ALCOHOL AND BODY WEIGHT IN THE ALBINO RAT

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This paper deals with one phase, effect upon body weight, of an experiment designed to test the effects of alcohol, both germinal and somatic, upon the albino rat. The data given cover ten successive generations of alcoholic administration. An introductory paper by HANSON and HANDY (1924) gives in detail the methods employed.

Suffice it here to say that: the fume tank method devised by STOCKARD was used in administering the alcohol; treatment was begun in each generation when the animals were twenty days of age and continued until they were one hundred days old, except in the first generation where the treatment continued for a period of one year; the treatment might be described as severe, lasting each day until the animals were unable to stand upon their feet; the general environmental conditions for test and control rats were identical—the alcoholic treatment being the single differential between the two groups; both treated and control animals were the descendants of a single pair of WISTAR INSTITUTE semi-inbred rats (Tyler strain); all matings throughout the experiment were sister-by-brother within the litter; the animals were weighed to a tenth of a gram at birth, at twenty days of age and every ten days thereafter until the last weighing at age one hundred days; all weighings were made by the senior author thereby reducing the personal equation to a minimum.

After the first generation which was small in numbers an attempt was made to base each body weight constant upon at least fifty rats. In practice, however, this was not always possible, the number falling below in some cases and rising considerably above in others. It is believed that in the rigid character of the controls, the number of treated generations, the strictly inbred character of the blood-lines, and the total number of animals (1825 at twenty days of age) involved, this experiment may contribute something to the alcohol problem.

Table 1 gives the data for the totals of the ten generations of control and test animals. The means are based on large numbers of rats, and these numbers are given to the left of each mean in the table. The data for the males and females are given separately.

Males: In males at twenty days of age the control mean is only 0.27 of a gram greater than the corresponding mean in the treated. As this

difference is less than its probable error it seems clear that alcohol fumes, administered to rats over a period of five years and including ten generations, has not impaired the ability of these animals to produce young of equal weight with those of the controls. It will be recalled that treatment

TABLE 1

A table showing body weight constants for the total ten generations at various ages.

AGE IN DAYS	NUMBER RATS	CONTROL	NUMBER RATS	TREATED	DIFF. / P. E
		Males			
20	408	25.17±0.22	490	24.90±0.21	——
40	392	64.39±0.58	434	58.57±0.59	7.09
60	364	113.71±1.06	374	102.76±1.01	7.52
80	317	156.70±1.40	317	145.55±1.44	4.82
100	248	190.85±1.70	227	177.31±1.86	5.42
		Females			
20	454	24.14±0.22	473	25.07±0.21	3.10
40	412	59.66±0.52	421	55.89±0.50	5.24
60	402	99.85±0.86	386	91.01±0.85	7.31
80	374	130.11±1.00	324	126.30±1.08	2.59
100	266	150.79±1.25	170	144.18±1.68	3.19

began at twenty days of age, so that comparisons between treated and controls at this age are based upon rats which have not themselves been treated. Any inherited growth deficiency due to alcoholization of parents and grandparents should be evident at this age. HANSON and HEYS also have shown elsewhere that in litter size and birth weight the offspring of the treated are fully equal to those of the controls.

After the weighing at twenty days those rats in the alcoholic line of descent received their first treatment in the fume tanks and both treatment and weighings were continued until one hundred days of age was attained. The comparison between the two means at every subsequent weighing shows a large significant difference, reaching its maximum at sixty days where the difference is 7.52 times its probable error. This difference at every age above twenty days is in favor of the controls. The conclusion that alcoholic treatment has adversely affected the growth rate seems valid—in other words, descendants with an alcoholic ancestry weigh just as much at birth and at twenty days as the corresponding controls, but these same descendants show a marked falling off in body weight soon after they themselves become the subjects of treatment.

However, as above indicated, these same alcoholic-stunted animals for ten successive generations do not lose their inherent capacity to produce young which at the age of twenty days have normal body weight. Therefore, the effects of alcohol on body weight as shown by these data do not go beyond the soma.

Females: At the ages of forty to one hundred days inclusive the results with females are identical with those of the males and the discussion above applies equally here.

At twenty days the situation is different in this respect: that the young of treated ancestry actually have a larger mean weight by 0.93 of a gram than the controls. At all later ages, due to the direct action of the alcohol, the means of the treated are significantly lower than those of the controls.

Not only does an alcoholic parentage not inhibit growth up to twenty days of age, but actually in the case of females, due to selective elimination of inferior germ cells, differential prenatal mortality or some other unknown cause, produces twenty-day offspring with a significantly greater mean body weight.

It is worthy of notice that at twenty days in both males and females the mean body weight of treated and controls shows a difference of less than a gram although the two groups have been carried in separate lines of descent for a period of over five years.

MACDOWELL treated white rats with alcohol primarily with a view to testing their learning reactions in a Watson maze. Data on growth and fertility were taken at the same time and these have been published separately. The paper on growth (1922) discusses the effect of alcohol on body weight in several groupings of his animals variously described as "Treated rats," "Untreated rats from treated parents," "Untreated rats from untreated parents and treated grandparents," and "Treated rats from treated parents."

His first and last groups are most comparable to our experiment and they alone will be discussed. In the group termed by MACDOWELL, "Treated rats," his conclusion is that the treatment of white rats with maximum doses of alcohol tends to retard growth as compared with their untreated brothers and sisters. His data are in every particular, as regards this one group, identical with ours. In his group known as "Treated rats from treated parents," he found no significant differences between treated and controls. These latter data are based on thirty-one treated rats and thirty-four controls. Our own experiment might be described as treated rats from treated parents and grandparents for ten generations and in-

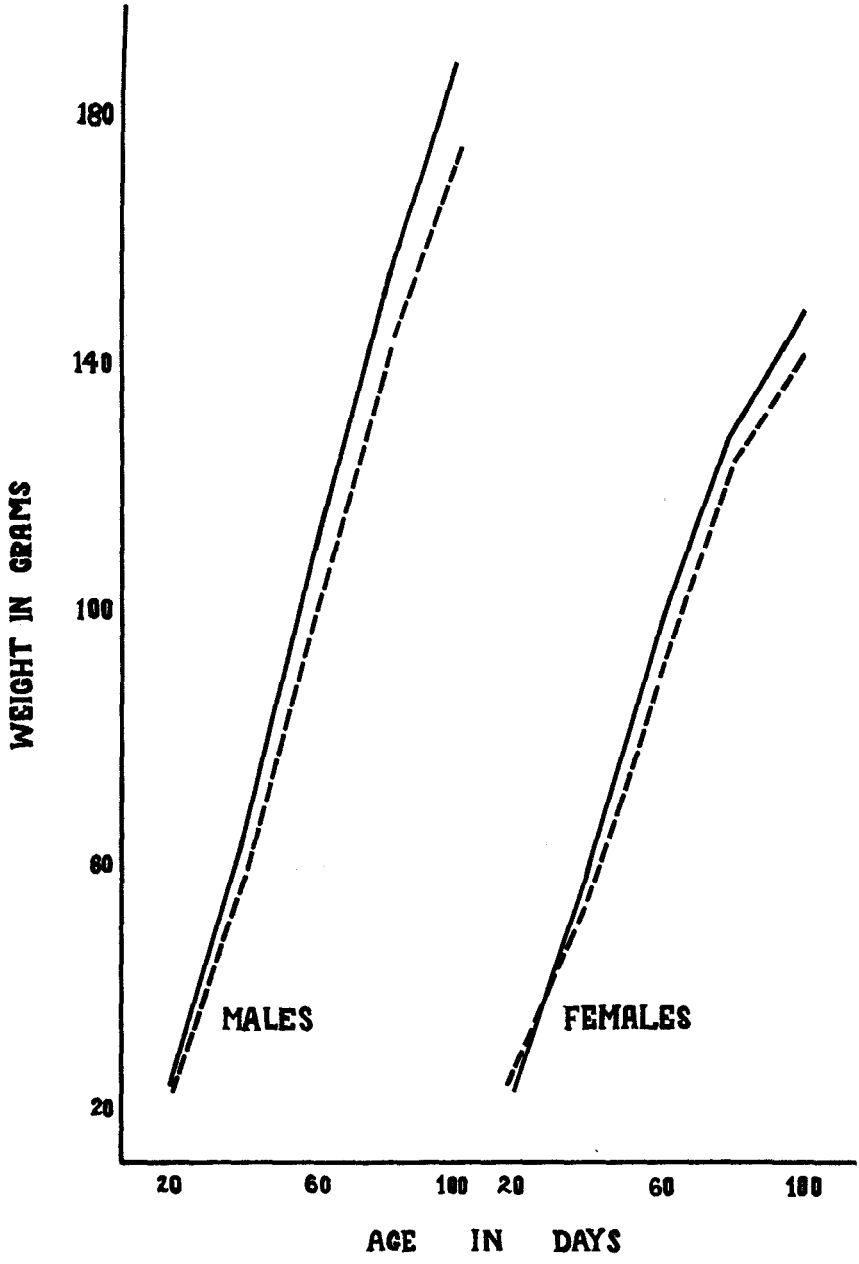
180
140
100
60
20
WEIGHT IN GRAMS
MALES
FEMALES
20
60
100
20
60
100
AGE IN DAYS

FIGURE.—1

volves nearly two thousand rats. That our results in this particular instance are not in agreement with MACDOWELL'S may well be due to the difference in the magnitude of the two experiments.

ARLITT (1919) claimed that alcohol retarded body growth and that "the defective body weight acquired by alcoholized rats is also inherited." MACDOWELL has ably criticised ARLITT'S methods and apparently undermined her conclusions. Our data, based on the same species, are, of course, further refutation if any be needed.

STOCKARD and PAPANICOLOAU (1917) found that in guinea pigs the normal offspring weigh more and for a time grow more rapidly than the young of alcoholic pigs.

PEARL (1917) describes the effects of both ethyl and methyl alcohol on chickens. After fifteen months of treatment the alcoholic birds were 9.9 percent heavier than untreated control birds of the same average age, and this increase in weight of the treated birds is apparently due entirely to deposition of body fat and not a fatty infiltration of any of the visceral organs.

CONCLUSION

1. Alcohol has a retarding effect upon the growth rate of albino rats.
2. This effect is not in any degree transmitted to their offspring even after ten successive generations of exposure to the fumes.

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