

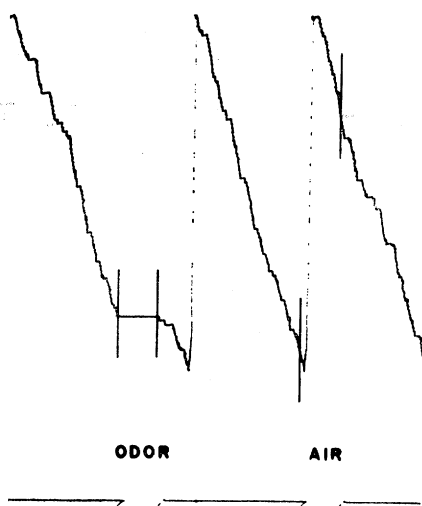


Fig. 2. Sample record of odor discrimination (cumulative response record of bar pressing). The pen moves from the top to the bottom of the record and resets automatically. Note that there is complete cessation of response during the introduction of odor but no diminution of response during the introduction of air from an empty control channel. The pairs of vertical lines on the record were drawn in to show the onset and duration of stimulation indicated by the signal marker.

odor bottles are maintained at a constant temperature by water bath *g*. The outflow from each odor bottle is controlled by a three-way stopcock so that the odor can be added to the main stream or shunted through a bypass (not shown) to an exhaust. This provides a continuous flow of air through the odor bottle when the input stopcock to the odorant bottle is opened, to insure equilibrium when the odor is added to the main stream. The concentration of odorant in the odor stream is a function of the rate of air flow over the odorant surface, the height of the odorant in the odor flask, and the vapor pressure of the odorant. The concentrations of odorant can be computed from the weight of odorant lost for given durations and flow rates. The final concentration of odor can be computed from the relative flow rates of pure and odorized air and may be specified in milligrams per liter, moles per liter, or number of molecules.

All parts of the olfactometer are made of Pyrex glass, including the first 5 in. of the "wind tunnel" section (*j*). The liberal use of ground glass joints makes the entire system easily demountable for cleaning. Section *k* is made of brass tubing 4 in. in diameter and contains the bar-pressing platform and dipper mechanism, which projects 3 in. into the glass part (*b*) of the response chamber. The platform, bar, and dipper and the anterior two-thirds of the animal are visible to the experimenter. A new model of the apparatus has been built (3) in

which the response chamber is made entirely of glass and in which the bar and drinking font project into the chamber from below, through small ports.

The training procedure is typical of operant discrimination training in which responses are occasionally reinforced in the absence of odor (S^D) but never during the presence of odor (S^A). The onset of odor signals the "no-reinforcement" condition. A control training procedure is employed in which clean air from an empty odor bottle is presented, *with reinforcement*, to insure that discrimination is learned on the basis of odor and not of other cues incidental to turning stopcocks, to changes of air pressure, and so on. Odor training (S^A) and control training are interspersed randomly. After discrimination has been established, test trials consisting of a 10-second period during which odorized air is introduced and a 10-second odorless control situation are presented, without reinforcement.

In the early experiments we employed a discrimination criterion of fewer than six responses during the 10-second odor test with no diminution in response rate during the 10-second odorless-air control procedure. In order to maintain discrimination at this level, discrimination training trials were continued and interspersed among test trials. Training trials usually consisted of 30 seconds or more of odor (S^A) or of odorless control procedure. Responses during the 10-second control test numbered approximately 30 (mode), with a range of from 20 to 40, depending on the animal. A well-trained animal usually stopped bar-pressing immediately in response to a suprathreshold odor, with a negligible latency after the odor stopcock was turned (see Fig. 2). The time before resumption of bar-pressing after the odor is turned off may be variable, but this was not important in the present testing procedure. This method has proved useful for studies of threshold in normal animals after ablation of the olfactory bulbs and in experiments on animals with altered endocrine balance.

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References and Notes

1. B. F. Skinner, *Behavior of Organisms* (Appleton-Century-Crofts, New York, 1938).
2. This study was carried out in the psychology laboratory of Brown University, under a grant from the National Science Foundation.
3. Victor Bartoszewicz of the Brown University chemistry department constructed the glass components of this olfactometer.

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Chromatography of Molten Salts on a Glass Powder Column

The physicochemical similarity of glasses with zeolites and with the non-crystalline oxides (silica, alumina) used in chromatography induced us to test the ion-exchange and adsorptive properties of glass under conditions in which these properties might be expected to be of practical use. As a medium, molten salts were selected.

A Pyrex column of inner diameter 8 mm and length 20 cm was filled with Pyrex glass powder (100 to 140 mesh); the column could be slowly charged with the melt. As stopcocks, connecting tubes of length 10 cm and inner diameter 2.5 mm were used. The tubes were placed in sections of the (vertical) oven that could be cooled.

In order to avoid chemical attack on the glass, only salts melting below 400°C were used, such as alkali nitrates and mixtures of alkali halides (preferentially the eutectic mixture of lithium and potassium chlorides, which melts at 352°C).

To this mixture, from 0.1 to 1 percent of chlorides of heavy metals, such as Cr^{III} , Cu^I , Ni^{II} , Co^{II} , and Mn^{II} , were added. Separation in zones was observed, which compared in sharpness favorably with those obtained by chromatography in aqueous solution. With the above column and the eutectic mixture used, the adsorption of the heavy metals at 400°C decreased in the above order.

Elution (with pure molten salt) is as easy as in the chromatography from aqueous solutions.

When a small particle of the eutectic mixture of lithium and potassium chlorides, containing one or more heavy metals, is slowly heated to the melting point on a porous Pyrex filter plate, concentric colored circles, showing the differential adsorption of the heavy metals, are observed.

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Nonpolar Transport of Gibberellin through Pea Stem and a Method for Its Determination

Gibberellin was found to differ from auxin in many physiological effects (1). Hence, it is of interest to see whether the transport of gibberellin through the stem is polar or not. As to gibberellin transport, it is only known that gibberellin is transported lengthwise twice as rapidly as transversely (2).

A method of determining gibberellins is needed for transport experiments, as