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**A note on the prevention of experimental low-phosphorus rickets in rats by the subcutaneous administration of potassium phosphate.**

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It is now well established that rachitic lesions of the bones may be readily produced in rats by a regimen deficient in available phosphate. With the standard Diet 84 in use in this laboratory, the minimal protective addition of  $K_2HPO_4$ , in the absence of effective light rays or specific antirachitic substances is in the neighborhood of 0.4 grams per cent of the diet—an amount equivalent to 75 mg. of phosphorus. The addition of 50 mg. protects in some individuals, but is on the border line.<sup>1</sup>

It seemed of interest to ascertain whether the subcutaneous administration of inorganic phosphate also conferred protection; and if so, to make at least a rough quantitative comparison of the amount required with that necessary when administered with the food.

A solution of  $K_2HPO_4$  was made up to contain approximately 5 mg. of phosphorus per cc. Actual analysis by the Briggs' modification of the Bell-Doisy method showed the solution to contain 4.85 mg. per cc.<sup>2</sup> The solution was sterilized, and kept in stoppered vaccine bottles to prevent evaporation. Graded amounts were injected 6 days a week over a period of 28 days. There was no local reaction, and the fluid was rapidly absorbed. Two litters of known stock (Gies) comprising 14 individuals, were used for the experiment. Three rats died before the termination of the experiment, and are not included.

The dosage and results are shown in the accompanying table.

<sup>1</sup> Pappenheimer, A. M., McCann, G. F., and Zucker, T. F., *J. Exp. Med.*, 1922, **xxxv**, 421.

<sup>2</sup> I am indebted to Miss Margaret B. Gutman for carrying out the analysis.

Rat No.	Litter No.	Diet	Days on diet	Amount of $K_2HPO_4$ solution injected (1 cc. $\equiv$ 4.85 mg. of P)	Total amount of P injected	Rickets		X-ray
						Initial weight	Final weight	
9012	C 5	84	28	—	—	45 gm.	50 gm.	+++++
9013	C 5	84	28	1.0 cc.	111.55	46	50	+++—
9014	C 5	84	28	0.8	89.24	62	74	±
9015	C 5	84	28	0.6	66.93	52	64	+
9016	C 5	84	28	0.6	66.93	60	64	+
9017	C 5	84	28	0.6	66.93	55	60	+
9018	C 5	84	28	0.4	44.62	50	58	++ healing
9019	C 5	84	28	0.2	22.31	42	48	++
9021	C 6	84	28	—	—	43	44	++
9023	C 6	84	28	0.6	66.93	50	56	++
9025	C 6	84	28	0.2	22.31	42	50	++

It is seen that complete protection was afforded by injections of 1 cc. of the solution, equivalent to an average daily dose of 3.98 mg. of phosphorus. The total amount administered during the 28 day period of the experiment was 111.55 mg. Injection of lesser amounts gave only incomplete protection.

Data as to the phosphorus retention of rats on Diet 84, with and without cod liver oil or light treatment, are available from the published analyses of McCann and Barnett.<sup>3</sup> Their table shows that the mean total phosphorus content of the bodies of four untreated rachitic rats, was 203 mg.; and of 5 treated rats on the same diet, 306 mg. There was thus, under the influence of these prophylactic agents, an additional total retention of 103 mg. of phosphorus, or an average daily retention of 3.7 mg.

This figure corresponds in an interesting way with the above figure of 3.9 mg., needed to afford protection by subcutaneous injection.

The average daily food consumption of two rats (Nos. 111 and 116) on Diet 84 plus 0.4 per cent  $K_2HPO_4$ , was found to be 8.94 and 8.86 gm. respectively. This corresponds to an approximate daily intake of 6.7 mg. of added phosphorus—an amount which may be taken as the minimal protective dose per cc. If this estimate holds true for a larger series, one may consider the protective *subcutaneous* dose as approximately 60 per cent of the amount required when administered with the food.

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#### A comparative cytological study of the neoplasms of animals and plants.

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The attempt to compare animal cancer and plant overgrowths must involve a cytological study of their respective tissues. For animal cancer three cases of epithelioma were mainly studied

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<sup>3</sup> McCann, G. F., and Barnett, M., *J. Biol. Chem.*, 1922, liv, 203.