a cover glass. Preparations made thus may be kept under observation for a long time with little attention, except occasional moistening. With animals wrapped in the usual manner in wet cloth, preparations have been used in our laboratory for periods exceeding two hours. The method is so simple and obvious, the writer suspects that others must also have thought of it; but he makes bold to pass it on to those who may not have done so.

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THE DESIRABILITY OF HOMOZYGOUS MICE IN NUTRITION EXPERIMENTS

IT is pretty generally conceded that the Wistar strain of rats is preferable in nutrition experiments, so that the animals will be homozygous and also of the same strain in coordinating the work of different investigators. Mice are used mainly by bacteriologists, cancer workers and geneticists, but in the assay of hormones and the determination of the nutritive value of pure chemical substances it is sometimes possible to save thousands of dollars by using mice instead of rats. Yet no standard strain of mice has been generally adopted. Since, however, a number of papers have appeared, using the Bagg strain of homozygous albino mice (Cold Spring Harbor Station of the Carnegie Institution), it seems probable that Table 1, showing the growth rate (mean body weight and standard deviation) of Bagg albinos, quoted from our paper in "Science Reports of Tohoku Imperial University," April, 1935, should be of interest. A paper on the growth and chemical composition of the brain of Bagg albinos by Hideo Endo will also appear in the same reports at a later date. Although the mouse grows at a slower rate we have been able to produce marked rickets in the mouse on the same diet that produced rickets in the rat.

TABLE 1

BODY WEIGHTS AND STANDARD DEVIATIONS IN GRAMS

Day of age	Males		Females	
	Mean weight	S.D.	Mean weight	S.D.
1	1.313	.200	1.300	.200
2	1.506	.245	1.515	.200
3	1.754	.283	1.770	.316
4	2.090	.374	2.160	.316
5	2.452	.458	2.570	.436
6	2.880	.548	3.020	.557
7	3.300	.574	3.470	.781
8	3.770	.663	3.970	.761
9	4.205	.768	4.425	.894
10	4.670	.774	4.920	.974
11	5.020	.948	5.320	1.118
12	5.390	1.128	5.630	1.288
13	5.775	1.162	6.040	1.331
14	6.100	1.162	6.410	1.414
15	6.407	1.200	6.690	1.536
16	6.570	1.049	6.920	1.477
17	6.780	1.183	7.040	1.550
18	6.850	1.483	7.170	1.517
19	6.960	1.442	7.240	1.637
20	7.130	1.466	7.410	1.674
21	7.330	1.449	7.720	1.612
22	7.669	1.634	7.950	1.761
29	9.480	1.803	9.870	1.897
36	12.360	2.345	12.500	2.290
43	14.740	2.236	14.470	2.190
50	16.740	2.510	15.610	2.388
57	18.540	2.934	16.640	2.367

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SPECIAL ARTICLES

COMPARISON OF X-RAY AND GAMMA RAY DOSAGE[1]

NEED for a suitable correlation between x-ray and radium dosage had led us to extend our recent studies in the ionization produced in liquids by x-rays.[2] This note is for the purpose of giving briefly the results of some absolute measurements of the ionization produced in carbon bisulfide by gamma rays. Air ionization methods, while satisfactory for dosage measurements up to 200 kv, may be rendered ambiguous for higher frequency radiations because of lack of radiation equilibrium. A comparison of the physiological effects of different radiations ideally should be based on comparison of the numbers of ions produced in the tissue. In practice, one can make relative measurements in dielectric liquids nearly equivalent in density and atomic number to living tissue.

For gamma rays carbon disulfide is sufficiently near tissue (or wax) in atomic number and density to be considered equivalent. A combination of the two materials will, therefore, give an effectively homogeneous medium in which there will be radiation equilibrium and uniform mass absorption. Measurements were made of the gamma ray absorption in a layer 1 mm thick at the incident surface of a 25 cm cubical wax phantom. The ionization chamber con-

[1] Publication approved by the director of the National Bureau of Standards of the U. S. Department of Commerce.

[2] F. L. Mohler and L. S. Taylor, *Bureau of Standards Jour. Res.*, 13: 659, 1934.

sisted of two fine aluminum grids separated by a quartz disk 1 mm thick which had a 19 mm hole in the center. This was immersed in the liquid contained in a thin shallow glass dish which was in turn set into the wax surface. Fields up to 70,000 volts per cm showed that the "effective volume" was given by the geometric volume between the grids for separations from 0.5 to 2.5 mm. The radium, contained in a glass tube 8 mm long and .27 mm thick, was supported about 16 mm above the liquid surface and filtered with .75 mm brass plus 2 mm of bakelite. Applying approximate corrections for distance and filtration, the ionization produced by 1 mg of radium filtered with 1 mm of lead and at a distance of 1 cm from the wax surface was found to be 9400 e.s.u./cm³/hr. Assuming that the gamma ray absorption is proportional to the density of the liquid or gas and that the energy per ion pair is 24 electron volts as compared with 33 for air,[2] the above ionization would correspond to 6.9 roentgens per hour. Measurements made with the cell removed from the wax phantom showed the ionization to be almost entirely due to primary radiation. Similar measurements of the ionization produced in a mixture of CS_2 and ligroin (density = 1) by x-rays of equal doses generated at 120 kv and filtered with about .2 mm of copper gave an increase of about 30 per cent. due to back scattering as compared with 38 per cent. using a thimble ionization chamber calibrated in the usual manner. Since it is impossible to calibrate a thimble chamber for the radiation quality produced in the back scattering, the disagreement between the air and liquid measurements is not unexpected. Measurements made as here described in suitable liquids are independent of the radiation quality and hence the chambers need no calibration. While the above method seems well adapted to evaluating radium dosage in roentgens, the preliminary values given above are being investigated further in an endeavor to minimize the corrections.

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TRANSMISSION OF THE VIRUS OF POLIOMYELITIS TO MICE

THE purpose of this paper is to report the successful propagation and serial transmission of the virus of poliomyelitis in mice. The mouse was chosen for this study for reasons described by one of us.[1]

Three series of mice were exposed to short repeated doses of x-ray and then inoculated, both intracerebrally and intraperitoneally, with suspensions of the spinal cords of monkeys, who had succumbed to poliomyelitis. In the first series, the animals were irradiated daily for 10 days prior to inoculation. On the second day after inoculation, x-ray treatments were begun again and were given daily for 8 days. On the eleventh day after injection, all the mice showed ruffled hair, sluggishness and dragged their hind legs, either on that day or the following one. Four of the animals died on the eleventh day, one on the twelfth, three on the sixteenth and three on the seventeenth day after inoculation. Two were autopsied on the eleventh and twelfth days. A suspension of their brains, when inoculated into mice and a monkey, failed to produce reaction.

In the second series, on the eleventh and twelfth day after inoculation they showed ruffled hair, ataxia, sluggishness and dragged their hind limbs. The animals in this group died or were killed. A suspension of their brains produced similar symptoms after an incubation period of from 14 to 24 days, in 5 out of 8 untreated mice, which were injected. A monkey inoculated with this suspension showed a rise in temperature. Serial passages were carried out, using mouse brains as the inoculum. Thus far, the virus has been maintained through 17 generations. With succeeding passages, the animal response became more definite and the incubation period became shorter; so that by the fifth passage, a 10 per cent. suspension brought down all the animals after an incubation period of 3 days. Using more concentrated brain suspensions, the incubation period may be shortened to 2 days, and with diluted suspensions it may be lengthened to 7 days. By successive transfer, the infectivity of the virus has been increased, so that by the twelfth passage it was infectious in a dilution of 1:1000.

In the third group, 4 out of 7 mice, inoculated with the brain material of irradiated mice that had succumbed, showed symptoms similar to those of the mice in the second series. Fifty control animals that were exposed to x-ray, but were not injected, developed no symptoms, although some of them received twice as many x-ray treatments as did the inoculated mice. When the filtrate of the suspension of the brains of 2 of the animals that came down with the aforementioned symptoms was injected into 8 untreated mice, 7 of them showed the usual hyperirritability, ataxia, sluggishness, ruffled hair and humped back. A monkey, inoculated with this filtrate, ran a typical course of poliomyelitis, with a characteristic histopathological picture in the cord. In the next passage, all twelve mice injected showed symptoms after an incubation period of 3 to 4 days. This series has undergone 14 transfers with changes of infectivity and incubation period, similar to those of the preceding series.

[1] M. Brodie, *Proc. Soc. Exp. Biol. and Med.*, March, 1935.