CHEMILUMINESCENCE OF THE MOUSE LIVER AFTER INJECTION OF GLUCOSE

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The spectral composition of radiation from the mouse liver was studied in situ after intravenous injection of various doses of glucose. A statistically significant ultraviolet component – mitogenetic radiation – appeared after injection of 15 mg glucose. Only visible radiation was recorded after smaller or larger doses. The results are evidence of the role of unbalanced molecular constellations in the regulation of hepatocyte metabolism.

KEY WORDS: liver; mitogenetic radiation; unbalanced molecular constellations.

According to A. G. Gurvich's concept [1], the cell substrate contains highly labile unbalanced molecular constellations (UMCs) of proteins and peptides which, when broken down, liberate their potential energy in the form of "degradation" radiation. Degradation of UMCs with emission of photons of both ultraviolet (UV) and visible radiation is caused by cooling of the organs, especially the liver [5, 6], by starvation, and by certain other factors which severely disturb the metabolic conditions [2, 4]. UMCs are also ascribed a role in cellular metabolic processes [2, 3].

The object of this investigation was to study UMC of the mouse liver after intravenous injection of glucose solutions of varied concentration.

EXPERIMENTAL METHOD

Radiation emitted by the liver was measured by the FÉU-18a photoelectronic multiplier in response to cooling with liquid nitrogen. The spectral region of the radiation was identified by the use of quartz and glass filters, which were changed every 10 sec. The difference between the "glass–background" pulses corresponded to visible radiation with a wavelength of over 350 nm, whereas the difference between "quartz–glass" pulses corresponded to UV radiation with a wavelength of 230-350 nm.

Intravenous injections of 1, 3, and 10% glucose solution (VEB Jenapharm, East Germany) were given into the caudal vein of the mice in a volume of 0.5 ml. Control animals received 0.5 ml of Ringer's solution. Measurements began 8-10 min after exposure of the liver and 3-4 min after injection of glucose. During measurements the liver was continuously irrigated with Ringer's solution at 37-38°C. The experiments were carried out at different times of year, to exclude any possible effects of seasonal variations in metabolism.

EXPERIMENTAL RESULTS

After injection of 5 mg glucose radiation in the visible region of the spectrum continued with about the same intensity as in the control mice (of the order of 150 photons/sec $\cdot$ cm^2). The UV component was found only with a low level of probability in the 18-30 min interval ($P < 0.01$). After injection of 15 mg glucose, the shift of the spectrum into the UV region was manifested more clearly and earlier. A significant UV emission of the order of 200 photons/sec $\cdot$ cm^2 was recorded for 8-20 min from the time of injection,

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TABLE 1. Radiation from the Mouse Liver after Injection of Glucose

Concentration (dose of glucose)	Effect of injection of glucose (in pulses/10 sec)							
	after 3–10 min		after 8–20 min		after 18–30 min		after 30–46 min	
	UV radiation	visible	UV radiation	visible	UV radiation	visible	UV radiation	visible
Control	−0,07±0,26	1,90±0,27	−0,07±0,03	1,62±0,30	0,032±0,19	1,43±0,25	0,03±0,15	1,97±0,22
P		<0,001		<0,001		<0,001		<0,001
	n=180		*n*=260		*n*=310		*n*=230	
1% solution (5 mg)	−0,15±0,11	2,75±0,25	0,43±0,24	2,09±0,21	0,58±0,21	1,99±0,21	0,26±0,25	2,12±0,22
P		<0,001		<0,001	<0,01	<0,001		<0,001
	n=220		*n*=270		*n*=290		*n*=260	
3% solution (15 mg)	1,20±0,39	1,69±0,37	1,14±0,19	0,48±0,18	0,31±0,17	0,82±0,17	0,22±0,21	1,25±0,20
P	<0,005	<0,001	<0,001	<0,01		<0,001		<0,001
	n=200		*n*=340		*n*=360		*n*=245	
10% solution (50 mg)	−0,35±0,27	1,18±0,27	0,09±0,21	1,15±0,18	−0,11±0,18	1,23±0,17	−0,45±0,21	1,84±0,26
P		<0,001		<0,001		<0,001		<0,001
	n=160		*n*=250		*n*=370		*n*=165	

Legend: n) Number of 10-sec measurements.

and at the end of this period it was accompanied by a 3-4-fold decrease in the intensity of the visible radiation. Later the intensity of the visible radiation returned to normal. After injection of 50 mg glucose no UV radiation was found but the level of visible radiation was rather lower than the control during the first 30 min (Table 1).

The temporary shift of the emission spectrum of the liver toward the short-wave side discovered after injection of a certain dose of glucose points to a redistribution of the energy levels of the UMCs and to their probable participation in carbohydrate metabolism. The UV radiation is possibly connected with the appearance of phosphorylated intermediate products of glucose metabolism in the substrate of the liver cells and their addition to UMCs. This process must be accompanied by raising the energy level of the latter. During subsequent degradation of the UMCs emission could arise predominantly in the UV region until the utilization of the excess glucose had ended and the unbalanced order of the substrate had returned to its initial, lower energy level. As was shown previously [1-3], "overloading" the UMCs with large amounts of glucose and its derivatives leads to temporary suppression of the degradation radiation.

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