs during running and after its end. The animals could not cope with the assigned level of graded exercise.

Dexamethasone prevents the specific effect of exogenous PGE_2 on the circulating adrenalin level, probably due to its direct intervention at the synaptic level, and also with compensatory processes developing in the dogs with inhibited activity of their HHAS. Processes of temporary adaptation in old animals compared with middle-aged [9] are accompanied by predominance of the cholinergic phase over the adrenergic in all extremal situations.

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SPIN-LABEL STUDY OF THE STRUCTURE OF SKELETAL MUSCLE SARCOPLASMIC RETICULUM Ca-ATPase OF RABBITS WITH HYPERCHOLESTEROLEMIA

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Alimentary hypercholesterolemia (HCh) in rabbits, leading to a persistently high plasma cholesterol (Ch) concentration, is known to cause pathological changes in the membranes of various organs and tissues [1, 8, 9]. It has been shown, for instance, that in HCh there is a substantial disturbance of membrane-bound enzyme function [7, 8]. In particular, in a study of the Ca-pump of rabbit skeletal muscles during HCh, enzyme activity of Ca-ATPase was found to be lowered and passive outflow of Ca^{++} from vesicles of the sarcoplasmic reticulum (SR) was increased [7, 10]. Accordingly the study of the molecular mechanisms of these disturbances is very interesting.

The object of this investigation, conducted by the spin-label method, was to study correlation between structural changes and disturbances of Ca-ATPase function in skeletal muscle SR of rabbits with HCh.

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