

mone has no direct action on the oxidation-reduction processes of the tissues themselves.

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Effect of Various Bacteria Upon Growth of Planarian Worms.

ALICE M. BAHRs. (Introduced by H. J. Sears.)

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Dr. Wulzen and the author have been engaged over a period of years in testing the growth-promoting power, for planarian worms, of the tissues from various animals. We have found that the growth response of these worms varies markedly when different tissues¹ or the same tissue from animals reared under different conditions,² are fed as the entire diet.

As bacteria produce definite effects upon the growth of mammals when the tissues are invaded, it was of interest to test the effect upon planarian worms of adding various bacteria to a food of known growth-promoting power. The following organisms were selected: 2 strains of *Staphylococcus aureus* (No. 47P, isolated from raw beef liver, and No. 6, from a human case of mastoiditis), *Proteus vulgaris*, *Bacillus subtilis*, and *Sarcina lutea*, all grown upon plain agar slants for from 48 to 72 hr. before being fed to the worms.

The technique used in planarian nutritional studies has been described.^{1, 2} Each experimental diet was fed to a group of 30 measured worms, over a period of one month. The worms were kept in finger bowls, in sterilized tap water, at a temperature of 25°C. The experimental groups of worms were fed twice per week, the food being allowed to remain in the dishes with the worms for about 3 hours. After feeding, the excess food was removed and the worms washed in several changes of sterilized tap water.

In these experiments raw beef liver, an excellent food for planarian worms, was used as the basal diet. It was made into a fine brei by mashing upon a glass plate and removing connective tissue and blood vessels. One gram portions of liver brei were weighed

¹ Wulzen, Rosalind, *Univ. of Calif. Pub. Physiol.*, 1926, 7, 1.

² Bahrs, Alice M., *Physiol. Zoology*, 1931, 4, 189.

out and to each of these portions was added the particular strain of bacteria to be tested. Two agar slants of organisms were added to each portion of liver, the organisms being scraped from the slants with a sterile loop. The bacteria were thoroughly blended with the liver brei upon a glass plate by means of a flexible spatula, and after being thus mixed the mass was dropped into the dish with the experimental group of worms. There is no doubt that the worms did ingest the bacteria along with the liver, for the intense yellow color of *Sarcina lutea* could be seen in the worms after they had eaten a mixture of liver and this organism. The other organisms were not sufficiently colored to make this apparent, but all mixtures of liver and bacteria were readily eaten by the worms and their gorged appearance after feeding left no doubt as to their success with the food.

At the end of 4 weeks the total gains in length for the experimental groups of worms fed the following diets were: liver brei + *Sarcina lutea*, 169 mm.; liver brei + *Bacillus subtilis*, 164 mm.; liver brei, 163 mm.; liver brei + *Proteus vulgaris*, 148 mm.; liver brei + *Staphylococcus aureus* No. 47P, 139 mm.; liver brei + *Staphylococcus aureus* No. 6, 129 mm.

We have considered a difference of 30 mm. between 2 groups of worms significant. Treating the figures statistically, this appears to be a true difference. There is a difference of 15 mm. between the total lengths of the group fed liver brei and liver brei + *Proteus vulgaris*, and this difference is 3.3 times the probable error, not a significant difference. A difference of 24 mm. exists between the total gains in length of the worms fed liver brei and liver brei + *Staphylococcus aureus* No. 47P, 3.7 times the probable error, not a significant difference. 34 mm. is the difference between the total gains in length of the worms fed liver brei and liver brei + *Staphylococcus aureus* No. 6, 5.6 times the probable error, a statistically significant difference. (If the difference is 4 times the probable error of the mean, it is considered statistically significant.)

Two tests were made upon *Staphylococcus aureus* No. 47P. In the first experiment the liver control and experimental group of worms had a total length of 249 and 246 mm. respectively. Four slants of *Staphylococcus aureus* No. 47P were added to the gram portion of liver fed to the experimental group of worms. At the end of 4 weeks these worms had a total gain in length of 169 mm., or 62 mm. less than the experimental group fed liver alone. This experiment shows that a larger number of bacteria had a more

marked effect upon the growth of the worms, and also that the experiments can be duplicated.

None of *these* organisms produced pathological changes in the worms. Natural infections among planarian worms do occur, if care is not exercised to avoid outside contamination. We began using only sterilized water upon the worms about five years ago, and since then have had no trouble from these epidemics. Very definite pathological lesions are produced in the worms during these epidemics, but whether these are of bacterial or protozoan origin I do not know, and I doubt whether any work has been done upon this subject.

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Pellagra: An Experimental Study of the Skin Lesions.

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It was reported in a previous publication¹ that the skin lesions of pellagrins improved while they were restricted to a so-called "pellagra-producing" diet. Since this diet consisted of such diverse foods as cornmeal, pork fat, artificially colored (synthetic) maple syrup, polished rice, cornstarch pudding, and sugar, it seemed advisable to observe the skin lesions of pellagrins limited to a diet less complex in food materials and even more deficient in vitamin G. Evidence is presented in this paper to show that the dermatitis of pellagra often improves while the patient is restricted to cornstarch and lactose.

Ten cases with the characteristic dermatitis of pellagra were chosen for this experiment and extreme care was exercised to select patients without neurological involvement. Each patient remained in bed during the experiment and was given a diet of cornstarch and lactose amounting to 2,000 or 3,000 calories per day. Two of the 6 individuals in this series with stomatitis were unable to tolerate this diet so it was discontinued. The skin lesions of the 8 patients who remained on the diet of lactose and cornstarch showed definite

¹ Spies, T. D., *Am. J. Med. Sc.*, 1932, **184**, 837.