TABLE I.
Lactate, Pyruvate, and Acid-Soluble Phosphates in Monkey Brain.

Animal No.	Lactate		Pyruvate		Inorg. P		Phospho-creatine		Adenosine Tri-PO_4		Adenosine Di-PO_4		Treatment
	Cb*	Cx	Cb	Cx	Cb	Cx	Cb	Cx	Cb	Cx	Cb	Cx	
1	1.68†	1.80	0.171	0.157	3.65	3.93	1.70	1.33	1.40	1.68	1.74	1.27	Control
2	1.44	1.41	0.078	0.083	4.20	4.71	1.27	1.15	1.51	1.43	1.76	1.91	30% CO_2, 70% O_2 for 3 min.
3	5.22	5.40	0.263	0.269	6.32	5.67	0.47	1.12	1.14	1.18	1.73	1.65	10 sec. electric shock 55 sec. seizure
4	1.74	1.95	0.163	0.168	4.44	4.62	0.62	0.54	1.09	1.34	1.33	1.11	30% CO_2, 70% O_2 for 3 min. 10 sec. electric shock 55 sec. lag period No seizure

* "Cb" and "Cx" designate cerebellar and cerebral cortex, respectively.
† All values expressed as mM/1000 g (wet wt) tissue.

compound, the changes are too small, considering the precision of the methods of analysis, to allow conclusions to be drawn without more extensive studies on a larger series of animals. Such a study on monkeys is, at present, beyond our means.

Summary. The brains of normal monkeys and those treated with carbon dioxide and electric shock were fixed with liquid air and analysed for lactate, pyruvate, and acid-soluble phosphates. The levels of these constituents and their change under the above conditions were shown to be of the same magnitude and in the same direction as those found in similarly treated dogs, cats, and rats.

Received May 31, 1949. P.S.E.B.M., 1949, **71**.

17237. Effect of Environmental Temperature on the Response of Mice to Whole-Body Roentgen Radiation.

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A low environmental temperature for frogs and new-born rats is accompanied by decreased body temperature and oxidative metabolism, and relatively low radiosensitivity.[1-3] In the mouse, when the temperature regulating mechanism is functioning normally, a cold environment produces only a slight depression of body temperature, and oxygen consumption is elevated.[4,5] This increase in oxidative metabolism has been attributed to increased thyroid activity.[6,7] Since thyroid

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feeding has been shown to increase the incidence of death following roentgen irradiation in mice,[8] experiments were carried out to determine whether or not a cold environment would produce the same effect.

Male mice of N.I.H. stock were received at weaning, divided into treatment groups in which each litter was represented as equally as possible, and placed on a diet of Purina pellets. Three weeks later they were irradiated in groups of 10 made up of approximately equal numbers from each treatment group. The experiments were terminated 4 weeks after irradiation, 98.7% of the observed deaths having occurred between 4 days and 3 weeks.

From one experiment to another we have been unable to duplicate mortality for a given radiation dose, due possibly to genetic heterogeneity of the stock, possibly to fluctuations in X-ray output. Within an experiment these variations should have been largely neutralized by the equal distribution of litters and treatments into radiation groups. Only relative mortality figures are comparable between experiments, and only balanced experiments can be summed.

Irradiation factors were: 170 Kv, 20 ma, added filtration 0.55 mm of aluminum and 0.25 mm of copper, focal distance 50 cm, and dose rate 56 r to 64 r per minute. Total doses were 500 r in the first experiments, 470 r in the last 2 experiments. Cold and hot rooms, thermostatically controlled, were maintained between the limits 9 to 11°C and 29 to 30°C. The 30° temperature was chosen because, according to Harrington,[5] heat production is minimal at an environmental temperature of 30° to 33°C.

Paraffin sections of formalin-fixed tissues were stained with azure eosinate.[9] Frozen sections were stained for fat with oil red 0 by the method of Lillie and Ashburn.[10] With this method little or no fat is extracted from the tissue by the staining solution.

In the first 6 experiments a total of 200 mice kept at 30° and 256 at 10°, irradiated with 500 r, were caged together in groups of 10 on sawdust. At each temperature approximately half of the mice were acclimatized for 2 weeks prior to irradiation and half were placed at the temperature immediately after irradiation, where they remained throughout the observation period. In the 30° environment 46% of those acclimatized died compared with 63% of those not acclimatized. At 10°, 52% of those acclimatized died compared with 71% of those not acclimatized. The χ^2 values of the totals do not indicate significant differences between the temperature groups (2.7 for acclimatized and 1.8 for non-acclimatized mice). Acclimatization at either temperature favored survival $\chi^2 = 5.4$ for 30°, 8.3 for 10°). The results of the individual experiments were very erratic, however, and thus afford little confidence in the χ^2 values of the totals.

In this group of experiments survivors at either temperature gained weight during the last 2 weeks of observation. Leucocyte counts made on the first and fourth days after irradiation showed no difference attributable to temperature. Of the non-irradiated controls kept at these temperatures 2 out of 79 at 10° and 1 out of 50 at 30° died from undetermined causes, while the others made satisfactory gains in weight.

Histopathologic changes in the bone marrow, spleen, lymph nodes, thymus, and testis were essentially similar to those recorded in the literature,[11,12] often varied markedly among mice receiving the same treatment, and the severity of the changes did not consistently favor any one treatment group.

In the last 3 experiments the mice were caged singly in suspended mesh cages without sawdust from the time of irradiation (Table I). Ten non-irradiated controls so caged in the 10° environment survived the observation period of 4 weeks without apparent ill ef-

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TABLE I.
Incidence of Death Following Irradiation of Mice Caged Singly at 10° and 30°C.

Exp. No.	Dose r	30°C				10°C				χ^2 corrected			
		Acclimatized		Not accl.		Acclimatized		Not accl.		Acclimatization		Temperature	
		Dead	Alive	Dead	Alive	Dead	Alive	Dead	Alive	at 30°	at 10°	Accl.	Not accl.
7	500	8 40%	12	16 80%	4	16	4	20 100%	0	5.10	2.50*	5.10	2.50*
8	470	—	—	16 27%	44	—	—	41 68%	19	—	—	—	19.24
9	470	—	—	23 38%	37	—	—	36 60%	24	—	—	—	4.80
Totals				55 39.3%	85			97 69.3%	43				24.18

* These values are inexact because 100% of the non-acclimatized mice at 10° died.

fects. Rectal temperatures were determined by an oral clinical thermometer with the bulb completely inserted into the rectum while the mouse was restrained by a wire jacket. Mice at the end of 4 weeks in the 30° environment had an average temperature of 38.4°C, 1.2° higher than those in the 10° environment.

In these experiments, where the mice were unable to huddle together, 69% in the 10° room died compared with 39% in the 30° room. The χ^2 values for individual experiments are relatively homogeneous, and the value 24.18 for the totals indicates a high degree of probability that the results were not due to chance alone. In the one experiment where acclimatization effect was studied acclimatization again appeared to favor survival.

The detrimental effect of the cold environment was clearly demonstrable when the mice were not allowed to huddle together. The conclusion that resistance to lethal X-ray effects is lowered in a cold environment, when the oxidative metabolism of mice is elevated, is in harmony with results from feeding desiccated thyroid. There are, however, other physiological variables, such as the distribution of blood between peripheral and visceral circulation, which may or may not alter the resistance of the organism to irradiation.

In gross examination of the mice that died following irradiation a uniformly pale or mottled liver was frequently observed in those from the 30° environment. Where 10 mice were caged together, 48 out of 64 at 30° showed this condition in contrast to 7 out of 76 mice at 10°. Among the mice caged singly, 31 out of 41 had pale or mottled livers at death in contrast to 6 out of 107 mice of the 10° groups. There was no apparent difference in this respect between acclimatized and non-acclimatized mice. The liver was examined microscopically in mice caged singly that died 7 to 14 days after irradiation. From 27 such mice at 30°, 19 showed marked and 4 showed moderate fatty changes, while from 30 such mice at 10° no livers showed marked and 4 showed moderate changes. Among control mice caged 10 together only one out of the 10 kept 2 weeks at 30° showed moderate fatty changes, and none at 10° showed such changes.

The higher incidence of pale, fatty livers in mice that died in the 30° environment was not obviously dependent upon the occurrence of hemorrhage as grossly observed, or upon differences in hemoglobin concentration as determined on 22 mice 11 days after irradiation (at 30°, mean hemoglobin 10.3 g per 100 ml; at 10°, 10.5 g per 100 ml). Since the change occurred chiefly in the groups having the lower incidence of death it is apparently not associated with low resistance to irradiation. The many non-specific factors that could conceivably be responsible for the fatty changes do not permit the conclusion that irradiation had more than an indirect effect in its induction.

Summary. The net effect of a sufficiently

cold environment is to lower the resistance of mice to the lethal action of X-rays.

Subjection to a 10° or 30°C environment for 2 weeks prior to irradiation favors survival of irradiated mice maintained in those environments.

Mice kept in a 30° environment that die following irradiation frequently show fatty changes in the liver.

Received June 28, 1949. P.S.E.B.M., 1949, **71**.

17238. Effect of Nitrocompounds on Viruses of the Psittacosis-Lymphogranuloma Group.

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Because of the observation that nitroacridines showed a marked inhibition of agents of the psittacosis-lymphogranuloma group[1,2] while chloro-substituted and certain other acridines were ineffective,[1] it seemed desirable to investigate the activity of nitrocompounds other than acridines. Substances containing a benzene or furan ring were selected for investigation because certain structural features in nitroacridine are also present in the latter, simpler compounds. While these studies were in progress other publications have described activity of two compounds containing a nitro-phenyl group against viruses of the psittacosis group or rickettsiae. One of these is chloramphenicol (chloromycetin)[3,4] and the other a nitro analogue of D.D.T., 1,1, 1-trichloro-2, 2-bis (para-nitrophenyl) ethane which was found to show some effectiveness against murine typhus in mice.[5]

Material and methods. The source of the strains of the viruses of lymphogranuloma venereum, meningopneumonitis, cat pneumonitis, and mouse pneumonitis is given in a previous publication.[1] Experiments in mice 16 to 18 grams in weight were done with mouse lung passage of these viruses inoculated by the intranasal route. Titrations were done and the infecting dose adjusted so that control mice in each experiment when killed on the 6th day had pulmonary lesions giving a score between 30 and 60.† Drugs were given by the intraperitoneal route as single daily doses starting 2 hours after the virus. Control mice received saline intraperitoneally.

The experiments in chick embryos were done with yolk sac passages of the four viruses inoculated either into the yolk sac or the allantoic sac. The technic of the experiments using inoculation into the yolk sac with about 10 LD_{50} was identical with that previously described.[1] In the other series of experiments 10 to 100 ID_{50} (50% infectious doses) were inoculated into the allantoic sac of 11-day-old chick embryos and a single dose of drug inoculated after the virus either into the allantoic sac or into the yolk sac. Control embryos received saline. The embryos were sacrificed on the 5th day after inoculation and the degree of viral multiplication in the allantoic sac determined by inoculating allantoic fluids from individual treated and control eggs into mice by the intranasal route. Fluids

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† A lesion score of 100 represents death with complete pulmonary consolidation. In surviving mice 80 represents on the average 4+ consolidation; 60, 3+; 40, 2+; and 20, 1+.