

10 and 11 JULY 1970

**ORGANOLEPSIS AND NUTRITION:  
THE SENSORY PERCEPTION OF FOOD**

10 July, *First Session*

*Chairman* : PROFESSOR FRANCIS AYLWARD, PhD, DSc, FRIC,  
*Department of Food Science, University of Reading*

**A behavioural approach to organoleptic properties of food**

By J. TREMOLIÈRES, *Laboratoire de Nutrition Humaine, Hôpital Bichat, Paris*

Organoleptic or gastronomic properties of food can be analysed into two basic components: the stimulus which is an objective measurement of the effector of sensory perception—colour, smell, taste, palatability—and more generally the physiological effect of a physicochemical unit. These stimuli are interpreted in terms of a signal by the receptor who charges them with a meaning. These signals are chain reactions initiated by the objective stimuli and result in a certain behaviour of the receptor.

A sensory perception, therefore, is a combination of the objective characteristics of the stimulus and the subjective procedure which enables each of us to transform a stimulus into a signal. For a food, the stimulus can be objectively characterized by the biochemical composition, the physical characters and the physiological effects on digestive function and metabolism.

The subjective development which transforms a 'food' into an 'aliment' is what we intend to study.

*Preliminary remarks*

The scheme for the development of food behaviour which I am going to suggest will appear silly or at least disturbing compared with the scientific approaches to be used by other contributors here. So a few preliminary reflections are necessary.

(1) 'Food' or 'aliment'. Aliment seems to be a word not commonly used in English today. It was used in the nineteenth century by Maunder, who wrote in the *New and Popular Encyclopaedia* in 1848 'Climate, custom and the different degrees of want and of civilization give rise to an innumerable diversity of food', transforming food into aliments. In Latin countries food has no sense, because the emotional and the objective aspects of food are as tightly coupled as the soul to the body.

The question of whether it is possible to separate the emotional and the objective aspects of a food is a question of common sense or personal and social opinion.

Those who want an extension of international trade, standardization and scientific planning consider these emotional aspects as a restriction to development. Pleasure, 'volupté' and symbolic evocation are for them prehistoric taboos. They are concerned only to extend new markets and in the financial and ethical background of industrialization. As a Latin physician I feel that pleasure, 'volupté' and symbolic evocation are fundamental aspects of food. A food has no meaning if a man does not give it a meaning by willingly eating it.

(2) The analytical method of studying food behaviour is so complex that there is still a question of whether it will give useful results. The threshold of sweetness or bitterness depends on the associated colour or palatability, on previous conditioning, on the nutritional status, etc. It is the same for the intensity of drive. We do not say that the analytical study of perception, learning, conditioning, drive, reinforcement of drive or objective aspect of behaviour through experimental psychology are not of interest. We say that the trees hide the forest and that an intuitive approach is useful to give more common sense to these tedious experiments.

Are we not still with an eighteenth century mind excluding all phenomena such as feelings, pleasure, desire, evocations, symbols, etc. which are not objective and measurable? These subjective worlds exist, whether or not we can possess them by our objective scientific method. Why has this materialization or 'reification' which was necessary at the beginning of science remained so exclusive? The rejection of symbolism, emotion and mystery is also a kind of mysticism.

Why do we exclude so much the intuitive approach in knowledge and why are we so strict in our analytical, sequential logic in science? We will not pursue here the fact that the development of knowledge is a dialectic between intuition and the logical analysis of facts. A concept such as behaviour, a unit such as man, arise from an intuition of common sense. We are in a field of full relativity, each factor depending on all the others. Apollo and Venus, the reference man and woman, are themselves changing. The only reference base is not the man, but the mysterious processes which make him become what he is.

(3) A scheme in biology is like a formula in physics, a system which enables one to classify and relate units or properties in the chaotic complexity of reality. But a fundamental difference is that man can observe physics from the exterior of himself, he can be objective and logical. In biology he is implicated. Every time he is objective he changes himself. Time is not reversible, it is history. A scheme or knowledge in biology leads to new experiments and not to predictions. We are not in a sequential system but in a harmonic, agreeable system, where beauty prevails.

#### *A proposed scheme for food behaviour*

What are the series of processes or chain reactions which transform the objective properties of food into emotional qualities? Our starting point is Pascal's sentence: 'If you want to know which kind of processes make you act, it is simpler to consider your behaviour outside than your motivation inside.' Therefore we look to the behaviour to understand the motivation.

In Fig. 1 we see that an original decision is triggered by anticipation of a psycho-sensorial sensation. Above the horizontal line we have our personal behaviour

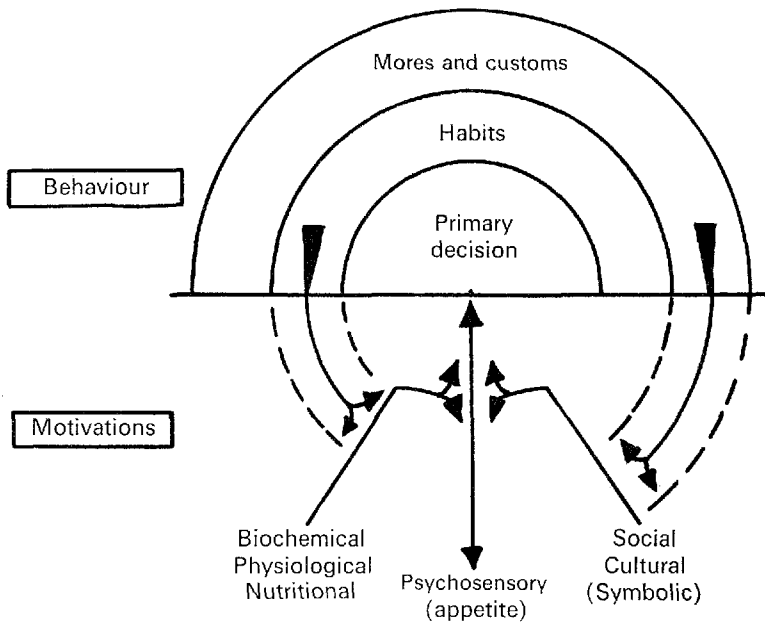


Fig. 1. An analytical system for food behaviour.

which integrates a general feeling arising from the nutritional status and a judgment based on the signal evoked by the food and its environment (the meal). The experience may or may not be integrated into habitual behaviour. Although habits may make automatic the system which permits new trials, we need only one bad experience with a food to make us intolerant. Customs can serve as models influencing new decisions and personal habits can produce customs. Below the line we can distinguish the roles of three types of motivation: nutritional, psychosensorial and what I will explain as symbolic or evocative values.

*Nutritional motivations.* Men ingest about 12% of calories from proteins (see Fig. 2), 1 g of water and 0.2 mg of salt per kcal. A compilation of most surveys around the world shows that a population prefers to have a low calorie intake rather than to change this basic ratio of protein to energy. The range is small, from 9% where the staple is starchy roots, 10% in rice-eating countries, 11% with wheat-eating people, and 12% in urban populations. In obese people the percentage tends to be low in the active phase and high in the stable phase of obesity. The selection is unconscious; it is probably an adaptation of man to his food from birth. The loss of water accompanies the expenditure of energy and the excretion of urea and sodium. The absolute level of proteins regulates activity and the mass of active tissue and thus the calories required. The calories in turn demand a certain level of water and the regulatory activity of the adrenals implicates salt.

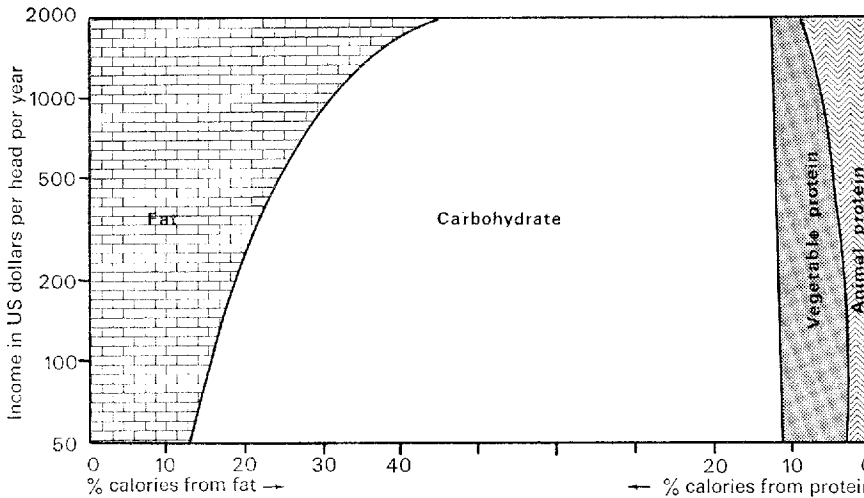


Fig. 2. Proportion of calories derived from fat, carbohydrate and protein as a function of income in 1962. Based on data from many countries in the world. (Perisse, personal communication.)

It would be interesting to look at the role of the selection of food in our neonatal period to explain the fascinating facts collected recently concerning the difficulty of reversing food habits contracted during early infancy.

There is a tendency to raise the percentage of calories from fat and sugar and to increase the consumption of beverages containing alcohol, caffeine or cola which produce exciting or euphoric effects. These dangerous tendencies have their roots in agreeable short-term sensations and in social pressures. Societies have to establish traditional taboos to protect people from themselves.

To study simultaneously a general feeling, its metabolic basis and its physiopathological implication is a very interesting field. The interrelation of calorie intake, energy expenditure and body composition was discarded for a long time in favour of the factorial analysis of each of these measurements. The fact that variations of intake change body composition and activity harmonically in different ways depending on age, constitution, etc., introduces physiology to a relativist universe. Men produce their food and foods produce their men.

These nutritional regulations are unconscious. They arise in relation to the ecological medium, and from the general feeling that a man gets from what he has done in relation to what he wants to be.

*Psychosensorial motivations.* The feeling of desire, pleasure or disgust has an immediate effect on our behaviour. 'Nature has maternally taken care that acts which are the most necessary for us are ordered not only by reason but also by "volupté"' (Montaigne). 'Volupté' is an untranslatable French word which means the sensation of pleasure, having a connotation of mystery, something to be explored. It is the new and as yet undiscovered field of life which is around pleasure.

We will classify these psychosensorial motivations into cephalic, abdominal and general sensations.

The cephalic sensations are probably the least efficient. They start with the pleasure to suck, a vestige of the first fish era and of our first years. It is still present in many obese persons and chewing-gum eaters who suck or swallow more than they masticate. It is a regressive but powerful compensation in an emotional stress situation.

Each of us has his own palate of taste. Some like the white, the soft, the scientifically controlled, untouched by hands, the standard taste and flavour. They do not like the sexual power of desire, they want to be protected by a rational system, they have a shade of anorexia nervosa. On the other hand, some like red meat, strong cheese, the diverse and strong taste or flavour. They enjoy new and mysterious experiences; for them, uniformity and repetition prostitute and kill pleasure because they destroy its meaning.

In some societies it is more important to produce beautifully coloured tomatoes or apples rather than delicate flavours. In France, fortunately in my opinion, we enjoy more the smell, the taste and the diversity. This is why we do not enjoy glutamate or cyclamate which dazzle the taste. When the symbolic values of food are important, a meal is an art and not a technique.

The abdominal sensation after eating is one of the most important conditioning factors in our choice of food. Our humour is closely determined by our abdominal sensation. 'We must hasten to put our soldiers into battle when they still have beef in their stomachs' said a British general. Many revolutionaries had digestive troubles and the colour of our spirituality is strongly influenced by our digestive anxiety or satisfaction. There is much serious work to undertake if we want to explain why meat is always preferred to bean protein, why the consumption of certain types of bread goes down regularly, why butter is preferred to margarine in Europe. We take great care about the biological value of proteins for underdeveloped peoples and we pay no attention to the digestive physiology of vegetable proteins.

In short, we are still using the coefficient of digestibility for men when we should study much more criteria of digestive acceptability which can be defined in terms of initial speed of proteolysis, stimulation or inhibition of digestive motility, secretion and absorption, etc. (Fig. 3).

Now, we get after eating a general type of sensation. We are not the same if we have eaten meat and drunk wine, or bread and water, or a glass of milk. There is a very old ascetic tradition, what Jaspers calls the axial period of history, corresponding to vegetarian habits. Pythagoreans, the followers of the Orphic cult, the prophets in Israel, and Buddha were all vegetarians. Saint Jerome says 'far from Ceres and Bacchus, Venus remains cold', while Saint Augustine says that 'fasting and a vegetarian diet exposes man's fragility and weakness. Meat on the contrary enhances life's pride, and is the food of conquerors'.

*Symbolic motivations.* This brings us to our last motivation, the symbolic one. It is the human name for what Lorenz and Tinbergen in their studies of instinct in animals call stimuli-signals.

I will introduce the meaning of these motivations by a wonderful observation of Montaigne: 'If there is some "volupté" which pleases my fancy, I do not let it take

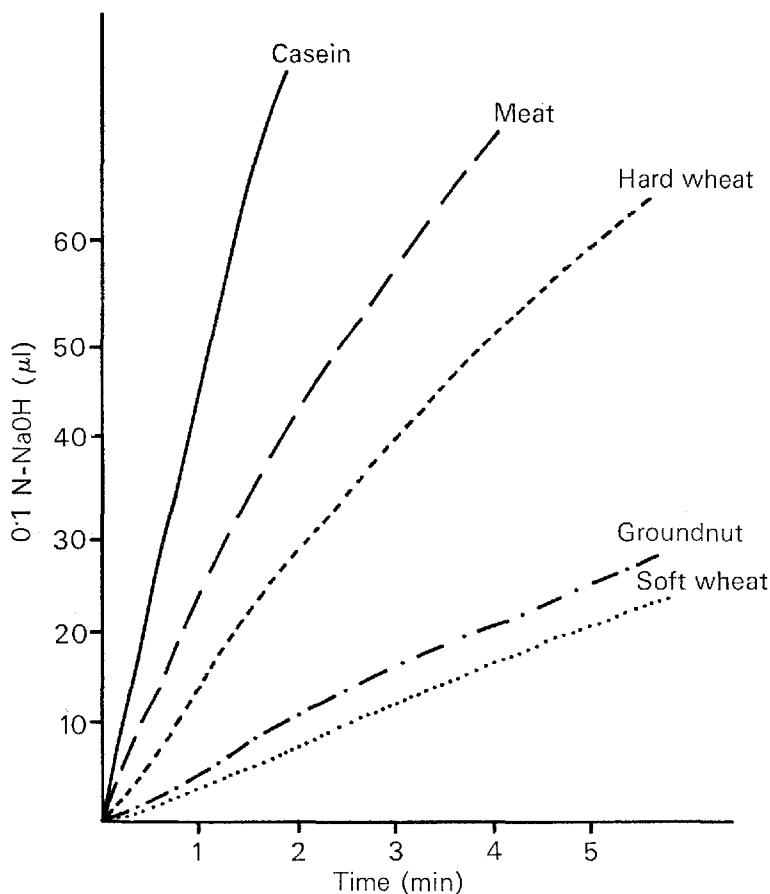


Fig. 3. Trypsin digestion of different foods, as indicated by hydrogen ion liberation ( $40 \mu\text{g/ml}$  of trypsin,  $2 \text{ mg N/ml}$ ,  $\text{pH } 7.0$ ,  $37^\circ$ ) (Camus, personal communication).

control of my senses; the soul must play a part, not to be bound but to be in harmony, not to be lost but to be discovered.' The point here is extremely important. We are pushed by desire and pleasure but we do not know where; nor do we know what we are becoming as a result of what we have done, whether it is good or bad, agreeable or disagreeable. We do not know what we will be after our first glass of wine, whether we will dislike the type of man that we have become. Man does not know where he is going but he knows how to go there.

These symbolic values of food are in these general feelings after eating which make us select meat or wine or water or milk and provide a practical explanation why each of us has his own way of selecting his food.

After this personal symbolism it is a fact that all through his life man likes the type of food that his mother gave him around the familial table. The greatest success for a wife is to make the food habits of her mother-in-law her own. In this sense very few husbands are married to their wives. But the most important aspect of these emotional values of food is that housewives become mothers through the

personalization of the food they prepare for their children around the family table. In former times the father was the one who provided the food. In our consumer society the father has to find another material support for the family. So it is around the family table that we get the emotional picture of our mother and father. We know from psychoanalysts and sociologists that a man is not sociable and that there was no civilization without a picture of a mother and a father, and it is through the type of food prepared for the family meals that we mainly get these pictures.

Another step in the symbolic values of food is in the meaning of meals for workers working together all day. Parkinson, the famous humorist and economist, says that if he wants to see quickly the value of a factory he goes to the canteen to see how people eat together. And, in fact, there is a tremendous contrast between the impression of community that we get from the meals of the peasants of Teniers or the prisoners of Solzhenitsyn and that of most of our modern canteens in which everybody seems to be alone in a compact number of people. A team of workers is happy to eat together. Why do we eat so often alone in our modern society? Is it because it is no longer a human society but a statistical population? The oldest and greatest taboo of human society is that a solitary enjoyment is a sin. Enjoyment must help communication and communion.

The next step is that a society does not eat the food of its enemy or of a group which can dominate it. This explains the very old refusal to eat pork by the Semitic, pastoral population, because it was the food of the Egyptian farmers who wanted to dominate them. This has far-reaching effects in our modern problems of free exchange and surplus policies. We have to remember that the price of food represents not only the cost of its production, but also the activity that it can develop in the country which consumes it. If a food is the sustenance of slaves a human society will always refuse it.

Now the last but not the least point is to remind you that the two tops or summits of our civilization, Plato's Symposium and Christ's Last Supper, were both meals. I leave this thought with you. For me it means that the communication through words is limited if it is not enhanced by an emotional communication through eating and drinking together. Bread and wine represent human life which has produced them and that human life will continue after they are finished.

### *Conclusion*

I have suggested a scheme for the processes of chain reactions by which it appears that men give a name to their food. The name of a food is like the name of a person, not only an objective definition, but also an evocative signal, a symbol, that we love or love not. This emotional aspect of food does not discard the objective definition through nutritional, organoleptic, gastronomic properties, which are the objective aspects of our aliments. But the meaning that a society gives them depends strongly on subjective experience. The practical implication is that the drive towards the same food is very different in different societies. As in languages, words and sentences have an objective common basis, but each society has its own.



Do we want to be in a Manichean, puritan, computerized world which prostitutes and rejects pleasure, desire, emotion and the mysterious meaning of our living flesh? Or will we recognize that man's creativity lies not only in his objectivity and logic, but also in the poetic intuition that he touches through the difficult body he has to assume when he lives seriously with what is hidden in the night of pleasure?

To be-have is to be and to have at the same time. Having must not destroy being.

### **Instrumental assessment of food appearance**

By D. B. MACDOUGALL, *Agricultural Research Council, Meat Research Institute, Langford, Bristol BS18 7DY*

The appearance of a foodstuff depends on diverse physical causes, refraction, absorption, light-scatter, etc., and although the aspects of appearance, colour, gloss, etc., can be separately described (Hunter, 1962, 1963; ASTM, 1966), they are subjectively integrated, each with greater or lesser importance, when a quality judgment is made. The basic problems involved in objectively assessing the appearance of materials are firstly, the separation of these components one from the other, for example transparency from opacity, colour from surface phenomena (MacDougall, 1968) and secondly, the translation of the physical information into psychophysical units and their spacing into psychological scales of uniform increments of perception, or quality tolerance. The most commonly used colour order system, based on visual perception, is that of Munsell (Newhall, Nickerson & Judd, 1943), in which the colour solid is divided into lines of constant hue and constant chroma or saturation at equal lightness value increments. A method of designating colour names within the system has been developed as an aid to verbal description (Kelly & Judd, 1955).

#### *The CIE system*

Three factors are involved in the perception and hence the measurement of the colour of any object; the spectrum of the material, the spectrum of the illuminant and the response of the observer's vision to the light stimulus entering the eye. For an observer with normal colour vision, any coloured light stimulus can be matched by a suitable mixture of three primaries, red, green and blue. From the results of colour matching experiments using monochromatic primaries, the Commission Internationale d'Éclairage (CIE) have defined the response of a hypothetical observer, the so-called 'standard' observer, to light stimuli at 2° and 10° fields of view. The red, green and blue primaries were replaced by a set of unreal primaries, X, Y and Z and the fundamental specification of any colour is given by the amounts of these primaries required to match the colour stimulus (Mackinney & Little, 1962;