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Conditioned Reflexes as a Method of Determining the Value of
Certain Ingredients From the Outside World. From the Point
of View of Public Health

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AN EXPERIMENT WITH THE USE OF THE CONDITIONED-REFLEX METHOD
FOR MEDICAL IDENTIFICATION OF SOME INGREDIENTS OF THE
EXTERNAL ENVIRONMENT

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During sanitary inspections it is necessary in many cases to identify small concentrations or traces of foreign substances present in the air, soil, food products and elsewhere, which do not lend themselves to chemical or physical methods of study or require complex apparatus or techniques for their identification.

One of our earlier efforts to get around this difficulty was an attempt to utilize the most accurate and sensitive apparatus that exists in nature, specifically, the receptors and analyzers of animals having well-developed sensitivity. The first thing we had to do was to develop in the animals conditioned reflexes to odors.

As test objects we first tried dogs, since dogs have a particularly sensitive sense of smell and are rather easily trained (other animals, including monkeys, can also be used for the purpose).

First we had to find out whether it is at all possible to establish a definite and stable reflex in a dog in response to a very weak odor, almost imperceptible to a human. If this were possible, then all subsequent variations and refinements of the method for medical use will present no difficulties and involve mainly the training of dogs.

Various substances with very weak odors were used for the experiments, including sunflower-seed oil. As all substances tried gave

analogous results, we will call them substance A in this article.

The formation of stable reflexes in dogs to substance A can be done in two ways -- the creation of either positive or negative reflexes. Positive reflexes in the response of dogs to stimuli associated with pleasure feelings seemed unsuitable to us because of the difficulty of establishing a well-defined reflex. Therefore we chose negative reflexes as evidenced in the tendency of the dog to avoid an unpleasant stimulus. In other words, we decided to associate the stimulus, the odor of substance A, with fright evinced by raising the fur, snapping of teeth and physical avoidance of the stimulus.

Two dogs were used for the experiments: a Caucasian husky named Noyba and a German sheep dog called Ketti. As stimuli we used pieces of blotting paper, small wooden slabs, pieces of meat, clods of earth and other objects, which had absorbed vapors of substance A. These objects were placed in a dessicator, in the bottom of which was a cup containing 5 cubic centimeters of substance A.

In order to produce the negative reflex, the instant of perception of the odor of A was associated with an acute painful sensation. A hunting harness fitting over the neck and chest was used to produce the painful sensation; the harness consists of a collar studded on the inside with sharp points and a chest harness made along similar lines. A jerk on the cord leading from the harness causes a sudden, sharp pain in the animal which visibly reacts by raising its fur, snapping its teeth and thrashing about.

For the first experiments a special wooden stand was built into which the dog was led so as to concentrate its attention on the necessary stimuli.

The procedure for inculcating conditioned reflexes in dogs to an odor was as follows:

1. Training the dog to the stand -- 12 days.
2. Work in the stand.
3. Inculcation of conditioned reflexes in harness.
4. Differentiation of odors (the dog would confuse the given odor A with similar odors) -- 20 days. In each dog a reflex was established for one odor only.
5. Differentiation of objects (so that the reflex would not be associated with equipment, people, or objects saturated with the odor, but only with the odor itself) -- 12 days.

RESULTS OF EXPERIMENTS

1. The dogs, Ketti and Noyba, were trained in the stand and freely permitted themselves to be led into it.

2. While in the stands the dogs were approached at random with objects without odor and objects from the dessicator saturated with substance A. When the latter objects were presented a jerk was given on the harness (neck and chest).

As a result of the action of the harness, Ketti started to enter the stand unwillingly. At first, there was some fright noticeable when any object was brought in, but after smelling the object, not the A odor, the dog quieted down. In order to avoid association of odor with the stand, subsequent experiments were done with the harness alone.

Paper without odor -- no reflex; paper from dessicator --

strong agitation. The reflex is strengthened by a jerk on the harness.

3. Worked without the stand, using only harness. Strengthened the primary reflex to an A odor by bringing up objects with and without odor A.

The reflex appeared in dogs without fail in response to substance A after the influence of the harness, an increase in nervousness was noticed even upon bringing up an object without odor.

4. Meat was placed on two boards lying on the ground: one board had no odor, the other with A odor. The placement of boards was constantly varied. The dog gave a satisfactory response, sometimes approaching the meat (on both boards) with heightened caution because of fear of the harness.

Noyba was led in with harness (without stand). The dog was approached with odorless boards 4 times and then given meat. It reacted calmly to the board without an odor. On the fifth time, a board taken from the dessicator, in which it had lain for nearly a month, was brought in. Upon bringing in this board with meat, the dog snapped its teeth, started to growl, and leaped sideways.

CONCLUSIONS

1. It was possible to establish a primary reflex in the dogs Ketti and Noyba to a very faint odor.

2. A differentiation of odors was established; the dogs only gave the characteristic reflex to that odor among several similar odors to which they were trained.

3. The inculcation of the reflex does not involve a visual component.

4. Consequently, the basic question, can dogs be trained to a definite, stable reflex response to an odor, ^{an odor} ~~under~~ ^{ion} differentiated ~~condition~~, is answered affirmatively.

In view of the data of our experiments, further work on the establishment of such conditioned reflexes must be conducted, in our opinion, along the following lines.

- (a) The inculcation of ^{of} olfactory reflexes only in healthy dogs, with a good sense of smell, and a well-developed hunting instinct. ^{of following}
- (b) Dogs should first be trained to ^{follow a scent,} hunt, be obedient, etc.

The dog must be accustomed to his surroundings, walked with a collar, taught encouraging and threatening intonations, walking at heel with and without leash and generally trained in restraint.

(c) Experiments should be conducted on inculcating positive as well as negative reflexes.

(d) Conditioned reflexes should be inculcated not only for odor, but for particular concentrations of substances.

(e) Inculcation of conditioned reflexes in cases where it is essential to determine the quality, type, condition, and changes in various substances (for instance, flour, tea, meat, etc) when such changes in odor or color are not perceptible to humans organoleptically or by the use of apparatus. Conditioned reflexes can be used also to identify a number of ^{of} contaminants in air, water, etc.

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