Both (1) and (2) above are contrary to Liebig's "law." Lagatu and Maume's results show that whatever effect the absence of an element from a fertilizer has on the yield, *it is not due to a depression of absorption of the other elements, but, on the contrary, to a nutritional lack of balance due to increased absorption of the remaining elements.*

It will be of interest to know if the remarkable results obtained by Lagatu and Maume in the case of the vine will be found to be true also for other plants. This point is now under examination for apple-trees grown under controlled conditions.[12]

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EXPERIMENTAL INFECTION OF RATS WITH THE BALANTIDIUM FROM THE PIG[1]

THE following observations were made during an attempt to obtain an experimental infection of *Balantidium* in the rat, in order that some of the relations of this parasite to the diet of the host might be studied.

So far as the available literature shows, no previous attempt has been made to infect rats with the *Balantidium* from the pig. Pritze (1928)[2] says that Nöller (1926)[3] has raised the question as to whether or not the *Balantidium* of the Norway rat may have been acquired from the pig. Nöller's article has not been available, but with its exception it appears that no *Balantidium* has ever been noted in the rat. Scott (1927)[4] listed thirty-two species of this genus but not one of them from the rat.

Experimental infections of the *Balantidium* from the pig have been established in the monkey by Brumpt (1909),[5] by Hegner (1926)[6] and Rees (1927)[7] in the guinea-pig. According to Hegner (1927),[8] Ohi (1923)[9] was unable to infect the guinea-pig, rabbit and dog with pig material.

[12] W. Thomas and R. D. Anthony, *Proc. Am. Soc. Hort. Sci.*, pp. 81–87, 1926.

[1] From the department of protozoology, Johns Hopkins School of Hygiene and Public Health. This work was aided by a grant from the committee on scientific research of the American Medical Association.

[2] F. Pritze, 1928, *Zeit. f. Parasitenkunde*, 1: 345–415.

[3] W. Nöller, 1926, "Tierheilk. u. Tierzucht.," pp. 88–95.

[4] M. J. Scott, 1927, *Journ. Morph. and Physiol.*, 44: 417–453.

[5] E. Brumpt, 1909, *C. R. Soc. Biol.*, 67: 103.

[6] R. W. Hegner, 1926, *Amer. Journ. Hyg.*, 6: 593.

[7] C. W. Rees, 1927, SCIENCE, 66: 89–91.

[8] R. W. Hegner, 1927, "Host-Parasite Relations Between Man and His Intestinal Protozoa." New York. 184 pp.

[9] T. Ohi, 1923, *Taiwan Igakkai Zasshi*, 229: 19–20.

At the suggestion of Dr. H. L. Ratcliffe, 0.5 cc of a culture of the *Balantidium* from the pig, concentrated by centrifugation, was injected into the cecum of a rat, after laporatomy. This rat had been fed a stock diet, high in carbohydrate content, to which was added carrots. Examination of the cecum of this rat, which was killed two days later, revealed many balantidia, all trophozoites, including some dividing forms.

Attempts were made to infect a number of rats. Two methods were used and the material was derived from two sources. The first was to inject into the cecum of laporatomized rats under aseptic conditions, trophozoites of *Balantidium*, either from cultures which had been concentrated by centrifugation, or from the colon of the pig. In the second method, material from the colon of the pig was strained through cheesecloth. Rats were given five or six cubic centimeters of this strained liquid material by stomach tube. Material of this sort was used in the first method.

Results obtained by the two methods were as follows:

Source of material	Method of injection	No. animals injected	Positive for *Balantidium*	Negative for *Balantidium*
Cultures	Intracecal	22	9	13
Colon of the pig	"	14	2	12
Colon of the pig	Stomach tube	12	8	4
Total		48	19	29

These infections lasted from two to twenty-three days. Some of the rats were killed before examination which showed them to be positive, and it is quite probable that, had these rats been examined by operation and allowed to live, the infections would have persisted for a longer time.

The parasites were localized in the cecum of the rat. Dividing forms were found frequently. Daily examination of pellets obtained from the rectum of two rats, which were known to be positive, when carried on over a period of five days, failed to show any cysts. On one occasion trophozoites were found in a soft, mushy pellet.

Attempts to infect four rats with the cysts of *Balantidium* from the monkey were negative. Negative results were obtained in an attempt to infect four rats with the *Balantidium* from the guinea-pig.

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