

sesame oil alone. Animals injected with sesame oil with or without male hormone had lighter pituitaries than normal non-injected controls. Animals injected with sesame oil solutions had an accelerated weight increase during the period of injections over that of their previous weight increase for a similar period just preceding injection, and over that of the normal non-injected controls kept in the same cages.

Conclusions. The observed results demonstrate that daily injections of 0.5 to 3 mg. of testosterone in sesame oil and of 3.0 to 5.0 mg. of androsterone in sesame oil into normal mature female rats leads to a suppression of the oestrous cycles, as expressed by the vaginal smear, during the 16-day period of injection.

These observations agree with the findings of Robson⁴ that testosterone causes total suppression of the oestrous cycle in mice. It seems quite adequate to the writer to assume that the pure crystalline androgenic substances, testosterone and androsterone, have an action upon the pituitary gland of the female rat in a manner consistent with the interpretation offered by Moore and Price. Nothing presented by these experiments, however, would rule out the possibility of a direct effect upon the ovary by crystalline androsterone or a possible neutralization of the action of estrogenic substances upon the female tract by androsterone.

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Effect of Various Degrees of Anoxemia on Secretion of Acid and Chlorides by the Stomach.

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Alvarez¹ found that when the hemoglobin fell below 12 gm. per 100 cc. of blood the mean gastric acidity fell sharply and the incidence of achlorhydria rose rapidly. Apperly and Cary² showed that when the red cell count of the blood fell below a certain critical level, free acid disappeared from the stomach. The acidity was also found to decrease with an increase in the erythrocyte count above

⁴ Robson, J. M., *Proc. Soc. Exp. Biol. and Med.*, 1936, **35**, 49.

¹ Alvarez, W. C., and Vanzant, F. R., *Proc. of the Staff Meetings of the Mayo Clinic*, 1936, **11**, 385.

² Apperly, F. L., and Cary, M. K., *Am. J. Dig. Dis. and Nutr.*, 1936, **3**, 466.

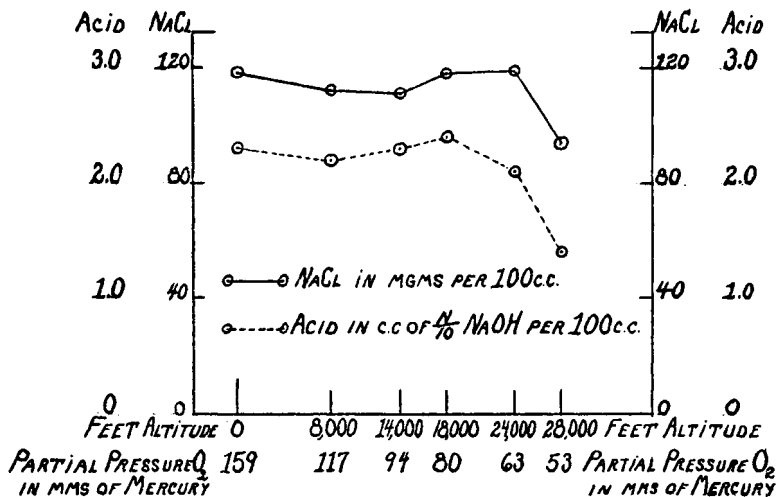
a certain normal level. It was felt that a study of gastric secretion under a condition of anoxemia might be of value in understanding the relation between the blood and gastric acidity.

Barbitalized dogs and cats (220 mg. per kilo), starved for 48 hours previous, were used. Two animals of approximately the same weight were chosen, one to serve as a control, the other to be subjected to anoxemia. The stomach was ligated at each end, washed, and filled with a measured amount of distilled water at body temperature. After 3 hours the stomach was removed and its contents measured and analyzed for acid and chlorides. During the 3-hour period the experimental animal was placed in a respiratory chamber and subjected to the desired degree of anoxemia. Partial pressures of oxygen of 117, 94, 80, 63 and 53 mm. of mercury were used.

Table I and Chart 1 show the results obtained. It will be seen

TABLE I.

Altitude in feet	Partial Pressure		Total Acidity	Chloride secreted
	Oxygen Mm. Hg.	No. animals		
0	152	74	2.3	118
8,000	117	4	2.2	112
14,000	94	19	2.3	111
18,000	80	20	2.4	118
24,000	63	14	2.1	119
28,000	53	17	1.4	94



THE EFFECT OF ANOXEMIA ON GASTRIC SECRETION

CHART 1.

that at less severe degrees of anoxemia both the acid and chloride secretion approach normal very closely. At a partial pressure of oxygen of 53 mm. of mercury (28,000 feet), a very severe degree of anoxemia, the secretion is appreciably depressed.

Anoxia is one of the concomitants of severe anemia. Wright³ shows that in severe anemia the amount of hemoglobin may be so small that only half the normal amount of oxygen can be present, although there is 95% hemoglobin saturation. In anoxia, the type produced in this work, the oxygen content of the blood remains nearly normal until the oxygen tension falls so low that hemoglobin unsaturation is considerable. This probably explains why less severe degrees of anemic anoxia are capable of depressing gastric secretion more than is anoxic anoxia.

Koehler, *et al.*,⁴ have shown that the degree of anoxic anoxia, which we have found capable of depressing gastric secretion produces a severe acidosis, probably incompatible with life for more than a few hours.

We feel that polycythemia could be ruled out as a causative factor because of the short duration of the experimental period.

It is believed that the anoxemia itself is responsible for the depression of secretion seen at the most severe degree. This may be due to actual or incipient tissue asphyxia, disturbance of the acid-base balance, or some other factor.

The fact that the secretory function of the stomach is capable of withstanding anoxemia so well is not entirely in accord with the statement of Hellebrandt⁵ that the secretory and motor functions of the stomach run parallel. It has been shown that comparatively moderate degrees of anoxemia depress gastric motility in both the empty and the full stomach.^{6, 7}

Summary. It was found, in barbitalized dogs and cats, that anoxemia less severe than that produced by breathing air with a partial pressure of oxygen of 53 mm. of mercury had no effect on gastric secretion. When this partial pressure, a very severe degree of anoxemia, is reached there is an appreciable depression of the secretion of acid and chlorides by the stomach. One may thus conclude that gastric secretion in response to filling the stomachs of barbitalized ani-

³ Wright, Samson, *Applied Physiology*, Oxford University Press, 1935, p. 418 ff.

⁴ Koehler, A. E., Behneman, H. M. F., Bennell, O. E., and Loevenhart, A. S., *Am. J. Physiol.*, 1925, **74**, 590.

⁵ Hellebrandt, F. A., and Dimmitt, L. L., *Am. J. Physiol.*, 1934, **107**, 364.

⁶ Van Liere, E. J., and Crisler, George, *Am. J. Physiol.*, 1930, **93**, 267.

⁷ Van Liere, E. J., Crisler, George, and Robinson, Dennis, *Arch. Int. Med.*, 1933, **51**, 796.

mals with water is appreciably influenced only by very severe degrees of anoxemia. It also seems that anemic anoxia is more effective in depressing gastric secretion than is anoxic anoxia.

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Studies on Zinc.

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Young rats weighing between 40 and 50 gm. were placed in groups of 5, three females and 2 males, in screen bottom cages. Food and water were supplied *ad libitum*. C. P. zinc carbonate was incorporated in the growing ration at 3 levels, corresponding to 0.10, 0.50, and 1.00% of zinc. The growing ration is a mixture of naturally occurring foods, and has served this laboratory well, during many years, for the growth and reproduction of rats. The zinc salt contained as a maximum the following impurities: arsenic 0.000%, chloride 0.002%, iron 0.01%, lead 0.002%, nitrate 0.000%, and sulphate 0.01%. Hemoglobin was determined by the Newcomer method.

Growth was normal on the rations containing 0.10 and 0.50% of zinc. The animals were vigorous when the experiment terminated, and there was practically no difference in the weight of the rats receiving zinc and those on the stock diet. The limit of tolerance to zinc carbonate lies between 0.50 and 1.0% of zinc in the diet. The animals on the 1% zinc diet failed to grow in the majority of cases, although some individuals weighed 140 to 160 gm. after 10 to 12 weeks. Some of the animals began dying within 4 weeks after being placed on this diet; some were partly eaten.

Growth and reproduction on the lowest level of zinc were normal. Several generations of these rats on the same zinc diet have shown no abnormalities. Reproduction was markedly affected, when the animals received 0.50% of zinc. The females on this diet became pregnant between the fourteenth and seventeenth weeks. One female had 3 young and lost 30 gm. at parturition. Another female had 3 young (one born dead) but lost 40 gm. at parturition. Another female when observed had 5 dead young weighing 24 gm. The young appeared white and bloodless. The females with the live young mothered them satisfactorily. The young averaged 30 gm.