TABLE 1

OBSERVATIONS ON THE OFFSPRING SIRED BY IRRADIATED MALE MICE

Treatment of male	Period 1		2		3		4		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
*a. Ratio of Live to Total Embryos**										
Control (R)†	41/67	61.2	37/80	46.3	27/47	57.4	1/1	—	106/195	54.4
Mercaptoethylamine (I + R)	62/105	59.0	35/85	41.2	15/18	83.3	1/2	—	113/210	53.8
b. Ratio of Total Embryos to Corpora Lutea										
Control (R)	67/91	73.6	84/103	81.6	47/69	68.1	1/9	—	199/272	73.2
Mercaptoethylamine (I + R)	97/126	77.0	81/101	80.2	18/38	47.4	2/7	—	198/272	72.8
c. Ratio of Pregnancies to Vaginal Plugs Seen										
Control (R)	6/11	—	6/9	—	7/13	—	0/14	—		
Mercaptoethylamine (I + R)	13/14	—	10/14	—	4/14	—	1/9	—		

* Small discrepancies in total numbers of embryos between *a* and *b* were due to the exclusion of 1 or 2 litters in which the number of corpora lutea or viability of particular embryos were in doubt.

† I, injected with mercaptoethylamine; R, irradiated.

monstrable influence upon the induction of dominant lethals by the radiation.

Tables 1*a* and 1*b* show further that between the 2nd and 3rd periods there was a marked falling off in the total number of embryos in both the control and the amine-injected groups. The 4th period was one of almost complete sterility. Table 1*c* shows that the proportion of fertile matings fell off similarly. These findings agree with Hertwig's (*3*) histological study which showed that spermatogonia were almost entirely destroyed by a comparable dose of radiation, resulting in a complete lack of mature sperm after an interval of a few weeks. In none of these tables is there any significant difference in fertility between the control and treated males. This clearly shows that male germ cells were not afforded any protection by mercaptoethylamine against radiation death.

After the end of the 4th mating period several males from the treated and control groups were killed, their testes fixed and sectioned, and subsequently compared, histologically, with those of nontreated males. The testes from the 2 x-rayed groups were similar but differed from those that had received no radiation chiefly in the relative numbers of mature spermatozoa and spermatids. In the latter case there were many mature sperm cells and spermatids in various stages of spermiogenesis, whereas in the former case there was only a small number of mature or maturing sperm. There were no obvious differences in the relative numbers of spermatogonia and spermatocytes in the seminiferous tubules of the 3 groups of testes. This picture indicates that the period of sterility was approaching its end. However, the histological picture strengthens the genetic results in indicating that the mercaptoethylamine had no effect in protecting the germ cells against radiation.

The combined *Drosophila* and mouse studies clearly indicate that mercaptoethylamine has no influence upon the genetic effects of radiation as measured in these experiments; nor does it protect the male germ cells against radiation death. These findings are thus in line with the more recent work of Bacq and his colleagues (*4*) suggesting that mercaptoethylamine exerts its protective action through the liver and that the primary effects of radiation on other organs are not prevented.

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Preparation of High-Purity Lithium Metal by Vacuum Distillation

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In connection with the stable isotope program of this laboratory, measurements of physical properties of isotopically pure, or nearly pure, isotopes and their compounds are being carried out to determine possible significant differences in their values. For example, as a result of mass difference, there may be some variations in melting points and boiling points of the isotopes. For dependable values, however, it is also necessary to have high chemical purity.

[1] This paper is based on work performed for the AEC by Carbide and Carbon Chemicals Co., a Division of Union Carbide and Carbon Corp., at the Oak Ridge National Laboratory.

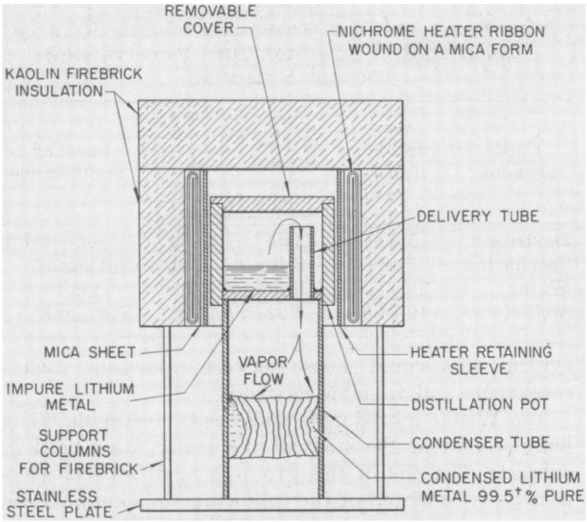

Fig. 1. Distillation unit.

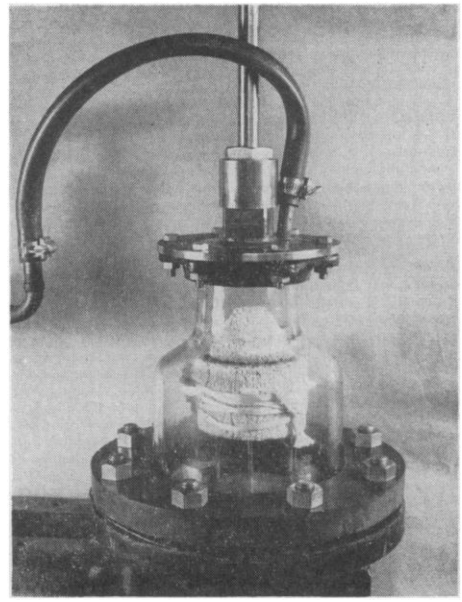

Fig. 2. Vacuum system.

Since the lithium nuclides are available (*1*), and furthermore, because any difference in properties should be enhanced in the case of lithium on account of the relatively large mass difference between its isotopes, they were investigated first. But the methods used for small-scale reduction of lithium compounds to the metal leave considerable impurities, so that some sort of purification is necessary.

Commercially, metallic lithium is purified on a large scale by distillation (*2*). Epstein and Howland have reported preparation of small quantities of high-purity metal by vacuum distillation in glass (*3*). Rogers and Viens distilled the metal in a 5-ft-long steel retort (*4*).

The apparatus described here is much smaller than either that of Rogers and Viens or the commercial arrangement, it does not require the "cold finger" of Epstein and Howland, yet it is quite simple and efficient. The unit consists of a "pot" made of 1⅞-in. OD stainless steel tubing with 5/32-in. wall thickness, a removable cover, and a delivery tube—all resting on a "condenser" of 1½-in. stainless tubing of 1/16-in. wall thickness which is placed on a stainless steel plate. Heating is accomplished with a suitable length of ⅛-in. nichrome resistance ribbon wrapped around mica sheet which, in turn, is coiled around a sleeve of stainless steel shim stock and insulated thermally by fire brick. The arrangement, as shown in Fig. 1, is enclosed in the Pyrex vacuum system shown in Fig. 2. Although many of the distillations were carried out with the 3×6 in. Pyrex glass reducer, the tendency of the glass to crack under the strain which developed while tightening nuts to seal the system led finally to the substitution of a 4×6 in. black iron, flanged reducer. Both types of reducers were capped at the ends with flanges and gaskets which accommodated the vacuum line, the leads from the power supply, and leads for the thermocouple. The temperature of distillation is about 500° C, although this can be varied to suit the sample.

The efficiency of the process is shown by typical data given in Table 1. Separation is poor where strontium is an impurity, since the vapor pressure curves for lithium and strontium are so nearly alike (*5*). Otherwise, with a 5-g charge of material with 2 or 3% impurities, the yield of 99.5+% metal is 60–70% of the charge in about 4 hr when the pressure is 0.05

TABLE 1

Constituent	Run No. 1*		Run No. 2*		Run No. 3†		Run No. 4†	
	Initial %	Final %	Initial %	Final %	Initial %	Final %	Initial %	Final %
Al	> 1	T‡	> 1	ND	ND	ND	ND	T
Ba	ND§	T	ND	ND	0.03	T	0.03	T
Ca	0.05	T	0.05	T	0.5	T	0.5	T
Mg	T	T	T	T	0.3	T	0.3	0.05
Na	0.5	< 0.05	0.5	< 0.05	0.1	≅ 0.05	0.1	≅ 0.05
Si	0.1	T	0.1	T	ND	ND	ND	ND
Sr	ND	ND	ND	ND	> 1	1	> 1	0.5

* Electrolytically reduced metal.
† Thermally reduced metal.
‡ T = trace (< 0.02%).
§ ND = not detected.

micron. The constituents with higher vapor pressures than lithium are deposited beyond the lithium, and those with lower vapor pressures than lithium are either deposited before it or remain with the undistilled charge material.

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Differential Dietary Choices of Albino Rats Occasioned by Swimming[1]

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Claude Bernard (*1*) first enunciated the principle of the constant internal environment. Later Cannon (*2*) extended the concept in the field of physiology and spoke of the steady state, or homeostasis.

Richter (*3*) was the first to employ the concept of homeostasis in the area of behavior when he and his associates reported that rats were able to grow and thrive on a self-selected diet containing as many as 15 purified foodstuffs. Richter (*4*) also reported that when particular "part-regulators" of body balance were removed, such as the adrenal glands, the total organism through its behavior in a free dietary choice situation would compensate for the loss of the "part-regulators" and, in the case mentioned, would consume excessive amounts of sodium chloride and thus remain alive in spite of bilateral adrenalectomy. Similar observations on increased calcium and decreased phosphorus intakes of parathyroid-ectomized rats have been interpreted homeostatically by Richter and Eckert (*5*). Pancreatectomized rats were found to ingest large amounts of water and to select fats and protein and refuse carbohydrate, thus losing the symptoms of diabetes (*6*). From these and similar studies (*7, 8*), Richter and his associates concluded that behavior itself could act as a homeostatic mechanism for the total organism.

The present study was designed to investigate further the concept of homeostasis at the level of the total organism, the behavioral level. Specifically, we were interested to determine whether, after swimming in a tank of water until symptoms of exhaustion were evident, rats would choose between calorically useless saccharine and valuable dextrose.

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TABLE 1

COMPARISONS OF FOOD SELECTIONS OF TEN RATS ON MODIFIED SELF-SELECTION DIET PRIOR TO AND DURING SWIMMING

Food element	Av. intake during rest	Av. intake during swimming, cc	t	Level of significance
Dextrose	3.69 cc	43.00	11.30	Beyond 0.1%
Saccharine	3.46 cc	2.40	0.31	Not signif.
Water	20.53 cc	6.71	3.97	1%
McCollum	12.74 g	5.02	2.22	Not signif.

Ten Wistar inbred male albino rats, averaging 250 g body weight at the start of the study, were used as subjects. The diet of this group, a modified self-selection type, consisted of the following: in solution form —20% solution of dextrose, 0.15% solution of saccharine distilled water; in solid form—McCollum stock diet. The solutions were presented in 100-ml graduated inverted bottles affixed to specially constructed living cages. The solid was available in a nonspillable food cup placed within the living cage. The positions of the solutions were switched in a random manner to prevent establishment of position habits. Daily records were kept on the quality and quantity of dietary choices during an 8-day "rest period." Following this period was a 14-day interval during which the animals were swum daily in an inverted glass bell jar containing moderately warm water for an average of 1 hr 50 min, or until distress was evident.

Table 1 shows the average daily dietary selections of the 10 subjects during the 8-day rest period and the 14-day swimming period.

The data treated statistically, using the F and T tests, indicate that significantly more dextrose was consumed during the swimming period in comparison with the rest period. No significant differences were found in the amounts of saccharine and McCollum diet chosen during the two periods.

The results of this study make it apparent that rats will alter their dietary selections in relation to the requirements of the situation. They tend to prefer a calorically valuable substance to a similar tasting but calorically useless substance when forced to expend energy.

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