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Relation of Survival Time of Respiratory Gasping Mechanism of the Isolated Mouse Head to Age.

RICHARD K. THOMS AND WILLIAM A. HIESTAND.

From the School of Pharmacy and the Laboratory of Animal Physiology, Purdue University, Lafayette, Ind.

It was shown previously[1] that survival of the "primitive respiratory center" of the rat head is inversely proportional to age of the animal. The method used was the recording of the gasping (mandibular movements) following decapitation. Young rats (under 5 or 6 weeks of age) showed 2 periods of gasping, the initial period being aerobic and the second period anaerobic. Rats older than 5 or 6 weeks were reported to show only the first (aerobic) series. Similar results were later obtained with ischemic heads of rabbits, cats, and dogs.[2] Work from our laboratory[3] has corroborated these findings, however it has been observed[4] that occasionally an adult rat may show a few gasps of the second series. Kabat[5] previously demonstrated a reciprocal relationship between age and resistance to arrest of brain circulation in dogs.

That the sudden change of the newborn mammal from the fetal to the outside environment may be more successfully accomplished a source of anaerobic energy is available to the young. This fact coupled with

1 Selle, W. A., and Witten, T. A., PROC. SOC. EXP. BIOL. AND MED., 1941, **47**, 495.

2 Selle, W. A., PROC. SOC. EXP. BIOL. AND MED., 1941, **48**, 417.

3 Hiestand, W. A., Tschirgi, R. D., and Miller, H. R., *Am. J. Physiol.*, 1944, **142**, 153.

4 Tschirgi, R. D., personal communication.

5 Kabat, J., PROC. SOC. EXP. BIOL. AND MED., 1939, **42**, 534.

TABLE I.
Showing Relation of Age to Number of Gasps and Survival Time in 144 White Mice.

Age in days	1	3	4	5	6	7	8	9	10	11	12	15	19	over 20
No. mice used	8	6	6	6	6	7	10	7	7	6	11	2	13	49
Wt in g (avg)	1.7	2.3	2.4	2.7	3.1	3.5	2.6	2.3	4.9	5.3	4.7	4.6	9.3	27.5
No. gasps 1st ser. (avg)	12.5	9.5	9.8	8.7	8.1	8.1	6.0	11.3	6.4	3.7	6.4	8.0	7.2	10.9
No. gasps total (avg)	32.1	28.2	20.9	20.3	21.3	26.7	45.7	22.7	43.4	21.5	16.8	22.0	7.2	10.9
Duration of 1st ser. in sec. (avg)	32.2	19.0	14.5	25.5	13.3	13.1	19.5	24.6	11.6	10.1	13.3	14.5	18.6	16.05
±S.E.	±2.2	±1.5	±2.5	±4.0	±.97	±.04	±2.5	±2.9	±.68	±.99	±1.1	±3.6	±1.8	±.25
Total survival time in sec. (avg)	1652.1	1459.2	1326.3	780.0	916.0	576.1	574.3	754.3	354.3	109.0	71.8	64.5	19.9	16.05
±S.E.	±135.4	±101.3	±119.6	±92.5	±67.1	±62.7	±127.7	±46.5	±32.8	±12.1	±10.3	±35.0	±1.8	±.25

the ability of the young to withstand anoxia more effectively than the adult has been amply demonstrated.[6-10]

In the present investigation 144 white mice of the Purdue Swiss and Hygienic strains were used, no appreciable difference appearing in the gasping patterns of the 2 strains. Heads were decapitated with a single stroke of a razor blade held vertically in a holder as previously used with rats.[3] No gasping results in the mouse unless the cut is made posterior to the fore-legs. Rats will gasp if the cut occurs posterior to the external ear lobe. In both cases the excised head con-

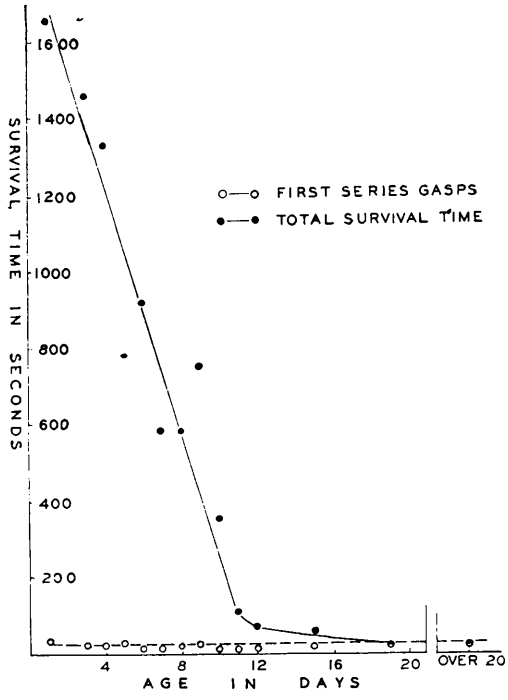

FIG. 1.
Showing survival time in relation to age in 144 mice. Each point represents the average of mice used at a given time.

6 Avery, R. C., and Johlin, J. M., PROC. SOC. EXP. BIOL. AND MED., 1932, **29**, 1184.

7 Fazekas, J. F., Alexander, F. A. D., and Himwich, H. E., *Am. J. Physiol.*, 1941, **134**, 281.

8 Kabat, H., *Am. J. Physiol.*, 1940, **130**, 588.

9 Himwich, H. E., Fazekas, J. F., and Homburger, E., *Endocrinol.*, 1943, **33**, 96.

10 Himwich, H. E., Bernstein, A. O., Herrlich, H., Chesler, A., and Fazekas, J. F., *Am. J. Physiol.*, 1942, **135**, 387.

tains the medullary centers as well as the carotid reflex areas. Gasps were recorded manually on an electric kymograph traveling one centimeter in 5.540 seconds. Ninety-five mice from the ages of 1 to 19 days and 49 mice older than 20 days were used. In no case did any gasping occur beyond the first (aerobic) series in mice over 19 days of age. This observation holds true for many other mice used in other experiments and not included herein.

Table I and Fig. 1 show the results of this study. It can be seen that the aerobic first series of gasping remains quite constant throughout the life of the mouse indicating that the availability of the energy material remains little changed. The second or anaerobic series of gasps diminishes until about the 19th day when it is lost forever, thus indicating that the anaerobic energy of the newborn mouse persists for only 19 days.

Conclusions. The survival of the gasping mechanism of decapitated mice, like rats, is inversely related to age. Mice up to 19 days of age show 2 series of gasps, the early or aerobic series remaining quite constant throughout life, the second or anaerobic series gradually diminishing from the maximum in the newborn until it disappears completely at about 19 days of age.

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Effects of Urethane (Ethyl Carbamate) on Mitosis.*

M. F. GUYER AND P. E. CLAUS.

From the Department of Zoology, University of Wisconsin, Madison.

The authors[1] showed that transplanted rat carcinoma (Flexner-Jobling carcinoma) was far more susceptible to the lethal effects of X-rays when growing on rats which had been treated with colchicine than when growing on untreated controls. Unable because of war conditions to obtain colchicine to continue their experiments, they resorted to urethane (ethyl carbamate, $C_2H_5OCONH_2$) which was reputed to have much the same effects on mitosis. They found that while urethane does affect mitosis, the result was not the same as that following colchicine. The present study deals with their experiments and observations on this point.

The treatments were standardized to intraperitoneal injections of 1 cc of a 10% aqueous solution of urethane per 100 g of body weight of the young adult rats being treated. This was an anaesthetizing dose which left the animals inert for several hours. Of the 42 animals treated, 21 were male and 21 female. No significant sexual differences were found. A series of 14 mice were also injected and studied for comparison.

Since the purpose of our study was to determine the effect of urethane on mitosis it was important to select a tissue favorable for study. After some exploration we settled upon the corneal epithelium, recommended by Buschke, Friedenwald and Fleischmann[2] for mitosis counts and for differentiation of the various phases of mitosis. While the number of division figures vary greatly from the periphery to the center of the cornea, they are approximately the same in all meridians. A band 2 mm wide was cut out along the greatest meridian of the cornea and carefully separated from adherent tissues. After rinsing in 80% alcohol it was placed for an hour each in 95% alcohol, and absolute alcohol, and then stored in cedar oil. After at least an hour in cedar

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1 Guyer, M. F., and Claus, P. E., PROC. SOC. EXP. BIOL. AND MED., 1939, **42**, 565.

2 Buschke, W., Friedenwald, J. S., and Fleischmann, W., *Bull. Johns Hopkins Hosp.*, 1943, **72-73**, 144.