and pronounced in the double operated injected animals.

Summary. Within 48 hours, parathyroidectomy lowers the serum Ca in non-nephrectomized mature rats from 10.7 to 8.3 mg %. In the same period of time the serum Ca in nephrectomized-parathyroidectomized rats decreases from 9.6 to 6.5 mg %.

The injection of 5×20 units of PTH into normal rats, after 48 hours produces an average elevation of the serum Ca of 1.5 mg %. The injection of the same quantity of PTH into parathyroidectomized-nephrectomized rats, after the same time produces an average elevation of the serum Ca of 4 mg % (from 6.5-10.5 mg %). Although these experiments prove that PTH raises the blood Ca without the intermediation of the kidneys, they do not exclude the possibility that the hormone may under normal conditions also affect renal function.

Conclusion. (1) The serum Ca elevating activity of the parathyroid hormone is demonstrable in bilaterally nephrectomized rats. (2) Confirming previous observations, it has been found that "osteitis fibrosa" is produced by PTH injection in the absence of the kidneys.

The author wishes to express his thanks to Mrs. Claudia Schogoleff for her technical assistance.

Since this paper was submitted, there has appeared a paper by Ingalls, Donaldson and Albright (*J. Clin. Invest.*, 1943, **22**, 4) showing that injections of PTH in nephrectomized rats produces more severe skeletal lesions than those which result from nephrectomy alone.

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B Vitamins in Germinating Seeds.*

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In the course of studies on the B vitamin contents of foods, it was noticed that samples of fresh corn, peas and beans contained greater amounts of certain B vitamins than did the dried seeds. This suggested that the B vitamin levels in these seeds might be related to their metabolic activity.

Germination of various seeds is known to be accompanied by increases in ascorbic acid and thiamin content.[1-4] Experiments were therefore begun to determine whether this was also true for the other B vitamins.

Samples of blackeyed peas, lima beans and cotton seeds were allowed to germinate in covered Petri dishes between layers of moist filter paper. The temperature was maintained at approximately 30° for periods of 36 and 48 hours. At the end of the germination period the seeds were ground, digested with takadiastase and papain according to the general enzyme procedure of Cheldelin, Eppright, Snell and Guirard,[5] and assayed for 8 B vitamins. Microbiological methods of assay were employed throughout.[6] The results are shown in Table I.

Comparisons are made on the dry weight basis, in order to compensate for differences in moisture content. Although many samples which absorb large amounts of water during germination do not appear to gain in

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1 Biswas, H. G., and Das, K. L., *Science and Culture*, 1938, **4**, 360.

2 Muthanna, M. C., and Ahmad, B., *Current Sci.*, 1940, **9**, 320.

3 Mentzer, C., *Bull. soc. chim. biol.*, 1940, **22**, 444.

4 Rytz, W., Jr., *C. R. Soc. Biol.*, 1938, **129**, 814.

5 Cheldelin, V. H., Eppright, M. A., Snell, E. E., and Guirard, B. M., *The University of Texas Publication*, 1942, No. 4237, 15.

6 Williams, R. J., *The University of Texas Publication*, 1941, No. 4137, 7.

TABLE I.
B Vitamin Content of Seeds.
(γ/g on dry weight basis.)

	Blackeyed Peas					Lima Beans					Cotton Seed		
	Content			Increased %		Content			Increased %				
	Before germination	After germination 36 hr	After germination 48 hr	36 hr	48 hr	Before germination	After germination 36 hr	After germination 48 hr	36 hr	48 hr	Before germ.	After germ. 36 hr	% Inc.
Dry wt, %	95	36	43			92	19	41			84	53	
Contents:													
Thiamin	8.5	12	11	41	30	5.8	4.7	4.8	—19	—17	3.2	4.9	53
Riboflavin	1.5	3.9	3.9	160	160	1.4	2.4	2.4	71	71	2.3	2.8	22
Nicotinic Acid	14	24	51	71	260	11	16	26	46	140	16	24	50
Pantothenic Acid	11	13	17	18	55	9.0	11	20	22	122	11	22	100
Pyridoxin	2.0	3.3	4.6	65	130	6.0	6.7	9.5	12	58	0.91	2.6	190
Biotin	0.22	0.31	0.41	41	86	0.11	0.16	0.20	46	82	0.29	0.28	— 3
Inositol	2600	4400	4600	69	77	1800	3100	3800	72	110	3400	2800	—18
Folic Acid	7.8	4.6	4.2	—41	—46	3.6	2.7	4.2	—25	17	3.8	7.9	110

vitamin content, actually they are found to increase appreciably when only dry weights are considered.

It is apparent from Table I that the effect of germination on vitamin levels varies considerably for the different vitamins studied. A large increase in nicotinic acid is recorded upon germination. Riboflavin, pantothenic acid, pyridoxin, biotin and inositol also show appreciable increases in at least 2 of the seeds tested. Thiamin is a borderline case; it increases somewhat in peas and cotton but decreases in lima beans. Folic acid is seen to decrease considerably in peas, but there is a marked increase of this vitamin during the germination of cotton seed.‡

The increases in the rates of synthesis of the various vitamins also differ. Thus, thiamin and riboflavin do not appear to be synthesized in peas or beans after 36 hours of germination; the amounts present remain constant. The inositol contents also appear to be approaching a maximum after 48 hours. Nicotinic acid, pantothenic acid and pyridoxin, on the other hand, seem to be synthesized more slowly at first, but increase markedly between 36 and 48 hours. Biotin is intermediate.

The B vitamin levels of corn and beans at different stages of development have also been determined. The results are shown in Table II. The samples were taken from neighboring plants of the same age. The seeds were divided into 4 age groups representing progressive stages of growth. These are characterized in Table II according to the moisture content, the size of the ears of corn and bean pods. The age groups are designated as Age 1, 2, 3 and 4, respectively.

It is of interest to note that the percent of solids is less in the second age group than in the first. The reason for this is not apparent.

With both corn and beans most of the vitamins reach a concentration peak at the

‡ Since this manuscript was originally prepared a study similar to the present one has been reported by Burkholder.[7] The results, insofar as they are comparable, are in generally good agreement with our own.

7 Burkholder, P., *Science*, 1943, **97**, 562.

TABLE II.
B Vitamins in Corn and Beans at Different Stages of Development.
(γ/g on dry weight basis.)

	Corn (Golden Bantam)				Beans (Bush Lima)			
	Age I	Age II	Age III	Age IV	Age I	Age II	Age III	Age IV (Seeds)
Dry weight, %	15	7.8	26	70	31	21	82	92
No. specimens sampled	2 ears	3 ears	2 ears	1 ear	6 pods	6 pods	6 pods	1 lb
Avg wt per ear, g	5.7	26	87					
Wt corn per ear, g	3.6	12	31					
Length of pods, inches					1-1½	3	3	
Contents:								
Riboflavin	3.9	5.5	4.0	1.5	2.2	4.1	1.4	1.4
Nicotinic Acid	59	94	59	17	28	42	17	11
Pantothenic Acid	20	17	12		25	40	35	9.0
Pyridoxin	2.9	3.7	1.4	7.6	1.7	3.0	2.7	6.0
Biotin	1.3	1.4	0.35	0.21	0.25	0.39	0.41	0.11
Inositol	1500	2900	1500	1500	2000	4100	1600	1800
Folic Acid	5.0	7.9	2.8	1.6	13	18	5.7	3.6

second age of development, after which they decline steadily as the seeds mature. Pantothenic acid is seen to decline from the start in corn.

Pyridoxin is exceptional in that it is present in the highest concentration in the mature seeds. It is possible that pyridoxin may be a storage form of this vitamin and that pseudopyridoxin[8] may be the active form in the young plant.

Summary. Germination of seeds is accompanied by increases in the content of most B vitamins. The increases are greatest for nicotinic acid, followed by pyridoxin, pantothenic acid, riboflavin, inositol and biotin in approximately the order named. Thiamin is a borderline case. Folic acid is seen to decrease substantially in peas and in one sample of lima beans.

Contents of B vitamins in growing corn and beans are found to reach a peak at a relatively early stage of development, after which the amounts present decrease steadily as the seeds mature.

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[8] Snell, E. E., Guirard, B. M., and Williams, R. J., *J. Biol. Chem.*, 1942, **143**, 519.

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Pantoyltaurine and Growth of Rats.

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It has been shown by Snell[1] and by McIlwain[2] that N-(a-γ-dihydroxy-β-β-dimethyl butyryl Taurine (pantoyltaurine)) inhibits the growth of certain bacteria which require pantothenic acid as an essential nutrient. The inhibition was reversed by the addition of large amounts of pantothenic acid. In analogy to the relationship between pyridine-3-sulfonic acid and nicotinic acid[3] it was as-

[1] Snell, E. E., *J. Biol. Chem.*, 1941, **141**, 121.

[2] McIlwain, H., *Biochem. J.*, 1942, **36**, 417.

[3] McIlwain, H., *Brit. J. Exp. Path.*, 1940, **21**, 136.