of the opposite side. The ends of the tube can be sealed by melting or with wax. Enough mercury should be inserted to barely make contact when switch is in a level position. Nitrogen gas inserted into the tube with the mercury will prevent oxidation.

The cradle is made of a piece of sheet copper cut and bent and suspended on screw x, which acts as a fulcrum. A wire hook around the stem of the float balances the switch mechanism.

When the arrangement has been completed and the current turned on, allow the motor to run until the mercury has reached the highest point of the small part of the glass tube. The mercury will not be pumped over, if before starting the large arm was not more than two thirds full when float is submerged. At the high point there should be enough mercury left in the large arm at least to nicely suspend the float with its load of stem, stoppers and switch.

By proper adjustment of the stops g above and below the hook on the mercury switch, the high and low point of the vacuum can easily be regulated. The best arrangement seems to be to have current on at 20 inches and off at 25 inches. If all seals are good, it will take an hour or more to cause this drop, and a good pump will recover it in two or three minutes.

The stoppers above and below the upper screw eye are to prevent the float from moving over unnecessary distance, causing possible trouble to the switch. Some pains will be needed to get the arrangement balanced to do its best. The balance depends upon the weight of glass in the float, the stoppers on it, the balance of the switch mechanism and even upon the flexibility of the lead wires connecting the switch with the current cord. If the float is too light a little mercury in the float will help.

Once the outfit is properly adjusted, it becomes practically automatic.

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SPECIAL ARTICLES

PRODUCTION OF DOMINANT LETHAL GENETIC EFFECTS BY X-RADIATION OF SPERM IN HABROBRACON[1]

THE occurrence of dominant lethal genetic effects, following x-radiation, was first demonstrated in 1927 among the offspring of x-rayed males of Drosophila by H. J. Muller,[2] who states: "It was also possible to obtain evidence in these experiments for the first time of the occurrence of dominant lethal genetic changes, both in the X and in the other chromosomes. Since the zygotes receiving these never developed to maturity, such lethals could not be detected individually, but their number was so great that through egg counts and effects on the sex ratio evidence could be obtained of them *en masse*. It was found that their numbers are of the same order of magnitude as those of the recessive lethals. The 'partial sterility' of treated males is, to an appreciable extent at least, caused by these dominant lethals."

An immediate connection between the dominant lethal genetic effect and decrease in number of offspring, uncomplicated by lethal action of the rays upon the sperm themselves, would be difficult to establish in Drosophila or in any other organism in which biparental inheritance is the rule. In the parasitic wasp, *Habrobracon juglandis* (Ashmead), however, the males ordinarily develop from unfertilized eggs, only a small percentage of males in certain crosses exhibiting biparental inheritance. For this reason, if sperm were injured so that they were incapable of fertilizing eggs, x-radiation of males might be expected to cut down number of daughters, but there should be a compensating increase in number of male offspring, "step-sons" of the treated males.

During the course of investigations of the effects of x-rays on the ratio of male biparentalism, wild type (stock 1) adult males were treated with x-rays,[3] and mated on the next day and every fourth day following to recessive, orange (eyes) defective (r_4 vein) virgin females (stock 3), until each male had been mated to four females. Brothers of the treated group were mated with sisters of the mates of the treated males as controls. The first three matings of each male were observed, but in the case of the fourth, only about one half of the matings were actually observed in either controls or treated, the males in the other cases being allowed to remain with the females overnight.

As was to be expected, the proportion of biparentals among the offspring in bisexual fraternities was significantly lowered in the progeny of the x-rayed males, being 24.3 per cent., as compared with 64.8 per cent. among the progeny of controls. The mean number of offspring per female per vial is found to be $9.64 \pm .2077$ for the controls, and $6.16 \pm .122$ for the treated. The difference is $3.48 \pm .241$.

[1] The present investigation has been aided by a grant for apparatus and technical assistance to Dr. P. W. Whiting from the Committee on Effects of Radiation on Living Organisms (National Research Council). The author is indebted to Dr. Whiting for his constant interest and generous advice and direction.

[2] H. J. Muller, "Artificial Transmutation of the Gene," SCIENCE, lxvi: 1699, 84–87, 1927.

[3] Dosage, 2,500 R units; conditions, 50 KV, 8 milliamps., ½ mm Al shield, 15 cm distance from target; time, 25 minutes.

The above data take into account only the bisexual fraternities. In addition to these, 1,111 sisterless males were produced by 48 females which had been paired with x-rayed males. The mean number of progeny per female per vial for this group is 4.94 ± .1777. Since the matings of these females had been observed just as carefully as those of the controls (which produced practically no unisexual fraternities), and since the mean number of progeny per female per vial for this group is significantly lower than that of either group of bisexual fraternities, whereas unisexual fraternities regularly include much larger numbers of individuals than do bisexual, we are justified in concluding that the absence of biparentals is not due to the lack of viable sperm, but rather to the presence of sperm capable of fertilizing the eggs and of preventing development. These "unisexual" fraternities thus are not comparable with unisexual fraternities from unmated females. They are initially bisexual, from which all the biparentals have been culled by the lethal effects of the sperm in fertilization.

These data show clearly that we have to do, not with lethal action of x-rays on gametes, but with a true zygotic dominant lethal effect.

Certain data reported by Raymond J. Greb[4] tend to corroborate the conclusion reached from the above findings. While investigating the effects of x-radiation of mated females upon the rate of production of mosaic males in Habrobracon, Greb found that the number of sons per mother (in bisexual fraternities) was reduced slightly in the group of treated mated females, but that the percentage of females among the offspring was reduced significantly (20.8 per cent.) and that the total number of offspring per mother was also significantly lowered (37.32 per cent.). The points to be noted here are: first, that while the number of females was considerably lowered among the progeny of treated, the number of males produced did not increase to the extent of preserving the same average number of progeny per mother as that for the controls; and, second, that although this lowering of the general fecundity among the treated may not stand alone as conclusive evidence for the production of dominant lethals (because of the uncertainty as to the extent to which the direct effects of x-radiation on the eggs contributed to this diminished fecundity), they are in accord with the results obtained from the investigation in which the males alone were x-rayed.

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[4] Raymond J. Greb, "Effects of X-radiation on Production of Mosaic Males and on Sex Ratio in Habrobracon." In press.

A NOTE ON ELECTRICAL POTENTIAL AND THE PHYSIOLOGICAL GRADIENT

THE known facts about physiological gradients have been experimentally discovered, chiefly, as with Child's Planaria, by the study of teratological forms produced by subjecting the growing plant or animal to a differential of environment. This differential has usually been determined chemically, electrically or by the action of heat or of light. The electric current or potential has been found as yet to have three effects upon growth, namely, inhibition, reversal or retardation. The following experiment with hens' eggs was carried out as a feeler in order to indicate what might be expected in a fuller study of the effect of electrical potential on the development of the chicken embryo.

Five dozen eggs (White Leghorn) served in the experiment. Twenty-eight of these served as a control group, being hatched in the same incubator as the experimental group, but subject to no electrical potential. The remainder were divided into four groups as follows:

6 eggs with field in direction of minor axis.
8 eggs with field in direction of major axis.
9 eggs with vertical field—positive above.
9 eggs with vertical field—negative above.

These eggs during the period of incubation were set between metal plates carrying a steady potential difference of 81 volts, which was provided by two dry batteries. The eggs were insulated from the plates by sheets of cardboard.

Twenty-one chicks were obtained from the control group at the end of twenty-two days.

The eggs in the horizontal fields were retarded about 36 hours, 10 chicks being obtained from the 15 eggs, these chicks being, as far as could be determined, quite normal.

Of those in the vertical fields none emerged, even after 28 days; but on the 23rd day these were "candled" and found to be at the stage of maturation which is normally reached on the 18th day, and one broken up was seen to be alive

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