POSITIVE FEEDBACKS AT WORK DURING FEEDING

by

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(With 2 Figures)
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INTRODUCTION

As a rule food intake leads to satiety, that is, to a physiological state of the organism in which the tendency to feed is very low. This process of reducing hunger and increasing satiety can be understood largely with the aid of negative feedback mechanisms that regulate caloric intake in relation to caloric deficits.

However, if it is assumed that an animal starts feeding because some satiety parameter falls below a critical level, then the question may arise why the first feeding bouts—involving the ingestion of calories—would not bring back this parameter above the critical value and so stop food intake immediately after these first feeding bouts. Evidence in favour of such an early rise of satiety parameters has been given by STEFFENS (1969) who showed an increase of bloodglucose and insulin levels occurring during the very first minutes of a meal in rats.

The question that arises can be summarized in the following way. What causes animals to eat in meals instead of being nibblers? (For a definition of a meal see WIEPKEMA, 1968). This problem has been discussed elsewhere in some more detail (DE RUITER et al., 1969 a and b). Here I shall present data supporting the idea that feeding facilitates itself by means of positive feedbacks.

The significance of such positive feedback mechanisms has recently been discussed for feeding and drinking by several authors (LE MAGNEN, 1969; MCFARLAND, 1969; MCFARLAND & MCFARLAND, 1968 and DE RUITER & WIEPKEMA, 1969 b). To analyse this possibility of self-facilitation detailed feeding patterns have been recorded during the first phase of a meal in mice.

1) Thanks are due to all members of our team on the regulation of food intake for their helpful comments during the preparation of this paper.
METHODS

Male mice (CBA) were kept separately in small home cages under a day-night regime of 12 h light and 12 h darkness; ambient temperature 23°C. All observation periods fell in the first (active) night hours of the animal. Each observation period started when food was presented in the home cage after an immediately preceding period of either 2 h or 24 h of food deprivation. Each record began when the animal started feeding and lasted about 5 minutes; the exact end of a record was determined by the end of the last feeding bout starting within 5 minutes from the beginning of the record. Two diets were used: 1) standard powder food for mice (Trouw, Nijkerk, The Netherlands) mixed with some water (water: food = 2:3; by weight) and 2) the same diet containing 2.0% sucroseoctoacetate (SOA), a very bitter but non-toxic substance. The bitter diet was only used after the longer deprivation periods. Each animal was observed no more than once a day; animals and diets were tested in a random order. By direct observation feeding and various other modes of behaviour were recorded on a 20-channel event recorder. Periods during which the animal only performed pure feeding, like gnawing or ingesting, were called uninterrupted feeding bouts. These bouts could be alternated by short or long bouts of behaviour like scratching, looking around, climbing, etc.

RESULTS

Comparison of feeding behaviour of 12 animals after 2 h or 24 h of fasting shows that in the latter case total time spent feeding is higher (Table 1), the difference being very significant (P≤.001, Mann-Whitney U test, Siegel, 1956). Since there is a strong positive correlation between total time spent feeding and amount of food eaten during that period and since

<table>
<thead>
<tr>
<th>food deprivation</th>
<th>n</th>
<th>mean total time feeding sec.</th>
<th>mean number of feeding bouts</th>
<th>mean duration of feeding bouts sec.</th>
<th>mean duration of non-feeding bouts sec.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 h</td>
<td>23</td>
<td>199</td>
<td>14.2</td>
<td>7.7</td>
<td>14.4</td>
</tr>
<tr>
<td>24 h</td>
<td>24</td>
<td>176</td>
<td>14.0</td>
<td>12.6</td>
<td>9.5</td>
</tr>
</tbody>
</table>

n = number of 5 minutes' observation periods. Diet: only normal food.