18. Ratnoff, O. D., *J. Exp. Med.*, 1948, v88, 401.

19. Clark, D. G. C., Cliffton, E. E., and Newton, B. L., PROC. SOC. EXP. BIOL. AND MED., 1948, v69, 276.

20. Christensen, L. R., and MacLeod, C. M., *J. Gen. Physiol.*, 1945, v28, 559.

21. Anson, M. L., *ibid.*, 1938, v22, 79.

22. Somogyi, M., *J. Biol. Chem.*, 1938, v125, 399.

23. ———, *ibid.*, 1945, v160, 61, 69.

24. Tagnon, H. J., Levenson, S. M., Davidson, C. S., and Taylor, F. H. L., *Am. J. Med. Sci.*, 1946, v211, 88.

25. Macfarlane, R. G., and Biggs, R., *Lancet*, 1946, v2, 862.

26. Kaplan, M. H., *J. Clin. Invest.*, 1946, v25, 331.

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Strain Differences in Response of Mice to Mammary Gland Stimulating Hormones.* (23129)

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Most species of mammals require a combination of progesterone and estrogen to obtain full development of the mammary gland while in a few species, notably the guinea pig and the monkey, estrogen alone will cause complete development(1). Possible strain differences in mammary gland growth responses within a species are less well known. In studies on mammary cancer susceptibility in mice, strain differences have been found to exist. Also Richardson(2,3) and Richardson and Cloudman(4) have reported variation in extent of rudimentary duct development in various inbred strains of male mice. Mixner and Turner(5) have used ovariectomized virgin albino mice rather extensively in experiments on factors responsible for and influencing mammary lobule-alveolar growth. In these studies a single strain of albino mice had been used. In subsequent studies a second strain of mice showed a marked difference in mammary growth responsiveness as compared to the first strain of mice. Other strains of mice were then tested in this respect.

The present paper deals with strain differences in the mammary lobule-alveolar growth responsiveness of mice to estrone in conjunction with both progesterone and pituitary mammogenic lobule-alveolar growth factor.

Procedure. Two anterior pituitary extracts and progesterone were assayed for their ability to promote mammary lobule-alveolar growth in 4 strains of mice. Our original strain of albino mice (designated "Schwing") were obtained from Edward Schwing, Harrison, Ohio, who stated that his strain of mice was started about 1906 from a pair of mice. A second strain of mice (designated "Swiss") was obtained from Rockland Farms, New City, N. Y. The third strain of mice (designated "Kansas") was obtained from Mrs. Ray Whitehouse of Hardtner, Kansas, who stated that the original pen of mice was obtained from James W. Howck & Co., Tiffin, Ohio. The last strain of mice (designated "Sutter") was obtained from Arthur Sutter, Springfield, Mo., who advertised them as "Rockland All-Purpose Strain White Mice." The criterion of response in the assay method used was the per cent of ovariectomized mice showing a minimal mammary lobule-alveolar growth response after 10 daily injections of standard anterior pituitary preparation or progesterone, each injected in conjunction with a daily dose of 0.75 μg estrone. A mouse unit of mammogenic material is that amount of material required per mouse which will cause 50 $\pm$ 10% of 10 or more mice to show this minimal stimulation of the mammary glands.

Results. Mice of the 4 strains selected

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TABLE I. Mammary Gland Growth Responses of Various Strains of Mice.

Preparation and total dosage* (mg)		Mice: Strain	Mice: No. of animals	Mammary lobule-alveolar responses: +	Mammary lobule-alveolar responses: —	Mammary lobule-alveolar responses: % positive
Lot 13, initial ext. of ant. pituitary, stockyard cattle	7.5	Schwing	35	18	17	51.4
	"	Swiss	15	8	7	53.3
	"	Kansas	11	3	8	27.3
	"	Sutter	11	3	8	27.3
	15	"	13	7	6	53.8
Lot 15, acetone-ether, dried ant. pituitary, pregnant cattle	15	Schwing	27	14	13	51.9
	"	Kansas	12	1	11	8.3‡
	"	Sutter	34	9	25	26.5‡
Progesterone	1	Schwing	21	10	11	47.6
	1	Swiss	15	4	11	26.7
	1	Kansas	12	1	11	8.3‡
	1	Sutter	24	6	18	25.0†
	2	"	12	6	6	50.0

* Plus 0.75 μg estrone/day.
† Response is significantly different from the Schwing strain at the 5% level.
‡ ——————————*Idem*—————————— 1% " .

were each injected with a total of 7.5 mg of Lot 13, initial extract of anterior pituitary, stockyard run of cattle, which amount was a mouse unit according to assays using the Schwing strain. In addition a second group of Sutter mice received 15.0 mg or 2 mouse units of this same extract per mouse (Table I). The Schwing and Swiss mice gave assay responses of 51.4% and 53.3% respectively while the Kansas and Sutter mice each gave 27.3% positive responses indicating that their magnitude of response was about one-half that of the first two strains. By doubling the dose (15 mg) for the Sutter mice, unit assay response (53.8%) was obtained.

Mice of the Schwing, Kansas and Sutter strains were each injected with a total of 15 mg of a second anterior pituitary preparation designated Lot 15, acetone-ether dried anterior pituitary, pregnant cattle, which amount was a mouse unit according to the Schwing mice assay (Table I). The Kansas and Sutter mice gave responses of 8.3% and 26.5% respectively, indicating again that their magnitude of response was one-half (or less) that of the Schwing strain of mice.

Mice of all strains were injected with a total of 1 mg of progesterone, this being a mouse unit according to the assay on Schwing mice. A second group of Sutter mice received 2 mg or 2 mouse units of progesterone (Table I). The Sutter, Swiss, and Kansas mice gave 47.6, 26.7, 8.3, and 25.0% mammary responses respectively with 1 mg of progesterone. The Kansas and Sutter mice responded in a similar manner to that of the previous experiments, the Swiss mice being inconsistent in this respect. The difference in mode of action of progesterone and anterior pituitary factor could readily account for the differing response of the Swiss mice to these preparations. It is interesting to note that the Sutter mice gave a control assay response (50%) with 2 mg (2 mouse units) as they did similarly with 15 mg (2 mouse units) of the first pituitary preparation.

A chi-square statistical analysis was used to determine whether the individual and collective responses of each of the Swiss, Kansas, and Sutter strains of mice differed significantly from that of the control Schwing strain (Table I). From this analysis it may be concluded that the mammary growth responses of the Kansas and Sutter strains differed in a highly significant manner ($P<0.01$) from the Schwing strain responses. The difference in the way the Swiss strain responded to anterior pituitary extract and progesterone, makes a comparison of the Swiss strain to the Schwing strain inconclusive.

Discussion. The cause or causes of these strain differences in mice in mammary gland growth responses are not known. It is possible that in some strains of mice the mam-

mary gland cells are more refractory to their direct growth stimulus than in other strains. This might be the case with the strains of mice which were deficient in their response to anterior pituitary materials. Since progesterone exerts its mammary growth effect through the anterior pituitary, it is possible that in some strains the pituitary is not optimally stimulated by progesterone, poorer mammary growth resulting. Further studies will have to be made to determine the possible roles of other endocrine glands such as the thyroid in the observed deficiencies in mammary growth.

Summary. Four strains of albino were studied as to mammary lobule-alveolar growth responses to anterior pituitary preparations and progesterone. Statistically significant differences in strain responses were found. The Schwing and Swiss strains of mice were definitely superior to the Kansas and Sutter strains in their response to anterior pituitary preparations. The Swiss, Kansas, and Sutter strains of mice were all inferior to the Schwing strain in response to progesterone.

1. Turner, C. W., Chap. XI, *Sex and Internal Secretions,* Second Edition, Allex, Danforth and Dorsy, Williams and Wilkins, Baltimore, 1939.

2. Richardson, F. L., *Anat. Rec.,* 1951, v111, 669.

3. Richardson, F. L., *ibid.,* 1953, v117, 449.

4. Richardson, F. L., and Cloudman, A. M., *ibid.,* 1947, v97, 223.

5. Mixner, J. P., and Turner, C. W., *Mo. Agr. Exp. Sta. Res. Bull.* No. 378, 1943.

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Effect of Some Pentoses on Growth of Lactobacilli.* (23130)

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Two recent reports(1,2) have emphasized the effect of certain pentoses in stimulating early growth of lactobacilli. In the report of Camien and Dunn(1) 3 pentoses were used individually. Often L-arabinose was somewhat more effective for *L. gayonii* and related species than was D-xylose or D-ribose, though the stimulatory effect of the individual pentoses differed somewhat with different cultures.

The present report deals with the growth response to a mixture of 3 pentoses shown by a collection of lactobacilli. The investigation was prompted by preliminary observations on a few cultures which indicated that homofermentative lactobacilli responded to pentoses quite differently than heterofermentative lactobacilli, particularly in a semisynthetic medium. It was found that this difference between the 2 fermentative types holds true, for the most part, for a larger number of lactobacilli and the degree of difference varies with the test medium.

Materials and methods. Two culture media were used for the tests. One was a semisynthetic medium containing 0.5% acid digest of casein plus added tryptophane, cysteine, serine, threonine, purines, pyrimidines, vitamins, acetate, inorganic salts, and 1.0% glucose which was autoclaved in the medium. The detailed composition was given previously(3) but in the present study a few changes were made: the hydroxyproline of the previous work was omitted and xanthine was used in place of hypoxanthine. For testing the effect of pentoses, a mixture of L-arabinose, D-ribose, and D-xylose was sterilized by heat, but apart from the medium. This solution was added to tubes of previously autoclaved medium in an amount sufficient to give 0.5% of each pentose. In performing the tests, one series of tubes contained only the 1% glucose, tubes of the other series contained 1% glucose plus 0.5% of each of the 3 separately-sterilized pentoses. Certain departures from the foregoing pro-

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