might be feasible in the rat, provided that some other technique than sewing might be used in making the anastomosis. We had on hand a number of small cannulae made of magnesium and intended for blood-vessel surgery. According to Lexer[1] these were introduced into surgery by Payr. The technique we have developed consists essentially of tying the cut end of the esophagus over one end of the cannula and the end of the duodenum over the other. This unsurgical method could not be expected to work in larger animals, but in the rat it gives very promising results.

We have thus been able to perform gastrectomies on 31 rats, and at present have 8 living. These have survived their operations by 8, 8, 8, 8, 21, 21, 25, 43, and 51 days respectively. Of the 23 that have died, the survival times were 1 (9), 2 (3), 3 (2), 4 (1), 5 (1), 6 (3), 7, 8, 9, 13, and 20 days respectively. In all rats now living the filling of the intestine by way of the anastomosis during the ingestion of an opaque meal has been observed by fluoroscopy. In the accompanying roentgenogram is shown the anastomosis in the rat which is now in its 43rd day; this rat has had acute esophageal obstruction 4 times, but is now able to eat anything it cares for. Four of these rats have regained their pre-operative weights. They begin promptly to eat anything offered them, but lose interest very soon. We have tried feeding by dropper, administration of cod liver oil, and frequent small feedings of varied foods. The blood has not yet been studied, pending the solution of the dietary problem; such studies should be significant in view of the anemias observed by Ivy, Morgan, and Farrell[2] in gastrectomized dogs.

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Natural Variability Among White Rats in Degree of Susceptibility to Infection with Eimeria miyairii.*

E. R. BECKER AND PHOEBE R. HALL.

From Iowa State College, Ames.

Animals differ in respect to the limits to which infectious organisms can multiply in their bodies and the morbidity of the symptoms.

[1] Lexer-Bevan "General Surgery", 1908, 557.

[2] Ivy, A. C., Morgan, J. E., and Farrell, J. I., *Surg., Gyn., and Obstet.*, 1931, **53**, 1.

* This work was supported by a grant from the Rockefeller Fluid Research Fund at Iowa State College.

The present report is concerned principally with the first generalization in the case of *Eimeria miyairii* in white rats. The individual rats employed were of extremely mixed heredity, involving about 4 strains.

All but 10 (obtained when young from another department) of the 48 rats used in the experiment were raised in our laboratory under conditions which did not permit them to become naturally infected, a fact substantiated by fecal examinations at least every fourth day during the growing period. The growing rats were fed a modification of Steenbock's growth ration. When they had attained a weight of from 65 to 149 gm. (mean wt., 106 gr.; std. dev., 24.06 gr.) they were put individually into specially constructed cages of hardware cloth, which permitted the collection of all the fecal pellets in a pan of water below, and fed, either in a few drops of milk or on bread, 1,500 oocysts daily for 5 days. Seven or 8 days after the first infective feeding the oocysts first appeared in the feces, and continued to appear for from 6 to 8 days thereafter. At the end of this period the discharge of oocysts ceased entirely and the animals could not be reinfected immediately, although we found that a slight degree of reinfection was possible after a lapse of 2 or 3 months.

Our data are based upon daily counts of the total number of oocysts discharged by individual rats during each 24-hour period. The technique is as follows: First, the daily collection of feces from each rat is thoroughly homogenized by an electric mixer. The material is poured into a volumetric flask, and diluted to 200 cc. The content of the flask is poured into a beaker and again thoroughly mixed. A direct count is then made of the number of oocysts in 1.8 cmm. of this suspension, and the total yield for the day is easily calculated. In most cases the yields for the second and third days exceed those for any of the other days. The total number of oocysts discharged by a rat during the period required for the development of total immunity is obtained by adding the daily counts.

The microorganism was originally obtained from the cecum of a wild brown rat. It was passed through 3 white rats, and some of the collection of the last of the 3, in the sporulated condition, was used as the infective material. The number of oocysts constituting the daily dose was arrived at by a process of counting and diluting.

The total number of oocysts passed by the individual rats, with no regard to sex, ranged from 14,100,000 to 169,220,000, with a mean of 54,184,200 $\pm$ 3,213,000, a standard deviation of 33,002,400, and a coefficient of variation of 60.09%. Our frequency dis-

tribution table shows the following classes (yields of oocysts) expressed in terms of $X10^4$ and frequencies (rats) respectively: 2,000, 12; 4,000, 16; 6,000, 9; 8,000, 4; 10,000, 4; 12,000, 2; 14,000, none; 16,000, 1. A separate analysis of the yields for the males gives the following statistical constants: Number, 30; mean, 64,297,675 ± 4,403,100; standard deviation, 35,757,500; coefficient of variation, 55.61%. The same for the females: Number, 18; mean, 37,328,300 ± 2,840,000; standard deviation, 17,864,000; coefficient of variation, 47.86%. The difference of the means for the 2 sexes is 26,969,400; the probable error of the difference, 5,239,000. The ratio of the difference of the means to the probable error of the difference is 5.143, a value which indicates an extremely high degree of significance. It is necessary to be extremely reserved in accepting this sex difference, however, for in most cases the males and females were from different litters and, hence, probably of widely differing heredity. We are now continuing the experiment without splitting up the litters of rats.

Conclusion. White rats show exceedingly great variability in potentiality for the production of oocysts during an infection with *Eimeria miyairii.* If a similar situation exists among other species of either mammals or birds, the implications are far-reaching and important, for they may serve to explain many of the cases where one worker claims to have controlled or cured coccidiosis with a particular food or remedy, while another secures contrary results with the same methods.

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Action of Bufagins Isolated from Different Species of Toads.

K. K. CHEN, H. JENSEN AND A. L. CHEN.

From the Lilly Research Laboratories, Indianapolis, and Johns Hopkins Medical School, Baltimore.

In the investigation of *Ch'an Su,* a commercial preparation of the venom of a Chinese toad, and the poisonous secretions of 10 additional species of toads collected from different parts of the world, the authors found variations in the potency, physical constants, and chemical composition of some of the principles that were isolated from them. The secretion of each species of the toads contains at least from 3 to 5 distinct principles that belong to 5 classes of com-