surface or by a strip of interseed (0.5x3.0 cm). The anterior abdominal wall was covered with continuous catgut sutures in several layers. The animals were killed by a toxic dose of hexenal injected 5 days after the operation. In a postmortem examination the nature of repair processes in the region of the parietal peritoneum of the lateral abdominal wall was studied. The count of adhesions was performed in accordance with Diamond *et al.* [2].

The area and type, as well as the firmness of the adhesions were taken into account and the results obtained were summarized using a point system.

The statistical treatment of the numerical data was performed using the Fisher-Student test.

RESULTS

On a macroscopic investigation of the abdominal cavity of animals killed no traces of FG-1 were found in any of the 10 experiments of the first group four days after the operation; an initial stage of interseed resorption was detected in the second group. There was a pronounced hyperemia around the suture in the control group, which was less expressed in the first two groups.

In the first two groups, on the whole, adhesions were found to cover up to 50% of the suture on the parietal peritoneum of the lateral abdominal wall and the adjacent organs were found to be involved in the adhesive processes only in isolated cases. In most cases in the third group adhesions were found to encompass more than 75% of a suture and to be connected with the abdomina organs (intestine, omentum, and liver). These and other characteristics of the adhesions were summarized using a point system and tabulated (Table 1).

As shown in the table, the spread as well as the type of adhesive processes on a suture on the parietal peritoneum of the lateral abdominal wall in the first two groups were reliably lower than in the third group, while no essential differences of adhesion density were found in all groups.

The analysis of the results suggests that both fibrin glue FG-1 and interseed TS-7 promote a reduction of the area of postoperative adhesions and make them less expressed.

The use of these substances during the operation caused no technical complications, nor did they prolong the surgery.

The results of the present investigation, which are in accordance with other data [2, 4] as well as our own data [1], suggest that both fibrin glue FG-1 and interseed TS-7 promote a reduction of the frequency of postoperative adhesions and enchance the effectiveness of reconstructive plastic operations in the abdominal cavity.

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Isopropoxygermathrane as a Stimulator of Hepatocyte Regeneration

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One of the most topical problems of modern biology and medicine is the search for and investigation of stimulators enhancing the regeneration of various organs and tissues. In this context the research of liver regeneration stimulators is of special interest, as this organ possesses a broad spectrum of physiological functions. The realization of these is highly dependent on the hepatocyte mitochondria respiration. One

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should also keep in mind that in the development of pathological states of various genesis an important role belongs to the products of lipid peroxidation (LPO) [4-6].

In recent years the attention of scientists has been attracted by a new class of bioactive silicon-containing compounds, namely silathranes. Earlier we have shown [2, 7, 8] that some silathranes stimulate wound healing and enhance the repair of the mucosa in experimental gastric ulcers. Preliminary data indicated an influence of silathranes on liver mass recovery. The substitution of a silicon for a germanium atom results in the formation of germathranes and, frequently, in changes in the biological activity of athranes [9]. Therefore, we attempted to analyze the effect of isopropoxygermathrane (IPG) on the mitotic activity and cell size of regenerating liver, as well as on its secretory activity, rate of mitochondria (Mc) respiration, and intensity of LPO in the hepatocytes.

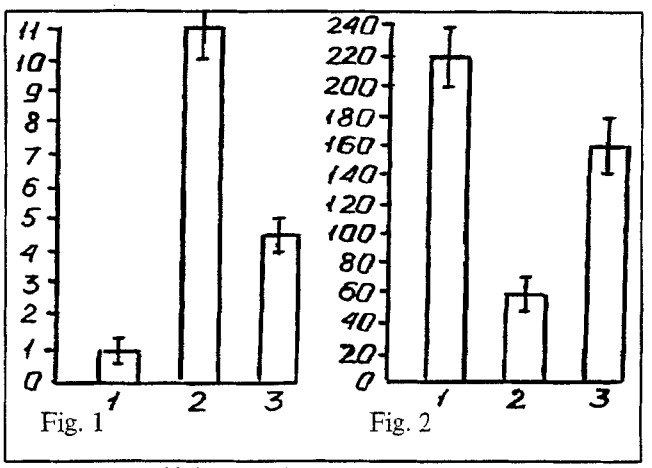

Fig. 1. Intensity of Fe^{2+}-induced CL in rat liver homogenates. Ordinate: intensity of ultralow luminescence expressed in arbitrary units. Here and in Figure 2: 1) intact rats; 2) control (operated anduntreated) rats; 3) experimental (operated and IPG-treated) rats.

Fig. 2. Dynamics of bile-secreting function of rat liver. Ordinate: quantity of secreted bile (in mg per hour).

MATERIAL AND METHODS

The experiments were carried out on outbred male albino rats weighing 150-180 g. Two-thirds of the liver was resected by the method of Higgins-Andersen under ether rausch narcosis. The operated animals were randomly distributed into five groups, four experimental ones and a control one, 10 rats per group. All experimental animals were twice administered intraperitoneally IPG in a dose of 40 mg/kg, first immediately after the operation, and then 24 hours afterwards. Control animals received saline in the same periods and in equal quantities. The animals were sacrificed 48 hours after the completion of the operation, *i.e.*, a day after the second injection of IPG.

The liver of animals from the 1st experimental group was extracted, fixed in formalin, and embedded in paraffin. Sections 10 m thick were stained with hematoxylin-eosin. Using light microscopy, the mean dimensions of a hepatocyte and the number of cells in different phases of mitosis per 1000 cells were calculated.

Table 1. Main Indexes of Mitochondria Respiration in Hepatocytes of Regenerating Rat Liver: Effect of Isopropoxygermanthrane (M±m, n=10)

Index of mitochondria respiration	Group		
	reference (intact)	operation only	operation plus IPG
V0	6,6±0,2	7,2±0,3	6,9±0,2
V3	39,2±1,9	51,4±2,6	47,6±2,1
V4	16,3±0,9	36,7±2,3	26,4±1,6
RC	2,4±0,1	1,4±0,1	1,8±0,1

Note. The respiration rate (V) of mitochondria was determined in nmol O_2/min•mg protein; V_0: primary respiration rate in the presence of glutamate and malate; V_3: respiration rate in state III after Chance; V_4: respiration rate in state IV after Chance; RC: respiration coefficient (ratio V_3/V_4)

The liver of animals from the 2nd experimental group was analyzed using polarography methods. The rate of hepatocyte Mc respiration was recorded with a Clark-type oxygen electrode. The preparation of Mc was obtained from the liver according to [3]. The Mc suspension contained 80-100 mg protein per milliliter.

Using the device described by us earlier [1], the intensity of LPO was recorded by chemiluminescence (CL) assay in the liver of the 4th group of experimental animals. LPO was induced in liver homogenates by the addition of 10 ml of 10^{-2}M $FeSO_4$ solution. The liver tissue was minced in a Potter homogenizer and transferred to the measurement cell (the final volume of suspension in the cell being 10 ml). The incubation medium contained 105 mM KCl and 20 mM KH_2PO_4, with the pH adjusted to 7.4. The final concentration of LPO inducer was 10^{-3}M. The intensity of CL was detected using equal homogenate quantities in the measurement cell. The estimation unit represented a ratio of Fe^{2+}-induced signal to the spontaneous CL level, *i.e.*, the amplitude of flash expressed in arbitrary units.

The animals of the 4th experimental group were used for the direct measurement of bile secretion by the regenerating liver following the second injection of IPG. The cannulation of the common bile duct was performed under urethane anesthesia (a dose of 1g/kg). The pancreatic duct was ligated and the quantity of bile harvested during one hour was recorded.

The data obtained in the experimental groups were compared with analogous data obtained on intact animals (reference data).

The significance of the results was estimated according to the Student test.

RESULTS

The morphometric analysis revealed that the area of hepatocytes in the animals of the reference group varied within 450±20 m^2, and in the control group 460±25 m^2; however, in the rats treated with IPG, it attained 660±40 m^2, thus reliably ($p<0,01$) exceeding both the reference and control values. The total number of cells in various phases of mitosis was 0.62±0.03‰ in the reference group and 0.71±0.04‰ in the control animals. In the IPG-treated rats this parameter exceded almost twofold the reference data and attained 1.13±0.05‰, again reliably distinguishing the experimental group from both the reference and control rats. Among the cells undergoing mitosis, the share of cells in metaphase plus anaphase was near 42% in the reference group, 47% in the control animals, and 63% in the experimental rats. Thus, in the experimental group this parameter was one-third more than in the control ($p<0.05$). The mitotic index of hepatocytes in the periods of metaphase and anaphase amounted to 9.2±1.7 and 10.5±2.1 in the reference and control groups, respectively. In the experimental animals the index twice exceeded the mentioned values and rose to 21±2.3.

The data on the respiratory function of the hepatocytes are summarized in Table 1. It is seen that the administration of IPG leads to a decrease of the rate of oxygen transfer across the MC membrane and to a reliable ($p<0,01$) change in the respiration coefficient as compared to both the control and the reference groups. This fact implies the possibility of the transition of the biooxygenation processes in the Mc from the hexosic to the pentosic pathway, this last being linked with the formation of macroergic compounds, including RNA.

The analysis of the influence of IPG on the POL revealed that the operation increased the intensity of CL in comparison with the reference level, while in the experimental group (*i.e.*, operation plus IPG administration) the level of CL was significantly diminished, which means that IPG acted as an antioxidant (Fig. 1).

Lastly, Fig. 2 shows that IPG significantly enhances the production and secretion of bile, when compared to the control group.

Thus, IPG was shown to induce a wide spectrum of effects: a) acceleration of the primary and final mitotic phases; b) increase in the intensity of the metabolic processes in the interphase hepatocytes simultaneously with the reduction of oxygen consumption in the respiratory pathway of Mc to the minimum; c) inhibition of LPO in the hepatocytes; and d) enhancement of the bile secretory function of the liver. Taken together, these results allow IPG to be considered as a valuable compound for stimulation of the functional activity in the posttraumatic and/or postoperative regenerating liver.

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