Results similar to those described above have already been noted in experimental studies on the production of skin tumors. Mottram[6] found that painting mice with 3:4 benzpyrene and irradiating them on the sixtieth day with a dose of 176 to 1,584 r gamma radiation produced both benign and malignant tumors of the skin. No tumors followed painting for the same period without irradiation. Similar results were obtained by Mayneord and Parsons[7] by the combined application of x-rays and a different carcinogen. They observed that irradiated and painted mice developed sarcomas at an earlier date and in greater numbers than the non-irradiated mice. Gilmour[8] obtained similar results by the combined application of estrone and 3:4 benzpyrene. The follicular sex hormone alone did not produce cutaneous tumors.

These observations indicate that subthreshold doses of different carcinogens may summate, or that one may sensitize tissues for the action of the other. The essential similarity of leukemia and accepted types of cancers is again emphasized by these experiments. The same agents differently spaced and dosed may produce either predominantly leukemia or the more accepted types of cancers. The mechanism of summation of carcinogenic stimuli deserves further experimental study.

CONCLUSION

Both x-rays and methylcholanthrene are leukemogenic. The leukemogenic action of small doses of methylcholanthrene is greatly enhanced by pre-irradiation with doses of x-rays which alone rarely produce leukemia. The leukemogenic action of x-rays is milder than that of methylcholanthrene and affects a smaller number of mice after a longer period of latency.

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THE COMPARATIVE NUTRITIVE VALUE OF BUTTER AND SOME VEGETABLE FATS[1]

IT has been generally accepted by nutritionists that, aside from differences in vitamin potencies, all fats have essentially the same nutritive value. An exception to this is the specific rôle played by those fats which contain certain unsaturated fatty acids.[2] Schantz *et al.*[3] have recently postulated that butter is more effective than vegetable oils in producing growth in weanling rats presumably due to long chain saturated fatty acids, although in a recent report the superiority of butter over corn oil was observed only when the dietary carbohydrate was lactose while conditions were reversed when carbohydrates other than lactose constituted the carbohydrate portion of the diet.[4]

We have followed the rate of growth of 21-day weanling rats for six or 12 weeks on diets composed of 68 per cent. of mineralized skim milk powder and 32 per cent. of the fat under study with supplements of vitamins A (as carotene and A), D and E added to the fats. Corn, cottonseed, olive, peanut and soybean oils were tested as well as butter and vegetable margarine fat. In one series where vegetable margarine fat and butter fat only were compared over a six-week period no differences in growth rate were noted. A total of 46 male rats and 89 female rats were used in these tests. In series II, where groups of approximately 15 male and 15 female rats were fed for 12 weeks diets containing each of the seven fats listed above, no differences were found in the growth at three or six weeks or with the males at 12 weeks. The female rats receiving the butter diet weighed slightly more at 12 weeks, but the difference was not significant statistically. However, in series III where diacetyl was added to the vegetable fats in an amount of 4 parts per million, no differences of weight were noted at any interval either in the males or females. The same number of rats was used as in series II. Not only was the growth rate identical as demonstrated by body weight but bone growth was also equal as found by x-ray measurements of tibia length at the end of three and six weeks on the respective diets. Also no significant differences were obtained in the water, protin, lipid, ash and calcium content of the rats which had received the various diets for 12 weeks. This would prove that the equal growth was actually due to similar tissue growth.

One explanation for the discrepancies between our results and some of those where *ad lib.* feeding is employed[3] is in all probability to be traced to the fact that weanling rats prefer a butter flavor and will eat more of such a diet. In experiments where the rats had a choice of a diet containing margarine fat or peanut oil with or without diacetyl, the rats ate more of the diacetyl-containing diets 18 times and of the unflavored diets in only one instance. Also in tests on twelve weanling rats carried out over 12 weeks, where both an unflavored peanut oil diet and one containing commercial butter flavor[5] were offered the rats, a decided preference was invariably shown for the

[6] J. C. Mottram, *Am. Jour. Cancer*, 30: 746, 1937.
[7] W. V. Mayneord, L. D. Parsons, *Jour. Path. and Bact.*, 45: 35, 1937.
[8] M. D. Gilmour, *Jour. Path. and Bact.*, 45: 179, 1937.
[1] This work was carried out under a research grant from The Best Foods, Inc.
[2] G. O. Burr and M. M. Burr, *Jour. Biol. Chem.*, 82: 345, 1929; 86: 618, 1930.
[3] E. J. Schantz, C. A. Elvehjem and E. B. Hart, *Jour. Dairy Sci.*, 23: 181, 1940.
[4] R. K. Boutwell, R. P. Geyer, C. A. Elvehjem and E. B. Hart, *Jour. Dairy Sci.*, 26: 429, 1943.
[5] Verley "B F A."

flavored diet by eight of the rats, while almost equal quantities of the two diets were consumed by the other four rats. In no single case is there any evidence of a preference for the unflavored diet.

These experiments indicate that on an adequate vitamin intake the fats studied are of equal nutritional value for growing rats. They explain how the greater growth of weanling rats on a butter diet in experiments where *ad lib.* feeding is employed may result simply from a greater food consumption due to the preference of rats for butter flavor. Diets containing all these fats were used with equal efficiency in transformation to body tissue.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

A SIMPLE AND EFFICIENT CALOMEL HALF CELL

SOME fifteen years ago a co-worker was told to prepare a calomel half cell using a glass filter tube on the

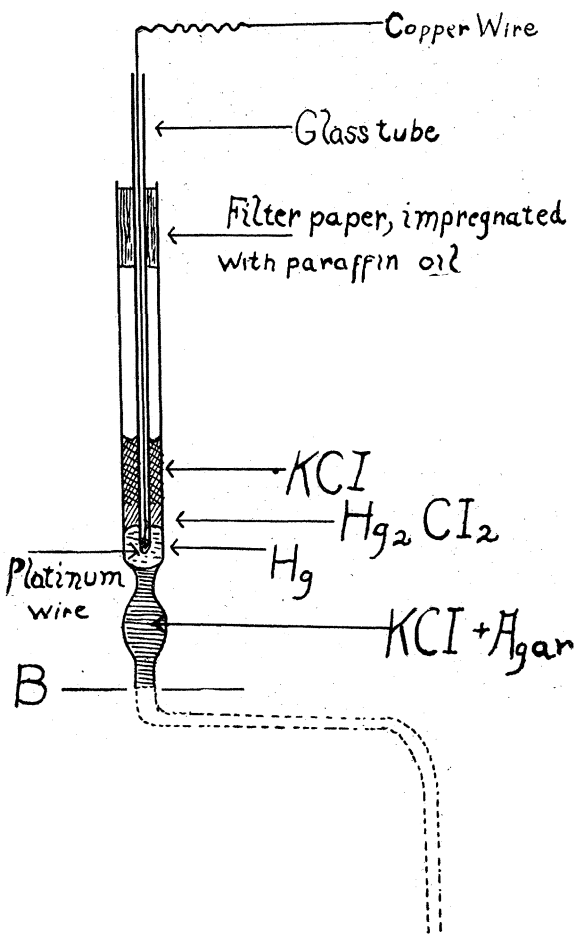

FIG. 1

end of the siphon connecting the cell and the analysis vessel. He covered the glass filter plate with the mercury, added the calomel and the KCl solution and inserted this electrode directly into the analysis vessel. Evidently, as he stated afterwards, he had suffered from temporary absence of mind, for that electrode could not be expected to work. But the half cell too was absent-minded: it worked. The thin moisture layer on the glass surface was sufficient to form a conductive bridge between the calomel-KCl suspension above the mercury and the filter plate below it.

I remembered this fact later when needing a standard half cell, but lacked the usual implements to construct it and had not the possibility of acquiring them. Here it is (see Fig. 1); it needs only 0.5 ml of mercury, works perfectly and may be useful in teaching and research laboratories. The half cell may be inserted in a flask containing an indifferent solution and connected with the analysis vessel by a siphon; in this case its end (B) may be closed by agar or by a stopper of cotton or filter paper.

To be introduced directly into the analysis vessel, the bottom end has the form indicated by the dotted trace.

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BOOKS RECEIVED

COBB, STANLEY. *Borderlands of Psychiatry.* Harvard University Monograph in Medicine and Public Health Number 4. Illustrated. Pp. xiv + 166. Harvard University Press. $2.50.

DEGERING, ED. F. *An Outline of the Chemistry of the Carbohydrates.* Illustrated. Pp. viii + 474. John S. Swift Co. $6.00.

DODGE, BERNARD and HAROLD W. RICKETT. *Diseases and Pests of Ornamental Plants.* Illustrated. Pp. xi + 638. The Jaques Cattell Press. $6.50.

GRANT, J. C. BOILEAU. *An Atlas of Anatomy.* Volume 1. Illustrated. Pp. xv + 214. Williams and Wilkins Company. $5.00.

HARRELL, RUTH FLINN. *Effect of Added Thiamine on Learning.* Pp. v + 55. Bureau of Publications, Columbia University. $1.75.

SCHOPFER, W. H. *Plants and Vitamins.* Illustrated. Pp. xiv + 293. Chronica Botanica Co. $4.75.

STRONG, OLIVER S. and ADOLPH ELWYN. *Human Neuroanatomy.* Illustrated. Pp. x + 417. Williams and Wilkins Co. $6.00.

Woods Hole Oceanographic Institution. *Collected Reprints.* 1942.