cerned. Serums of pigeons infected with psittacosis have likewise been reported as being highly specific.[17,18] Chickens have been found advantageous for the preparation of antiserums against a variety of substances (See reference 13).

The relations within this group as revealed by serum neutralization tests are in agreement with the relations established on other bases by other authors.[1,2,5,6,11,19] Our experiments suggest that neutralization tests with this type of serums is a more satisfactory method for studying the antigenic relations of this group of agents than those methods heretofore described.

17 Eddie, B., and Francis, T., Jr., PROC. SOC. EXP. BIOL. AND MED., 1942, **50**, 291.

18 Smadel, J. E., Wertman, K., and Reagan, R. L., PROC. SOC. EXP. BIOL. AND MED., 1943, **54**, 70.

19 Hamre, D. M., and Rake, G., *J. Bact.*, 1944, **47**, 312.

14633 P

Comparison of the Acid Humoral Intermediation of Stimulation in Respiratory and Non-Respiratory Muscles.*

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The strength of contraction of the rectus abdominus muscle of the frog immersed for varying periods (15-60 seconds) in weak acetylcholine solution (about 1 part in 500,000 parts of Ringer's solution, depending on the sensitivity of the preparation) was found to increase with the hydrogen ion concentration of the environment. Such effects occurred within a range of pH 7.5 to pH 5.0. Lactic, phosphoric, and carbonic acids produced comparable effects. These results agree with those previously reported in the rectus abdominus.[1,2] However, when the sartorius muscle was used it was found to respond with a weaker contraction under increasing hydrogen ion concentration of the environment. This unexpected finding led us to make comparative observations on a number of muscles of the frog, turtle and alligator. The rectus abdominus, mylohyoid and geniohyoid of the frog, mylohyoid of the turtle, and diaphragm of the alligator, muscles which contribute to the respiratory act, were found to show a progressively increasing strength of contraction with an increasing cH of the acetylcholine-containing environment, while the sartorius, peroneus longus and gracilis minor of the frog, muscles possessing primarily a locomotor function, showed either a consistent depression or an initial augmentation followed by an early depression.

This differential effect of acid on these two groups of muscles is of interest in suggesting, for the lower forms at least, that the control of breathing is not strictly a central reflex phenomenon but is supported by a peripheral motor adjustment as well. The chemical (acid) control of respiration may thus be extended to the respiratory muscles as well as to the carotid body and the intra-cranial portions of chemically sensitive control centers. How the differential humoral response of respiratory and non-respiratory muscle to cH has been attained is a problem requiring further study. The observation of Carey[3] that expansion and extension of the processes of the motor end plate of intercostal muscles of the rat occurs during hypercapnia suggests

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1 Mason, A., and Gesell, R., *Fed. Proc.*, 1942, **1**, 58.

2 Gesell, R., Mason, A., and Brassfield, C., *Am. J. Physiol.*, 1944, **in press.**

3 Carey, E. J., PROC. SOC. EXP. BIOL. AND MED., 1941, **47**, 67.

an additional role of acid as a nervous integrator. Enlargement of motor end plates in respiratory muscles might readily increase the amount of electrotonic current generated by the plates. A differential effect on the response of respiratory and non-respiratory muscles to the electrotonic current generated at the motor end plate is another possibility.

The differential effects of a common increase in cH may be of biological significance in preventing excessive use of locomotor muscles and assuring an adequate pulmonary ventilation for the needs of the body as a whole.

14634 P

Effect of Various Digitalis Glycosides upon the Cardioinhibitory Action of Acetylcholine.

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We have previously reported that in the dog 10% of the lethal dose of a certain tincture of digitalis abolished the cardiac inhibition produced by acetylcholine.[1] A preliminary investigation to determine whether this was due to some one or other of the known glycosides in digitalis purpurea has not been conclusive, but indicates that the glycosides do not behave identically in respect to their modification of the response to acetylcholine. To test this question further, the 3 glycosides of digitalis lanata, Lanatoside A, Lanatoside B, and Lanatoside C were employed.*

Anesthetized dogs were used. The minimal dose of acetylcholine bromide required to produce cardiac inhibition after injection into the femoral vein was determined. This varied in different animals from 0.1 to 1.0 mg. As the variation in an individual normal animal when tested at various intervals of time was occasionally as much as 50%, provision was made for such variation by using twice the minimal effective dose of acetylcholine. The cardio-inhibitory action of acetylcholine was determined from the carotid blood pressure tracing and by electrocardiograph tracings. An estimated 1/12th of the lethal dose of a glycoside was injected via the femoral vein, and similar doses were injected at 10-minute intervals until the animal died. Five minutes after each injection the test dose of acetylcholine (*i. e.* twice the original minimal cardio-inhibitory dose) was injected and observations made as to whether this did or did not cause cardiac inhibition. The results in 10 animals with each glycoside are shown in Table I.

Lanatoside C invariably abolished the cardiac inhibition produced by acetylcholine and did this when an average of 62% of the lethal dose was given. Lanatoside A produced such an effect in only 2 out of 10 experiments and Lanatoside B in but 5 out of 10 experiments. A statistical comparison of the frequency with which the various glycosides abolished the cardio-inhibitory action of acetylcholine shows that the probability that the differences between Lanatosides A and C could be due to chance alone is 1 in 2800; between B and C is 1 in 61; and between A and B is 1 in 6.

These results have a bearing upon the question of the similarity of cardiac effect produced by various cardiac glycosides. It is well known that these agents vary as to their absolute potency, absorbability from the gastrointestinal tract and duration of action. However, it is generally assumed that their cardiac actions are qualitatively identical. In the present experiments a progressively increasing cardiac action from initial to lethal effect was produced in each case.

[1] Wells, J. A., Dragstedt, C. A., Rall, J. E., and Ruge, D. A., *Fed. Proc.*, 1943, **2**, 93.

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