It is the purpose of this progress note to announce that during February, 1936, it has been shown experimentally that laboratory-reared *Anopheles* (*Anopheles*) *punctimacula* (Dyar and Knab) when fed on the blood of suitable malaria patients, are susceptible to infection with either *Plasmodium vivax* or with *P. falciparum*.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

DEVICE FOR THE MOTOR CONDITIONING OF SMALL ANIMALS[1]

SOME time ago[2] a conditioning apparatus for use with cats was published from this laboratory. That piece gave useful service, but another apparatus is now available which far excels it in speed and reliability of training and testing.

The present model is adapted from the ordinary rotating cage, used for measuring the general activity of small animals; and is so constructed that the cat, upon turning the cage an inch or more when the sound (substitute stimulus) begins, escapes the shock by breaking the high-voltage circuit through a pendulum-switch. Details of construction, as provided in mimeographed form by the technical staff of this laboratory, will be furnished gratis upon application to either of us.

In testing the apparatus, a considerable number of animals (20 cats, 12 guinea pigs, 5 male white rats) were first used. By our earlier methods of training, a large proportion of cats always proved intractable; hence we decided to try every cat in our colony and thus find what proportion of an unselected population would work acceptably. By this preliminary test (15 to 25 trials with 1,000 cycle tone) they were divided into three groups: A, those which began reacting to the tone during these initial trials (8); B, those which by reacting well to the shock gave promise of early conditioning (9); C, those which, being unresponsive, were discarded (3). Those in A and B were then given 25 additional trials, the percentage of conditioned responses (shock avoidance) being as follows:

Group A	96%	96	88	88	64	40	40	36	
Group B	84%	64	60	48	40	24	20	8	8

Despite these encouraging results, the crucial question still remained: How will the rotator work in limen-determination? It is here that most methods fail. Cats will often do well enough with loud or complex sounds; but when a sinusoidal stimulus of low intensity is used, they may fail to react even once to tones which are known to be quite audible to them. Then, for reasons just as obscure as their former refusal, they may suddenly begin responding at a level many decibels weaker than before. With faint stimuli cats are notoriously erratic.

Two cats were accordingly chosen for threshold work, the limens being measured at three frequencies (125, 1,000 and 8,000 cycles) with the technique regularly employed at this laboratory;[3] see adjoining table.

Cat	125 cycles 1	125 cycles 2	1,000 cycles 1	1,000 cycles 2	8,000 cycles 1	8,000 cycles 2
	52	50	68	68	40	46
	54	50	70	66	36	46
	50	48	70	66	38	44
	50	46	70	68	36	44
	52	48	68	64	36	44
Mean	51.6	48.4	69.2	66.4	37.2	44.8
Standard error of mean ...	0.75	0.75	0.49	0.75	0.80	0.49

These limens, measured directly after the initial 50 trials, are as consistent (low standard errors) as are the scores of representative dogs after weeks or even months of training (*cf.* footnote 3, 226). Since these initial tests, we have used the method with many other cats in our systematic programs and have found it equal in reliability and far superior in speed to our dog-training methods.

The guinea pigs scored as follows in the second of two series of 25 trials (numbers represent percentage of conditioned responses): 88, 64, 52, 48, 20, 20, 20, 20, 20, 16, 8, 8. Though somewhat inferior to the cats, they did better than was expected. Their explosive mode of response makes them peculiarly refractory to ordinary methods of training; apparently because the conditioned stimulus must be built up to unusual potency ere it can break down the high initial resistance of the pig's sensori-motor system. In view of their thyratron-like behavior, the scores of the pigs in the rotator seem to be notably good. The five rats, finally, gave these scores in the second 25 trials: 64, 60, 40, 44, 36.

Credit for suggesting the use of a rotating cage in this type of work is due the first-named author; but we share the conviction equally, derived both from quantitative evidence like the above and also from observing the animals when they work, that a real advance has been made in the business of training laboratory animals. The rotator combines various advantages. (1) It employs the shock-incentive, which, unlike food, is stable and unfailing, even when the animal's economy, visceral or somatic, is gravely disturbed (newly op-

[1] Communication No. 20 from the Animal Hearing Research, Department of Psychology; maintained by aid of the Research Council of the American Otological Society. The present investigation was aided by a grant from the Josiah Macy, Jr., Foundation.

[2] Culler, Finch and Girden, SCIENCE, 79: 525, 1934.

[3] Culler, Finch, Girden and Brogden, *Jour. General Psych.*, 12: 223, 1935.

erated, sick, decorticate.) (2) The activity required of the animal is easy and familiar. Instead of a localized, differential response (retraction of the right fore-paw), any gross somatic behavior will do. The cage turns so readily as to require minimal incentive or energy. (3) It gives the animal unhampered freedom of limb movement and thus obviates "fighting the apparatus." Any form of restraint is particularly resented by cats. (4) Its principal feature is probably that no response is incorrect. With most devices, everything the animal may spontaneously do is wrong except the one reaction imposed by the experimenter; hence most of the training-time is consumed in extinguishing or inhibiting false starts. Here on the contrary, any movement gross enough to turn the cage is adequate. If the animal tries to escape, it also turns the cage; whether it walks forward, backward or sidewise is immaterial. Only inactivity is unacceptable.

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AN AID IN COLOR-BLINDNESS

THE general assumption relative to color-blindness seems to have been that no artificial aid was possible for persons suffering from the condition. Actually, such a pessimistic attitude is not justified in the case of this or almost any other sensory deficiency. The inconveniences of color-blindness can be partially offset by proper use of color-filters.

For example, there appear occasional news items telling of color-blind persons who have learned to distinguish the red and green traffic lights by their positions in the signal and who have then been thrown into confusion by trying to apply their method of discrimination in a town where the practice is different as regards the position of the two lights. These stories have resulted in some attempts at standardization of the signals, but irregularities of practice still exist.

An infallible and simple expedient for the color-blind person faced by this situation is to affix red and green color-filters, one above the other, to the windshield of his car in such a way that their positons can not become accidentally interchanged. Because red and green are complementary colors, the red signal will be visible only through the red filter and the green signal through the green.

The device is improved by placing a prism or reducing lens over each filter in such a way that the signal will be visible through both filters at the same time.

In this form, that is to say, with the lenses, the idea has been tried out and found operative.

The experimental model as constructed by the writer employed red and green Eastman Wratten filters designated as 25A and 58B, respectively. These were mounted side by side between two pieces of glass, with a minus 3 diopter lens in front of each filter. Suction cups were provided for affixing the device to the windshield of a car, tests being made with color-blind volunteers both in traffic and in the laboratory.

Another possibility is that one of the color-filters might be perforated, and parts of the other set in it like polka-dots. Thus, if the red filter were perforated and the openings were filled with the green material, a red traffic light or other red object viewed through the resulting filter would appear bright with dark spots. A green object, on the other hand, would appear dark with bright spots. This is a type of discrimination which would be easy for the color-blind person.

Red-green color-blindness is probably not the only type that could be offset by the expedient of using color-filters, but to prescribe the suitable filters for other less well-defined types would be an undertaking requiring careful study and justified only in the event that the afflicted individuals can be persuaded to make use of the aid.

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