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Effect of Oxygen Pre-Breathing on Anoxemia in Albino Rats.

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While engaged in the study of a problem involving the changing erythrocyte counts in the blood of albino rats under low oxygen tensions,¹ it was noted that certain animals withstood the onset of critical anoxemia better than others. This observation, coupled with a report by Hill² concerning beneficial effects of oxygen pre-breathing upon aviators, stimulated the present inquiry as to (1) what effect intervals of oxygen pre-breathing might have upon the postponement of critical anoxemia in male and female groups of rats, and (2) what intervals might prove to be most advantageous, if effective at all, for these forms.

This report includes an analysis of the data taken from 4 series of experiments on 5 male and 5 female Wistar strain rats of comparable ages and weights selected from the department colony. Preliminary to the tests here cited, a number of experiments were performed in perfecting apparatus and technics. Each animal was subjected to intervals of pre-breathing of 25, 40, 70, and 130 minutes in a properly arranged chamber which could be exhausted and maintained at any given atmospheric pressure. As a control the same individuals were tested in air. The barometric pressure used was 200 mm Hg, which is equivalent to a partial oxygen pressure of only 42 mm Hg, or the approximate equivalent in altitude of 6½ miles above sea-level. The comparative differences in the time of onset of anoxemia in the different individual rats subjected to various intervals are shown in Table I. It is apparent from the analyses of these data that there are consistently slight differences in the 2 sexes, the females being slightly more resistant as a group than the males, when exposed to critical but not fatal low pressures (Table I). In fatal low pressures the females die in a shorter interval of time if no pre-breathing interval is administered.

When the data are resolved to averages and the pre-breathing intervals are plotted against resistance intervals in both sex groups, it is obvious that the 70-minute exposure is the most advantageous for both sexes. This is an interesting observation, since it appar-

¹ Escobar, R. H., and Baldwin, F. M., *Am. J. Physiol.*, 1934, **107**, 249.

² Hill, Leonard, *Nature*, London, 1932, **130**, 397.

TABLE I.
Critical Anoxemia in White Rats Following Varying Intervals of Pre-Breathing
When Subjected to Low Oxygen Tensions (200 mm Hg.)
Pre-breathing intervals in minutes.

No.	Sex	Air 25 min	Oxygen 25 min	Oxygen 40 min	Oxygen 70 min	Oxygen 130 min
		min	min	min	min	min
2	♂	11	20	14	26	15
8	♂	13	27	28	52	28
9	♂	12	36	25	31	30
10	♂	9	13	18	23	17
11	♂	13	26	23	42	22
3	♀	14	45	30	39	20
4	♀	10	29	35	44	26
5	♀	13	38	32	45	18
6	♀	19	33	40	32	39
7	♀	10	19	19	20	23
Avg for all		12	29	26	35	24
Avg for ♀		13	33	31	36	25
Avg for ♂		12	24	22	35	22

Figures in the vertical columns are averages taken from 4 observations on each individual rat after exposures as indicated.

ently establishes a favorable optimum pre-breathing interval for rats. Why a shorter interval is better than the longer period of pre-breathing is not clear, but it would seem that toxic effects to longer exposures of pure oxygen result here, as were noted by Barach³ on rabbits, and Haldane, Meakins and Priestley,⁴ and Haldane, Kellas and Kennaway⁵ on man.

In summary, it may be concluded that: (1) White rats as a class are normally quite resistant to low barometric pressures, but individual sex differences are apparent, the females being slightly more resistant than the males. 2. Pre-breathing oxygen for an interval of 25 or of 70 minutes is more advantageous in increasing resistance to anoxemia in both sexes, than no pre-breathing or pre-breathing for a longer interval. (3) The optimum pre-breathing interval from these data is 70 minutes.

³ Barach, A. L., *Am. Rev. Tuberc.*, 1926, **13**, 293.

⁴ Haldane, J. S., Meakins, J. C., and Priestley, J. G., *J. Physiol.*, 1919, **52**, 431.

⁵ Haldane, J. S., Kellas, A. M., and Kennaway, E. L., *J. Physiol.*, 1919, **53**, 205.