vitamin A as the diet employed for the stock animals which supplied the vitamin A experiments of 1930–31.

The records of the negative control animals show another favorable comparison between the two vitamin A-free basal rations. Averages of 11 rats placed after depletion on the vitamin A diet containing alcohol extracted casein show a loss of 28 grams in weight during their survival period of 22 days, or an average weekly loss of 8.9 grams. A similar study of 16 negative rats on the vitamin A diet with air-heat-treated casein shows a loss of 20 grams in their survival period of 16 days, or a weekly loss of 8.8 grams.

The Sherman-Munsell vitamin A-free basal diet has been proved by many workers to be adequate for growth when vitamins A and D are supplied. The growth records of 14 positive control rats that were fed a ration composed of 90 per cent. of the basal diet containing air-heat-treated casein, 10 per cent. butter fat, and 3 drops of viosterol weekly, gained 14 grams per week during an experimental period of 5 weeks. This excellent gain in weight of the positive animals would indicate that the casein had not been modified sufficiently by the action of heat to cause the nutritive value of the basal ration to be changed.

The matter of economy has already been mentioned. Because of the economical production of the heat-treated casein its use will naturally rest upon its being equal in vital respects to the alcohol-treated form. The above experimental data seem to establish the reliability of the air-heat-treated form of casein for the basal diet used in vitamin A studies.

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AUTOMATIC CONTROL FOR VACUUM APPARATUS

To those operating vacuum ovens with electric pumps, the need for automatic control has probably presented itself. If nothing more, the annoyance from noise due to continuous operation over long periods would be enough to suggest some means of control that would cut down the time of operation of the pump. Added to this is the economy in current consumed and the added life of the pump itself. Certainly, if a device that can cut down the time of operation to five or even ten minutes out of an hour can be installed, it is worth while, provided its original cost is not too high. Nothing within reason seems to be on the market, but a very simple and yet efficient one may be made at small cost.

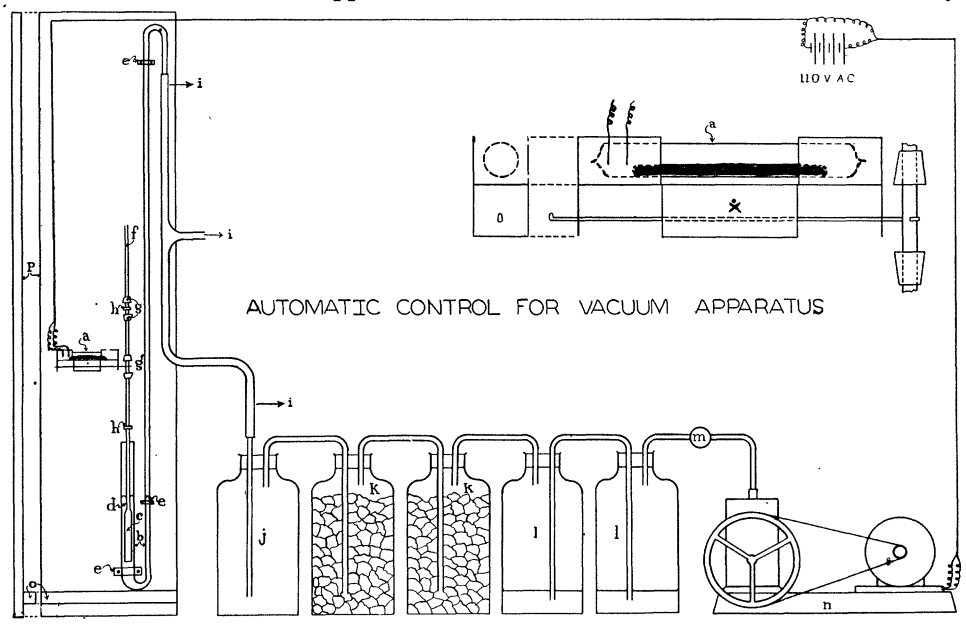

FIG. 1. p, board $\frac{7}{8}$″ x 10″ x 38″; o, shelf on p $\frac{7}{8}$″ x 1½″ x 10″; b, S-shaped glass tube; large arm, 1″ bore 12″ long, middle $\frac{1}{8}$″ bore 36″ long, short arm $\frac{1}{8}$″ bore 3″ long; c, glass float $\frac{3}{4}$″ dia. (outside) 3½″ long; f, stem of float $\frac{1}{4}$″ dia. (outside) 24″ long; e, clips to fasten b to board; h, $\frac{1}{4}$″ screw eyes 12″ apart; g, one hole rubber stoppers on f; a, mercury trip switch and cradle in which it rocks; x, screw fulcrum on which "a" rocks; d, mercury in glass tube; i, hose connections to glass tube, oven and moisture collecting jar; j, moisture collecting jar; k, calcium chloride jars; l, oil jars containing a little oil same as in pump; m, check valve (not needed if pump has one); n, electric pump and connections. Screw eyes "h" are to guide float and stem to prevent friction between float and tube; a few pointed papillae on the float will also prevent friction and avoid the use of the lower screw eye.

The accompanying figure will show the set-up.

Switch (a) can be bought or made. Its length should be about 3 inches. In such a switch the weight of mercury helps to operate it. If one is made, use a ½-inch glass tube and fuse platinum wires about ¼-inch apart near one end and reaching within ⅛-inch

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.