tion process from the beginning and, consequently, it differs from the other cells in its structural and functional properties. An explanation of these functional differences is essential for the understanding of the role of SMC in the pathogenesis of atherosclerosis.

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TRANSMISSION OF "REGENERATION" INFORMATION BY LYMPHOCYTES OF RATS AFTER WIDE INTESTINAL RESECTION

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KEY WORDS: intestinal resection; lymphocytes; regeneration.

The ability of lymphocytes to transmit "regeneration" information has been demonstrated in relation to regeneration of various organs both after surgical operations [1, 2, 6, 7] and after a pathologic process [3, 4]. It is not yet clear whether this ability is expressed after surgical trauma on organs with an initially high level of spontaneous proliferative activity.

To examine this problem it was decided to study how wide resection of the small intestine is reflected in information transmission by lymphocytes.

EXPERIMENTAL METHOD

Experiments were carried out on 38 male (August × Wistar Black)F_1 rats. Half of the intestine at a distance of 10 cm from the stomach was removed from rats which later acted as donors of lymphocytes. The animals were killed 17 h after the operation, a suspension of their spleen cells was made in medium 199 and centrifuged, viability of the lymphocytes was determined by the method in [1], after which they were transplanted into the femoral vein of intact syngeneic recipients in a dose of $4 \cdot 10^8$ cells. Rats receiving lymphocytes from animals undergoing mock operations (control recipients) and intact rats of the same age (intact control) acted as the control. All the animals were killed with chloroform vapor (at 9-10 a.m.) 48 h after transfer of the spleen cells. The small intestine (at a distance of 10 cm from

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TABLE 1. Changes in MI of Epithelial Cells of Intestinal Crypts and Esophagus under the Influence of Lymphoid Cells from Animals after Wide Resection of Small Intestine

Group of animals	Mitotic index, ‰		Mean number of cells per crypt
	in epitheliocytes	in esophageal epithelium	
Experimental recipients	64±4,2	6,1±4,2	41±0,9
Control recipients	44±4,2	2,5±0,5	38±1,0
Intact control	42±5,0	3,3±0,4	37±0,4

the stomach) and esophagus were fixed in Carnoy's fluid and embedded in paraffin wax. Sections 4-5 μ thick were stained with hematoxylin and eosin and mitotic activity was determined in the epithelium of the intestinal crypts and esophagus: 78 longitudinally cut crypts and 3000 esophageal cells were counted in each rat. The mitotic index (MI) was expressed in promille.

The numerical results were subjected to statistical analysis by the Fisher–Student method.

EXPERIMENTAL RESULTS

The histological structure of the intestinal wall and mitotic activity of the epitheliocytes of the experimental recipients differed from those of the control recipients and animals of the intact control. The first fact of importance is that among epithelial cells in the experimental group of recipients of lymphoid cells there were many more small lymphocytes than in the two control groups.

It will be clear from Table 1 that MI of the epitheliocytes from recipients of lymphoid cells taken from rats with wide intestinal resection reached 64‰, about 1.5 times more than in intact rats (42‰; $p = 0.001$) and in the control recipients (44‰, $p = 0.004$) (Table 1). This increase in the number of dividing cells was observed along the whole length of the crypt toward the villus. Despite such a relatively small increase in MI, it led to a significant increase in the mean number of cells ($p = 0.01$ and $p = 0.001$) per crypt in the experimental recipients (41 ± 0.9) compared with that in the control recipients (38 ± 1.0) and animals of the intact control (37 ± 0.4).

Determination of the ratio between the phases of mitosis also indicated a true increase in proliferative activity. The increase in the number of dividing cells was accompanied by a corresponding increase in the number of cells starting mitosis. The ratio of the total number of early phases to the total number of late phases in the experimental group remained within the same limits as in the control groups (2.3 compared with 2.2 in control recipients and 2.1 in intact rats). Lymphocytes of rats undergoing the mock operation had no significant stimulating action on enterocyte proliferation. However, in two of the seven control recipients, MI in epithelium of the intestinal crypts was nevertheless higher than in all animals of the intact control.

A similar rule regarding changes in proliferative activity under the influence of lymphocytes of animals undergoing the full and mock operations also was found with respect to esophageal epithelial cells in the experimental recipients 48 h after transplantation of lymphocytes from rats with wide intestinal resection a significant increase in MI was observed to 6.05‰ compared with 3.3‰ in intact rats and 2.5‰ in control recipients.

These results indicate that after wide intestinal resection the lymphocytes become capable of stimulating proliferative activity of epithelial cells in the intestinal crypts and esophagus, which is confirmed by data [1] obtained on models of regeneration of the liver and compensatory hypertrophy of the kidney. This property of lymphocytes does not have strict organ specificity. To determine whether selective organ specificity is present, additional investigations are necessary with determination of the rate of the mitotic cycle. The increase in the number of cells per crypt, and migration of dividing cells toward the villus suggest a combination of intensification of proliferation of epitheliocytes and shortening

of the duration of their mitotic cycle. In this connection the fact is worth mentioning that during intestinal regeneration the increase in mitotic activity of the epitheliocytes is never as high as during regeneration of organs normally characterized by low proliferative activity [5].

The increase in the number of lymphocytes in the intestinal mucosa of the experimental recipients is evidently involved in realization of the property of lymphoid cells of stimulating proliferation, but their genesis and mechanism of action are still unknown.

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EFFECT OF CYCLIC NUCLEOTIDES ON SENSITIVITY OF EARLY SEA URCHIN EMBRYOS TO CYTOTOXIC NEUROPHARMACOLOGICAL DRUGS

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In many cases the action of neurotransmitters has been shown to involve participation of corresponding cyclic nucleotides [11]. Substances identical with or related to neurotransmitters [1, 3, 4] and all components of cyclase systems [13] also are present in the cells of early embryos of different groups of animals (sea urchins have been best studied in this respect). It has been suggested [3, 9, 12] that these systems in early embryos, just as in differentiated cells, are functionally linked.

This hypothesis, verification of which was the aim of this investigation, was supported by the results of the writers' previous experiments, which showed that exogeneous cAMP and cGMP can reduce the sensitivity of sea urchin embryos to the specific cytotoxic action of neuropharmacologic drugs, namely antagonists of "prenerve" transmitters [6], to some degree. It has also been shown that the action of these drugs on times of micromere formation in embryos of the sea urchin *Schaphechinus mirabilis* is antagonistic relative to the corresponding effects of dibutyryl-cAMP and the phosphodiesterase inhibitor papaverine [9, 10].

EXPERIMENTAL METHOD

The test objects were early embryos of sea urchins *Strongylocentrotus intermedius* and *Scaphechinus mirabilis* (Sea of Japan), and *Arbacia lixula* and *Paracentrotus lividus* (Adriatic Sea). The technique of obtaining the gametes and incubation of the embryos was standard [5].

Antiserotonin drugs indocarb and 5-bromotryptamine [7], the tricyclic antidepressant melipramine, dibutyryl-cAMP, dibutyryl-cGMP, cAMP, the adenylate cyclase activator sodium fluoride, papaverine, and serotonin were used. The drugs were added to the incubation medium 3-5 min after fertilization. Their effects were assessed by their ability to block the first cleavage division or to abolish such a block caused by neuropharmacologic drugs, and also,

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