

media. Twenty per cent. horse serum gives practically constant titres at some time during the growth. The time relationships hold in all concentrations. Peptone (2 per cent.) slightly increases the titre and gives identical titres in 20 per cent. horse serum, and brings the variations within closer limits in rabbit serum media. The time relationships are directly dependent on the growth of the streptococci, so that the delay in lysin production in horse serum indicates a lag in the rate of multiplication during the early hours after seeding. Variations in the nature of the seeding can be obviated by seeding from a 20 per cent. horse serum broth in 2 per cent. peptone, in which all streptococci of human origin, whether virulent or avirulent, reach the same condition in regard to growth and number at the end of 16 hours, unless agglutination occurs.

135 (1717)

**The failure of rats to develop rickets on a diet
deficient in Vitamine A.**

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The fat-soluble vitamine, or a vitamine closely associated with it, is regarded by some as being equivalent to an antirachitic vitamine; the development or non-development of rickets is thought to be dependent mainly on the absence or presence of this factor. In a previous report one of the writers has stated it to be his opinion that this relationship does not hold true for human rickets. The following experiments were planned to ascertain whether a diet markedly deficient in this vitamine led to the development of rachitic lesions in young rats; for this purpose rats weighing about 30 g. were put on a diet of extracted casein 21 per cent., rice starch 57 per cent., salt mixture 5 per cent., Crisco 17 per cent., yeast extract (Osborne and Wakeman) 60 mg. a day. The casein was extracted by means of ether and

cold alcohol. The salt mixture was that employed by Osborne and Mendel. Thirty-five rats in all were used for this experiment. They were kept on this rigid diet for a period averaging about three to four months, but extending in several cases five to six months. In no instance were rachitic lesions noted either microscopically or macroscopically, merely an inactive osteogenesis. That the dietary in point of fact did contain only a minimal amount of the fat-soluble vitamine was proved by the lack of gain of the animals after they had been on this food mixture for about sixty days, by their prompt response in growth on the addition of 6 per cent. of butter fat to the diet, and by the development of ophthalmia or keratomalacia in almost all of the animals and its rapid subsidence on adding butter to the dietary. In addition to eye lesions the rats on a restricted diet developed many infections. Those receiving 0.5 c.c. of orange juice did not, however, develop either ophthalmia or infections as frequently as others where the diet did not include this food. Ten control animals which received the same diet, with, however, an addition of butter, did not develop ophthalmia, grew normally and remained in perfect health. Our deduction from these experiments is that a lack of the fat-soluble vitamine in a dietary which is otherwise complete does not lead to the development of rachitic lesions in rats.

136 (1718)

**The effect of various modifications of a diet producing rickets
in rats.**

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At the March meeting of this Society, it was shown by Sherman and by one of the writers of this paper that rickets regularly developed in rats maintained on a diet composed of patent flour, calcium lactate, sodium chloride and ferric citrate. It was further found that the substitution of 0.4 per cent. basic potassium