extinction curve. Their rates oscillate between 0% and 7% of the total number of stimulations for all animals, which means that none of them developed a successful response to light. The calculation of the level of significance of the differences found between the results of both groups, shows that the initial association of light and sound has systematically affected the behaviour of the experimental group ($P < 0.001$; Fisher exact probability test for the 6 initial sessions of the third phase).

Discussion. It can be concluded from the results obtained in these experiments, that an 'associative' conditioned reflex can be obtained on the rat. One could nevertheless object that the identity of reaction to sound and light can be simply interpreted as a case of response-generalization. This amounts to saying that no true association was formed in the experimental group, in other words that the light stimulus never acted as an authentic signal for the electrical shock. The absence of an efficient response to the light-stimulus in the control group seems, however, to establish the opposite. For the animals of this group, indeed, the situation presented called for a discrimination between a non-reinforced stimulus (L) and a reinforced stimulus (S). The results obtained for the controls show that the light did not play the role of a signal as the sound had done before. In the case of the animals of the experimental group, on the contrary, the percentages of pedal-pressing for light show that this stimulus acted, at least up to a certain level, as a signal for the sound, the latter acting in its turn as a signal for the shock. This means that, in so far as the animals reacted in the same manner for light and for sound, light acted as a signal for the shock. It can therefore be concluded that the temporal contiguity of 2 neutral stimuli has in itself enabled the rats to establish a functional relation between them, without the aid of any specific motivation factor.

Résumé. Les expériences discutées ont porté sur le rôle de la motivation – sous la forme d'un renforcement – dans l'établissement de réponses conditionnées instrumentales chez le rat. Les résultats obtenus sur un groupe expérimental et un groupe de contrôle comprenant chacun 7 animaux, montrent que la contiguité temporelle de 2 stimuli neutres (son-lumière) permet aux animaux d'établir entre ceux-ci une relation fonctionnelle sans intervention d'un facteur spécifique de motivation.

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The Constituents of Arterial Pressure Change

The hemodynamic determinants of arterial pressure are mainly cardiac output and systemic peripheral resistance. When a change in arterial pressure is observed in a cardiovascular reflex or response, one might be interested in the relative degrees of contribution of the 2 factors, cardiac output and peripheral resistance, to the arterial pressure change. This is a question of the constituents of the arterial pressure change. Formulation of equations for quantifying the constituents from experimental data would be useful for the analytical study of cardiovascular regulation.

Mathematical formulation. If we denote mean arterial pressure by P, cardiac output by I and systemic peripheral resistance by R, since P is a monotonically increasing function of I and R, it may be expressed as

$$P = f(I, R); \quad \frac{\partial P}{\partial I} > 0, \quad \frac{\partial P}{\partial R} > 0. \tag{1}$$

Assuming that a law analogous to Ohm's law of electricity holds good approximately among P, I and R, then

$$P = I R. \tag{2}$$

In total differential form

$$dP = R\,dI + I\,dR. \tag{3}$$

If we use increments instead of differentials, approximately,

$$\Delta P = R\,\Delta I + I\,\Delta R. \tag{4}$$

This equation means that any change in arterial pressure consists in the 2 parts: one due to a change in cardiac output and the other due to that in systemic peripheral resistance. The relative magnitude of contribution of each part to the arterial pressure change may be expressed by the ratio of each term of the right hand side of equation (4) to the total change, left hand side. Let us call these 2 ratios 'constituents' of the arterial pressure change and denote by C_I and C_R, i.e.

$$C_I = \frac{R\,\Delta R}{\Delta P} \tag{5}$$

and

$$C_R = \frac{I\,\Delta I}{\Delta P}. \tag{6}$$

C's refer to 'constituents', suffix I to cardiac output and suffix R to peripheral resistance. Obviously,

$$C_I + C_R = 1. \tag{7}$$

For actual computation, since R is not directly measurable, substituting the so-called total peripheral resistance, P/I, for R in equations (5) and (6),

$$C_I = \frac{P}{\Delta P} \cdot \frac{\Delta I}{I} \tag{8}$$

and

$$C_R = 1 - \frac{P}{\Delta P} \cdot \frac{\Delta I}{I}. \tag{9}$$

In a previous study[1] an index, β, was proposed for the degree of contribution of one particular region to a change in total peripheral resistance; i.e.

$$\beta = \frac{\Delta g}{\Delta G} = \frac{i\,\Delta P - P\,\Delta i}{I\,\Delta P - P\,\Delta I}, \tag{10}$$

where i = regional flow rate, g = regional conductance ($= i/P$), G = total conductance ($= I/P = 1/R$), and Δ's refer to their changes in a cardiovascular reflex or respon-

se. Adding up for all regional flow areas, $\Sigma \beta = 1$. If we multiply β with C_R and denote the product by β',

$$\beta' = \beta C_R . \tag{11}$$

This index will enable one to compare the relative importance of the change of a regional resistance to that in cardiac output, since

$$\Sigma \beta' + C_I = 1 . \tag{12}$$

Examples of application. The meaning of the above proposed indices, C_I, C_R, and β', will become clearer by examples of actual computation of them from experimental data.

Example 1. Bilateral carotid occlusion in a dog weighing 9.5 kg. Anesthesia with pentobarbital. Aortic flow and left renal flow were measured with electromagnetic flowmeters. Control values of pressure and flows and their changes during occlusion were:

$$\begin{array}{llll} P & = 112 \text{ mm Hg}, & \Delta P & = 63 \text{ mm Hg} \\ I & = 1500 \text{ ml/min} & \Delta I & = 54 \text{ ml/min} \\ i_{\text{Renal}} & = 97 \text{ ml/min}, & \Delta i_{\text{Renal}} & = 2 \text{ ml/min}. \end{array}$$

Substituting these values in equations (8), (9) and (11), we obtain

$$\begin{aligned} C_I &= 0.064 \\ C_R &= 0.936 \\ \beta'_{\text{Renal}} &= 0.062. \end{aligned}$$

Since the change in cardiac output was small, the reflex rise in blood pressure was for the most part (93.6%) contributed by the change in peripheral resistance. As a matter of fact, in this particular instance, the contribution of the cardiac output change to the reflex change in arterial pressure was so small that it was comparable to that of the peripheral resistance change in the unilateral renal area.

Example 2. Electrical stimulation of the carotid sinus nerve in a dog weighing 9 kg. Other experimental conditions were the same as in Example 1.

$$\begin{array}{llll} P & = 135 \text{ mm Hg}, & \Delta P & = -60 \text{ mm Hg} \\ I & = 1170 \text{ ml/min}, & \Delta I & = -230 \text{ ml/min} \\ i_{\text{Renal}} & = 87 \text{ ml/min}, & \Delta i_{\text{Renal}} & = -15 \text{ ml/min}. \end{array}$$

These values yield:

$$\begin{aligned} C_I &= 0.443 \\ C_R &= 0.557 \\ \beta'_{\text{Renal}} &= 0.045. \end{aligned}$$

In this instance, in contrast to the previous one, the change in cardiac output played an important part. The decrease in arterial pressure consisted in the part due to a decrease in cardiac output and that due to a decrease in peripheral resistance at a ratio nearly 1:1.

Zusammenfassung. Es wird eine Methode zur quantitativen Bestimmung der relativen Grössen, der jede Blutdruckveränderung beeinflussenden beiden Teilprozesse (Minutenvolumen- und Widerstandsänderung) mitgeteilt.

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Die Wirkung von Benzpyren, Zigarettenrauchkondensat und passiver Berauchung auf die Bildung der Zoxazolaminhydroxylase

Die Möglichkeit, die Aktivität hydroxylierend wirkender Enzyme bei Säugetieren durch Belastung des Organismus mit polyzyklischen aromatischen Kohlenwasserstoffen und anderen körperfremden Substanzen zu steigern, ist in den letzten 10 Jahren intensiv untersucht worden[1]. Zoxazolaminhydroxylase ist ein Enzymsystem, das durch Fremdstoffe induzierbar ist und dessen Aktivität in vivo an Hand der Paralysedauer nach Gabe von Zoxazolamin (2-Amino-5-chlorbenzoxazol) leicht gemessen werden kann. Es wurde zur Bestimmung der enzyminduzierenden Wirkung zahlreicher Stoffe benutzt[2–6].

Buu-Hoi et al.[7] zeigten, dass auch komplexe Substanzgemische Hydroxylasenaktivitäten stark stimulieren können. Sie bestimmten die Enzyminduktion durch Messung der Veränderung der Zoxazolaminparalyse bei Ratten, die i.p. Injektionen von Zigarettenrauchkondensat oder «air pollutants» erhalten hatten.

Unsere experimentellen Untersuchungen sollten klären, ob auch eine passive Berauchung eine Enzyminduktion auslösen kann. Daneben interessierte uns die Frage, ob Ratten und syrische Goldhamster a priori hinsichtlich der Aktivität von Enzymen, die den Abbau von Fremdstoffen fördern, erhebliche Unterschiede zeigen und ob diese Enzyme durch induktiv wirkende Stoffe oder Stoffgemische unterschiedlich zu beeinflussen sind. Untersuchungen über die Verträglichkeit und den Abbau von Nikotin (Reckzeh et al.[8] und Harke[9]) hatten erkennen lassen, dass der Hamster bzw. die Hamsterleber zu einem wesentlich stärkeren Abbau dieser Fremdstoffe fähig ist.

Methode. 240 männliche syrische Goldhamster mit einem Durchschnittsgewicht von etwa 90 g (Zucht See-

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