sounds about the northern side of the Shoshone Lake in particular as compared with those of the Seneca Lake might be. As it turns out no one seems to have taken note from lake to lake. Awing and strange as these nature sounds are, there has long been a silence about them quite as strange as the sounds themselves.

G. R. WIELAND

YALE UNIVERSITY

SCIENTIFIC APPARATUS AND LABORATORY METHODS

APPARATUS FOR MOTOR CONDITIONING IN CATS[1]

A CONVENIENT apparatus for motor conditioning in cats and other small animals has long been needed. These animals being widely used for operative purposes, it is often desirable to establish conditioned responses in connection with the operative procedures. The lack of a convenient means of training has, however, made it inconvenient to use them in many cases for which they would otherwise be particularly suitable. For example, cats are commonly used in experiments on the middle ear, but hitherto it has been difficult to determine the actual effect of these operative changes upon hearing.

The lack of a suitable conditioning technique has also led to the wide-spread belief that cats are "stupid." This attitude was exemplified by a well-known investigator who, after years of operative work with cats, remarked informally that if cats were able to learn anything he had not yet found it out. It seems likely that this apparent stupidity is due far more to inadequacy of the training techniques employed than to the animal. Proceeding on this assumption, we recently devised an apparatus which seems to be well adapted to the normal action-patterns of cats.

The apparatus consists essentially of four grills composed of small copper bars, set in a radial, fan-wise arrangement; each grill thus constitutes one quadrant of a complete circle. The grills are separated by metal barriers 6 inches high; the animal can easily pass from any quadrant to the next and yet each one forms a distinct compartment. The ends of the bars extend well beyond the upright walls of the cylinder and are thoroughly insulated from each other and from the rest of the apparatus. Alternate rods are connected at the inner circumference and then joined to one pole of the source of shock. The other rods are joined to form the four individual sections. The four leads are joined to switches which connect with the other pole of the shock-potential. Closing any one switch, therefore, completes the circuit for the corresponding grill. The stimuli are presented automatically by a relay circuit so that the sound is "on" for an interval of about 2.2 seconds and is directly followed by a momentary shock on the grill which the animal is then occupying. The shock-intensity is readily adjusted by applying a high voltage (1,100 volts) across suitable resistors. The whole apparatus is covered with a removable wire-mesh lid; the cat is observed from outside the test-room through a mirror.

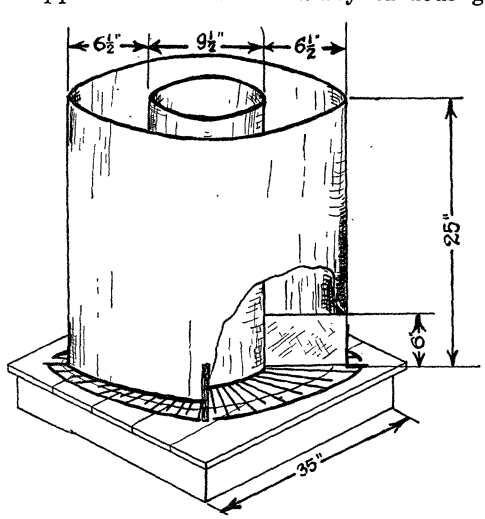

FIG. 1

In actual use, the animal is placed in any one of the quadrants. The stimulus-tone is presented and followed by the momentary shock, which is made just strong enough to stimulate the cat to move hastily over the barrier into the next quadrant. On the following trial, the cat again advances to another quadrant, and so on. The response required is thus as easy and natural as can well be imagined: merely moving into the section just ahead. At first the animal may prove slightly recalcitrant when shocked but soon reaches the stage of moving quickly and quietly ahead as soon as the tone begins.

We have used the apparatus for a number of months in conditioning cats and find that with 25 trials per day most cats will reach a score of 100 per cent. within from 7 to 14 days. This performance is fully equal to that of dogs who are conditioned to flex the right fore-paw upon presentation of a tone.[2] Cats promise to be particularly useful in auditory work, since they are perfectly quiet (no panting). Reliable limens can thus be obtained with minimal time and effort.

This apparatus was primarily devised for auditory stimulation, but by requiring the cat to make a com-

[1] Communication No. 6 from the Alpha Research Laboratory, Department of Psychology. Special aid from the Research Trustees of the American Otological Society and the Elizabeth Thompson Science Fund is gratefully acknowledged.

[2] SCIENCE, 78: 269–270, 1933.

plete circuit of the grill and thus return always to the initial position it may readily be adapted to other modes of stimulation (visual). We have not used it for training animals other than cats, but with minor modifications it should be eminently suited for any of the smaller species, such as guinea pigs.

ELMER CULLER
GLEN FINCH
EDWARD GIRDEN

UNIVERSITY OF ILLINOIS

THE DETERMINATION OF MOISTURE IN UNSTABLE PRODUCTS

FOR the determination of moisture in relatively unstable products the vacuum oven is more dependable than the electrically heated and controlled drying oven, as is shown by the results obtained on six brands of commercial smoking tobacco and on the tobacco removed from five brands of cigarettes, all purchased in the local market. The samples were ground to pass a 1 mm sieve and the determinations conducted in glass-stoppered weighing bottles.

The vacuum oven employed was a water-jacketed Carr evacuated by an ordinary filter pump at room temperature (25° C.) with the intake air passed through sulfuric acid. The drying period for finely ground materials is generally over night (20 hours), but in this instance was continued through two nights, because of excessive humidity in the laboratory, followed by a single over-night run for the second weight. The electrical drying oven was of standard make and heated to 95° C. The drying periods were two, of 3 to 4 hours each, followed by an over-night run for the third weight.

MOISTURE IN TOBACCO SAMPLES

Sample No.	Vacuum oven		Electrical drying oven		
	Period 1	Period 2	Period 1	Period 2	Period 3
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Smoking					
1	4.65	4.76	6.17	6.64	7.37
2	5.81	5.93	7.21	7.80	8.90
3	4.99	5.11	7.38	8.28	9.52
4	4.87	4.98	6.13	6.34	6.73
5	5.52	5.64	7.31	7.92	8.83
6	5.61	5.70	7.52	8.39	10.01
Cigarettes					
7	4.82	4.95	6.52	7.05	8.04
8	4.50	4.65	6.46	7.07	8.11
9	5.37	5.51	7.33	7.91	9.01
10	5.49	5.59	7.10	7.49	8.56
11	5.79	5.90	7.67	8.23	8.99
Average	5.22	5.34	6.98	7.56	8.55

The slight additional loss on the second weighing from the vacuum oven could be attributed largely to quicker handling and to lower humidity. Decomposition was a serious factor by the electrical drying oven, even for the first period, and increased for the duration of the test. Similar results were obtained on ice-cream stabilizers.

E. B. HOLLAND
C. P. JONES

MASSACHUSETTS AGRICULTURAL EXPERIMENTAL STATION

SPECIAL ARTICLES

HEREDITARY VARIATIONS IN THE GESTATION PERIOD OF THE RABBIT

FOR the past few years this laboratory has maintained an experimental colony of rabbits, comprising approximately 1,500 standard bred and hybrid animals. Each of the standard breeds has been inbred to a considerable extent in order to obtain a more homogeneous population than was represented by the original stock. In some cases close inbreeding has been maintained for several years. The data accumulated have included accurate records of the date of service and of birth of nearly all animals raised in the colony. Experience showed that the gestation period varied from 29 to 36 days. The data bearing on this subject have been submitted to a statistical analysis for the purpose of determining whether breed or race had any influence on the duration of pregnancy in the rabbit.

A total of 569 pregnancies from observed matings, distributed over a five-year period (1929 to 1933), forms the basis of the present analysis. Matings were made in all months, with the exception of July and August. Eleven breeds, consisting of ten standard bred strains and one intensively inbred line of albinos which may be considered as a breed or family, are represented. The mean gestation period ranged from a low of 30.37 days for the Polish to 32.89 days for the inbred albino group. The number in each breed, together with the breed mean values, are given in the accompanying table.

It was found that the variance between breeds was significantly greater than the variance within breeds (Var. between means of breeds = 19.09; Var. within breeds = 0.86; $F = 22.2$, $P = 0.01-$, significant). In order to make the test of variance more exacting, the albino group which had the longest gestation period, and which in reality is a family and not a standard breed, was excluded. On this basis, the variance between breeds, although reduced, was still significantly greater than the variance within breeds (Var. between