

# BIOCHEMISTRY AND BIOPHYSICS

## INVESTIGATION OF NUCLEIC ACIDS IN THE MYOCARDIUM OF RABBITS WITH EXPERIMENTAL ATHEROSCLEROSIS

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In the investigations of a number of authors [1, 5-7], a disruption of protein synthesis in various organs and tissues of animals with experimental atherosclerosis was detected.

Today the participation of nucleic acids in the processes of protein biosynthesis is generally accepted [10, 11, 13]. Therefore, the possibility of changes in the content and metabolism of the nucleic acids during atherosclerosis is not to be excluded; the development of the latter is linked with profound disturbances of the protein metabolism.

Few works have been devoted to the study of nucleic acids during atherosclerosis. There are indications of changes which take place in rabbits with experimental atherosclerosis, in the ribonucleoprotein content in the aorta [9] and ribonucleic acid content in nerve cells of various brain structures [4]. However, during the investigation of the amount of DNA and RNA in the liver and kidneys of animals with experimental atherosclerosis, no significant changes were observed [7]. In the latter stages of cardiosclerosis, caused by experimental stenosis of the aorta, a considerable lowering of the DNA content is detected in the myocardium of rabbits [8].

In this work the nucleic acid content in the myocardium of rabbits with experimental atherosclerosis of various duration and severity was investigated.

### PROCEDURE

The experiments were conducted with 25 rabbits of the chinchilla strain, weighing 2-3.5 kg. The experimental atherosclerosis was produced by the method of N. N. Anichkova, by feeding the rabbits daily a 10% solution of cholesterol in sunflower oil (0.2 g/kg). Six rabbits used in series I of the experiments were sacrificed 20-30 days after the beginning of the cholesterol administration; in series II, 10 rabbits were sacrificed 120-130 days after the beginning of the cholesterol feedings to the animals. The rabbits were killed by decapitation, the heart was quickly removed, placed in the cold, and the nucleic acid content of suspensions of myocardium tissue was determined by the two-wave spectrophotometric method of Tsanev and Markov [12]. An SF-4 quartz spectrophotometer was used in the experiments. The calculation of the nucleic acid content was carried out in milligram percent of phosphorus (P) per dry weight of tissue.

To characterize the degree of development of the process of atherosclerosis, the cholesterol content in the blood serum was determined by the method of Éngel'gardt and Smirnova, and the phosphatides in an alcohol-ether mixture were determined, followed by determination of the phosphorus level according to Fiske-Subbarow. The degree of atherosclerosis of the afflicted aorta was determined macroscopically.

### RESULTS

In series I of the experiments, the cholesterol content of the blood serum increased 2-4-fold 20-30 days after the beginning of the cholesterol feedings of the rabbits, while the phosphatides increased 2-3-fold in comparison with the normal values; the phosphatides/cholesterol ratio was considerably lowered. Macroscopic changes in the aorta were not detected in the investigation.

Nucleic Acid Contents (In mg % of P per dry weight of tissue) in Rabbit Myocardium in the Norm and in the Process of the Development of Experimental Atherosclerosis

Experiment series	Rabbit No.	P-RNA	P-DNA	P-RNA/P-DNA
Control	1	82,57	36,82	2,28
	2	70,75	49,90	1,42
	3	105,08	64,00	1,64
	4	82,47	49,24	1,68
	5	84,70	39,40	2,15
	6	101,40	53,35	1,89
	7	85,07	34,46	2,46
	8	93,48	57,90	1,67
	9	82,30	62,60	1,37
$M \pm m$		$87,54 \pm 3,54$	$49,63 \pm 3,65$	$1,83 \pm 0,13$
I	1	100,20	29,44	3,74
	2	102,40	34,18	3,00
	3	98,25	46,40	2,16
	4	95,90	45,48	2,11
	5	96,35	45,18	2,11
	6	98,40	32,38	3,04
$M \pm m$		$98,58 \pm 0,98$ $0,01 > P >$ $> 0,002$	$38,92 \pm 3,55$ $0,1 > P >$ $> 0,05$	$2,69 \pm 0,30$ $0,02 > P >$ $> 0,01$
II	1	101,50	23,65	4,28
	2	100,25	33,02	3,30
	3	99,25	24,63	4,03
	4	82,00	18,00	4,56
	5	80,59	28,65	2,83
	6	88,00	44,40	2,00
	7	107,10	20,12	5,34
	8	89,85	33,67	2,67
	9	84,24	30,00	2,81
	10	96,25	57,32	2,58
$M \pm m$		$92,90 \pm 2,90$ $0,25 > P > 0,1$	$29,35 \pm 2,55$ $P < 0,001$	$3,44 \pm 0,33$ $P < 0,001$

In the myocardium of the rabbits in this series of the experiments, there was a disruption of the nucleic acid ratio, mainly due to the increase in the amount of RNA (see table).

On the average the RNA level increased by 12.7% ( $P < 0.01$ ). The DNA content was somewhat lowered, however, this depression was not statistically reliable. The ratio of P-RNA to P-DNA in the rabbit myocardium of this series of experiments increased from 1.83 to 2.69 ( $P < 0.01$ ).

In series II the feeding of the rabbits cholesterol for 120-130 days led to the development of severe atherosclerosis in them, which was evidenced not only by the high level of hypercholesterinemia, but also by widespread atherosclerosis of the afflicted aorta.

The RNA content in the myocardium of these animals was only slightly higher than the normal level ( $P > 0.1$ ). Under these conditions the greatest change was undergone by the DNA content, which was lowered by 40.7% in comparison with the control ( $P < 0.001$ ).

In connection with the decrease in the DNA content, the ratio of P-RNA to P-DNA in the myocardium of the rabbits in the series of experiments II was increased considerably in comparison with the normal and in comparison with its level in the early stages of atherosclerosis ( $P < 0.001$ ).

The data obtained indicate that the nucleic acid content in rabbit myocardium is changed differently, depending on the degree of the atherosclerotic process. In the early stage of the disease, during which the cholesterol content is elevated in the blood serum but while pronounced atherosclerotic damages to the aorta are still absent, primarily the RNA content is changed; the changes in the level of DNA in this period are statistically unreliable. The increase in the index P-RNA/P-DNA occurs due to an increase in the amount of RNA in the myocardium.

In the last stage of atherosclerosis, which is characterized by a high degree of hypercholesterinemia and

a widely distributed, sharply pronounced atherosclerotic damages to the aorta, the DNA content is subjected to the greatest changes, and the index P-RNA/P-DNA is increased mainly due to the decrease in the DNA content.

The possibility remains that the hypertrophy of the muscle fibers and the increase in the adiposity of the cells due to some other substances, possibly fats, which may take place during this disease, may also play a role in the decrease in the DNA content in the myocardium of rabbits with experimental atherosclerosis [2, 3].

Nevertheless, whatever the mechanism of the lowering of the DNA content, this depression in any case may exert a negative effect on the organism.

Our investigation indicated that in the process of development of experimental atherosclerosis, both in the early and in the late stage of this pathological condition, the RNA and DNA contents, as well as their ratio in rabbit myocardium, are changed. As we have assumed, the indicated changes may lead to considerable disruption of protein synthesis in the organism during this disease.

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All abbreviations of periodicals in the above bibliography are letter-by-letter transliterations of the abbreviations as given in the original Russian journal. *Some or all of this periodical literature may well be available in English translation.* A complete list of the cover-to-cover English translations appears at the back of this issue.

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