

The changes in arterial pressure were similarly recorded when variations were artificially produced in the thoracic cavity. Similar latent periods were observed.

These experiments were repeated upon animals with denervated hearts and the same observations made, excluding a nervous factor.

It is evident that the effects of inspiration may show up entirely in expiration and the effects of expiration in the succeeding inspiration. The heart-respiration ratio determines in what phase of respiration the various changes will appear.

Many published arterial pressure tracings have been examined and it has been found that this explanation is quite valid in interpreting them.

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##### Production of rickets and osteoporosis on diets of purified food substances.

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In experiments on rickets, osteoporosis and xerophthalmia by my students and myself, white rats belonging to litters 1-150 were fed diets 1-467. In most of these white flour was an ingredient but some were made of purified food substances. It was found that a group of vitamins known as Vitamin A were all contained in the cod liver oil used; that commercially dehydrated spinach, or spinach dried in the laboratory at a low temperature, contained a growth promoting Vitamin A, and prevented xerophthalmia, but had no detectable antirachitic effect. Its effect in preventing osteoporosis was extremely small, and since the spinach contained calcium it was very difficult to decide whether the effect was due to calcium or due to vitamin. Extracts made from this spinach also failed to show antirachitic and antiosteoporotic effects. Vitamin B was derived from bakers' yeast. In most of these series of experiments, the antirachitic vitamin was kept low and constant while the calcium

and phosphorus were varied. Results confirm those of Sherman and Pappenheimer as well as those of Osborne, Mendel and Park. It has not been possible so far, however, to show that rickets depended on any ratio of calcium to phosphorus, the most striking result being that low calcium produces osteoporosis and low phosphorus produces rickets.

Diagnosis of rickets was made by Dr. C. M. Jackson<sup>1</sup> in the earlier experiments. By comparing the diagnosis made by Dr. Jackson on gross and microscopic pathology with x-rays taken the same day, a basis of interpretation was made of x-rays, and x-rays were used for diagnosis in the later experiments. It is not possible to record all these experiments but the following is given as an example. Ca was added as CaSO<sub>4</sub> and P as KH<sub>2</sub> PO<sub>4</sub>. The weights in each diet were planned to add up to about 100.

	Osteoporosis Mild Rickets	Osteoporosis	Osteoporosis	Mild Rickets	Normal	Normal
Lactalbumin	10	10	10	10	10	10
Vitamin B	5	5	5	5	5	5
Antiophthalmic vitamin	1	1	1	1	1	1
P	.2	.35	.5	.2	.3	.5
Ca	.2	.2	.2	.8	.8	.8
Other salts	2	2	2	2	2	2
Starch	62	61.7	61.4	60	59.7	59.4
Triolein	20	20	20	20	20	20

In the above table it is noticed that osteoporosis occurred on low calcium diets and mild rickets occurred on low phosphorus diets. Unfortunately, these diets contained a small amount of antirachitic vitamin but this was constant for all of the diets recorded in the table.

The rats were kept in a north room with glass windows closed all of the time. The mothers were fed on Steenbock's rat diet with the substitution of fresh milk by whole milk powder. The young, when 21 days old, weighed about 30 gm. and were placed on the special diets and allowed to remain for 30 days.

<sup>1</sup> Jackson and Carleton, *Am. J. Physiol.*, 1923, lxy, 1.