In the 3.75 cm free-martin the gonad is much less than half the bulk of those of normal males and females of corresponding age. The germinal epithelium (cortex of ovary) is only about one fifth the thickness of that of the normal female of corresponding age and less developed than a female of 3 cm greatest length. The blood of the male has already operated to inhibit growth of the entire gonad and to stop the differentiation of the cortex. The specific male sex-hormone is thus demonstrably present in the blood at this stage.

Interstitial cells appear in the testis of the normal calf embryo between the stages of 2.7 and 3 cm greatest length. At the latter stage they are identical in size and histological structure with those of later stages and the adult; they have a continuous history up to adult age. In the female, on the other hand, comparable cells do not appear in the ovary until about the time of birth.

The following conclusions may be drawn:

1. The appearance of interstitial cells in the testis at the very time that a male hormone may be demonstrated by its physiological effects (free-martin) is strong evidence that these cells secrete the sex-hormone.

2. The absence of such cells in the female and the corresponding lack of effect of the female blood on the male twin argue in the same sense.

3. In the female of cattle sex-differentiation before birth is apparently due to genetic factors exclusively; in the male the genetic factors are intensified by the production of a hormone.

The detailed data will be published shortly by the authors separately, Mr. Bascom dealing with the interstitial cells.

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THE EFFECT OF ACID ON CILIARY ACTION AS A CLASS EXERCISE IN pH

THE effects of changes in hydrogen-ion concentration have received so much attention in the recent literature that it has become desirable to incorporate some exercise into laboratory courses in physiology which will illustrate the principles by which the p_H of a solution is determined. For the majority of college laboratories "gas chain" apparatus, potentiometers, etc., are out of the question for student work. The colorimetric method, however, which is very simple and sufficiently accurate for general laboratory problems, can be used to good effect at very little expense.

For our class in general physiology consisting of some twenty students in their second and third college years, we have outlined an experiment on the stopping of ciliary movement in the epithelium of the frog's esophagus by acid which has proved most successful. The experiment is in the form of a problem, and is stated thus: "Find the concentration of acid which will stop ciliary action within approximately three minutes." The students work in pairs. A small bit of ciliated epithelium is placed on a slide, and while one student observes this under the low power of the microscope, the other places upon the tissue a few drops of acid, and records the time. When the concentration has been found which stops the movement of cilia in three minutes, an indicator is added in the correct proportion (Clark, '20, p. 40) and the p_H determined by matching the resulting color with the appropriate color in the color chart.

When acetic acid diluted with distilled water was used with brom phenol blue as indicator, the following answers were handed in by the class:

Motion stopped in less than 2 min., $p_H = 3.4$, 2 groups of students.

Motion stopped in 3 min., $p_H = 3.5$, 6 groups of students.

Motion stopped in 3½ min., $p_H = 3.6$, 1 group of students.

Motion stopped in 9 min., $p_H = 3.8$, 1 group of students.

The agreement between these results is, we think, very good for an ordinary class exercise.

It should be noted that ordinary distilled water is decidedly acid, $p_H = \pm 6.3$, and that cilia cease to beat in it within approximately half an hour. In 0.7% NaCl, the beating continues for a day, and in Ringer's solution for three or four days at room temperature. For

purposes of strict accuracy, therefore, the acid should be added to normal saline or Ringer's solution, but for class purposes the distilled water will serve.

The experiment has been designed not only to show the stopping of ciliary action at a definite hydrogen-ion concentration, but also to bring out the difference in effect between an organic acid, such as acetic, and a mineral acid, such as hydrochloric. In the latter case even a concentration, $p_H = 2$, thymol blue as indicator, will not stop the beating of the cilia in less than 15 minutes. The greater concentration of hydrogen-ion required for the mineral acid than for the organic acid is of course correlated with the difference in rate of penetration of these acids into tissues.

Furthermore, in order to obtain comparable results the pieces of epithelium must be from corresponding regions of the frog. If the tissue is taken from the more posterior levels, *i. e.,* from within the esophagus itself, where the cilia are very long, it is found that the beating continues for a longer time in a given concentration of acid than in the pieces from more anterior levels, *i. e.,* the back of the mouth, where the cilia are very short. The experiment therefore brings out the fact that susceptibility to acid decreases in passing from anterior to posterior levels of the alimentary tract.

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Reference: W. M. Clark, 1920, *The Determination of Hydrogen-Ions.*

THE SOCIETY OF MAMMALOGISTS

THE fourth annual meeting of the Society of Mammalogists was held in New York City on May 16 to 18, 1922, where the society was invited to hold its meetings at the American Museum of Natural History. Besides the regular business sessions and the election of new officers, papers were presented, and the program is given as follows:

TUESDAY, MAY 16

Afternoon Session, 2:00 P.M.

The present status of the elk: E. A. GOLDMAN.

Mammals of the mountain tops: WILLIAM L. FINLEY. (Presented by John Treadwell Nichols).

The water supply of desert mammals: VERNON BAILEY.

A quantitative determination of damage to forage by the prairie-dog, cynomys gunnisoni zuniensis Hollister: WALTER P. TAYLOR.

Studies of the Yellowstone wild life by the Roosevelt Station: CHARLES C. ADAMS.

The part played by mammals in the World War: ERNEST HAROLD BAYNES.

Evening Session, 8:00 P.M.

The members of the society were invited to the new home of the Explorers' Club, 47 West 76th Street. The board of directors of the club extended the courtesy of the club to the members of the society during their session.

WEDNESDAY, MAY 17

Morning Session, 10:00 A.M.

The frequency and significance of bregmatic fontanelle bones in mammals: ADOLPH H. SCHULTZ.

A fossil dugong from Florida: GLOVER M. ALLEN.

Certain glands in the dog tribe: ERNEST THOMPSON SETON.

The elephant in captivity: W. H. SHEAK.

The burrowing rodents of California as agents in soil formation: J. GRINNELL.

Afternoon Session, 2:00 P.M.

Symposium on the Anatomy and Relationships of the Gorilla:

How near is the relationship of the gorilla-chimpanzee stock to man? W. K. GREGORY.

Notes on the comparative anatomy of the gorilla: G. S. HUNTINGTON.

Was the human foot derived from a gorilloid type? D. J. MORTON.

Reichenow's observations on gorilla behavior: J. H. MCGREGOR.

On the sequence of eruption of permanent teeth in gorilla and man: MILO HELLMAN.

Phylogenetic relations of the gorilla: evidence from brain structure: FREDERICK TILNEY.

Evening Session, 8:00 P.M.

The motion picture as a medium for intimate animal studies: ARTHUR H. FISHER.

Motion pictures, some showing slow motion, of anthropoidea, sea lion, Barbary sheep, kangaroo and yak, and the habits of the beaver: RAYMOND L. DITMARS.

Motion pictures of sea-elephants: CHARLES H. TOWNSEND.