ture the physiological action of certain salts is recorded, but practically nothing can be found in regard to the physiological effects of the ingestion of saline drinking water. In a pamphlet published in 1925 by the U. S. Public Health Service, "Drinking Water Standards," an arbitrary standard is set for waters which are to be used on interstate commerce carriers, but it is a matter of common knowledge that much of the water being used continually by people in the southwest contains more saline matter than is permitted by the U. S. Health Service, and, nevertheless, there is no evidence of any deleterious effects arising as a result.

An investigation was begun in an attempt to answer the following questions in regard to saline waters. 1. What is the effect of the presence of considerable quantities of salt in our daily drinking water? 2. At what percentage does salt become deleterious to the organism? 3. Is it possible for the organism to adjust itself in time to saline drinking waters? The experimental animals used in this work were rats and other small animals. They were placed upon well-balanced rations supplemented with drinking water which was prepared by dissolving different amounts of various salts in distilled water. Sodium chloride was added to the water in amounts ranging from 500 p.p.m. to 50,000 p.p.m. Similar series were tried using calcium chloride, magnesium sulphate, sodium carbonate, sodium bicarbonate and calcium sulphate (up to the limits of saturation). The general appearance of the animals, their growth rate, their ability to reproduce and to rear their young and the condition of their organs at death were considered in studying the effects of the various salts upon the animal.

The first point determined was the maximum percentage of a single salt which could be administered in the water without producing harmful effects upon the animal. Mixtures of the salts were also added to the water to determine whether there might possibly be an antagonistic action between the various ions: that is, whether the deleterious effect of one ion might not be offset by the effect of a second ion. Such an antagonistic ion effect has been observed in certain body processes and also in plant nutrient solutions between sodium, calcium and magnesium ions.

From the data obtained, it is possible to postulate that 15,000 p.p.m. of magnesium sulphate has a retarding effect upon growth and that increases the mortality rate of the young. Twenty-five thousand p.p.m. of magnesium sulphate have a decided toxic effect. Calcium chloride produces even more harmful effects. No normal litters were found among rats drinking 10,000 p.p.m. of this salt; 15,000 p.p.m. lessen the growth rate, and 25,000 p.p.m. produce death. Ten thousand p.p.m. of sodium chloride affect reproduction unfavorably; 20,000 p.p.m. cause the growth of the animal to be stunted, and 25,000 p.p.m. produce a rapid decline in weight. Sodium carbonate is decidedly deleterious at a concentration of 20,000 p.p.m., and reproduction was interfered with at quite low levels. Sodium hydrogen carbonate is less injurious to the animals. A combination of 20,000 p.p.m. of sodium chloride and 5,000 p.p.m. of magnesium sulphate or calcium chloride inhibits growth. The results of feeding various other combinations of salts seem to indicate that in animals there is no antagonistic action between the ions such as there is in plants. The chlorine ion appears to be more toxic than either the carbonate or the sulphate ion. The calcium and magnesium ions are more harmful than the sodium ion. This can be explained by certain known physiological actions of ions. It is interesting to note that as the salt concentration increased the amount of water consumed by the animal daily also increased up to the point where the animal preferred to die of thirst rather than drink the necessary amount.

When animals which had been given a salty water were placed on distilled water soon after their first loss in weight, they rapidly regained their weight and appeared not to have been permanently injured by the saline content of the water. Animals which have received the salty water for some time seem better able to stand such water than do animals which are suddenly changed from distilled water to salty water.

The above results indicate that the continued use of saline solutions as drinking water produces injurious effects upon the animal organism. The concentration at which the solution becomes harmful varies with the particular salt used. The animal organism can apparently accustom itself within limits to a saline water, but in all probability it can not become adjusted to the effects of high concentrations.

V. G. HELLER
C. H. LARWOOD

OKLAHOMA AGRICULTURAL AND MECHANICAL COLLEGE

BOOKS RECEIVED

CHAMBERLIN, THOMAS C., and ROLLIN D. SALISBURY. *College Text-Book of Geology.* Part II. Historical Geology. Rewritten and Revised by Rollin T. Chamberlin and Paul MacClintock. Pp. ix + 497 + xxviii. 353 figs. Holt. $3.75.

MACPHERSON, HECTOR. *Modern Cosmologies.* Pp. viii + 131. 12 illustrations. Oxford University Press. $2.75.

SANDFORD, K. S., and W. J. AAKELL. *Paleolithic Man and The Nile-Faiyum Divide.* Pp. xv + 77. 11 plates. 25 text figures. University of Chicago Press. $5.00.

TERRILL, H. M., and C. T. ULREY. *X-Ray Technology.* Pp. viii + 256. 143 figs. Van Nostrand. $4.50.

WALTHER, JOHANNES. *Leopoldine.* Pp. xviii + 375. In German and English editions. Verlag Von Quelle & Meyer. Leipzig, Germany.