calcium or potassium ions influx; d) oscillating transmembrane active transports; e) an oscillatory voltage affecting rearrangement of fixed charges on the membrane surface[10] during oocyte maturation. Hypothesis a) may be discarted since membrane input resistance variations (105 ± 15 MΩ; $n = 10$) are random and did not follow potential oscillations. Events b) and c) can only explain temporal non-sinusoidal oscillations of membrane potential of a shorter period (order of seconds)[11]. Hypothesis d) is unlikely since the experiments were performed at room temperature; under these conditions active transport is supposed to be reduced or abolished[12]. Consistent with hypothesis e) is a rearrangement of the cell membrane due to spontaneous release of cortical granules in ovulated oocytes[13]. Whatever the origin of this type of ascillatory pattern, it indicates a state of electrical instability of the oolemma in the ovulated oocytes that might play a role during sperm-egg interaction[14].

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The chorda tympani nerve and taste in the chicken

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Summary. By recording the electrical activity in the chorda tympani nerve following chemical stimulation of the mandibular taste buds it was demonstrated that this nerve conducts gustatory information from this region of the mouth. The presence of relatively large numbers of taste buds in this region of the mouth would suggest that contrary to previous findings the chorda tympani nerve has an important role in taste perception.

The facial nerve of birds is thought not to be involved in relaying taste information[1-6] but recent work on the upper bill of the mallard has shown that taste buds are innervated by the facial nerve[7]. In the chicken, taste buds are found adjacent to the anterior mandibular salivary glands which are situated in the buccal epithelium of the lower jaw[8]. This area of the buccal epithelium is innervated by the chorda tympani branch of the facial nerve. By recording the electrical activity in the chorda tympani nerve the present experiment demonstrates that it conducts neural impulses orginating in these mandibular taste buds.

Methods. Ten 15-week-old Brown Leghorn hens were anesthetized with sodium pentobarbitone (Sagatal, May and Baker Ltd) and the forebrain removed by gentle suction. After decerebration the head was fixed on its right side by means of a metal plate screwed into the dorsal skull, and the upper and lower beaks were cemented with dental acrylic onto a fixed metal plate. The mouth was held open and the tongue was pulled to one side to expose the lower buccal epithelium. The hens were paralyzed with gallamine triethiodide (Flaxedil, May and Baker Ltd) to prevent reflex swallowing and artificially ventilated through an air tube in the trachea. A unidirectional air flow was ensured by rupturing the abdominal air sacs after laparotomy. The heart rate was continuously monitored and the air flow was adjusted to usually about 2 l/min in order to maintain a constant heart rate which was similar to that before the gallamine injection. The body temperature of the animal was maintained at 40 °C by means of a heating blanket and monitored with a rectal probe.

After removal of the overlying skin and muscle and mandible was exposed. The dorsal part of this was removed to expose the mandibular canal. The chorda tympani (CT) nerve was exposed at the point where it joins the sublingual ramus of the mandibular nerve. The CT is a small nerve (about 70 µm in diameter) and it was dissected to the jaw articulation and cut. A suitable length of nerve (1.5 mm) was desheathed and placed over 2 silver wire recording electrodes. The surrounding skin was sutured to a stainless steel loop and pulled up to make a liquid paraffin pool to prevent drying of the nerve. The electrodes were connected to a preamplifier (DAM-6A, W-P Instruments Inc), displayed on a storage oscilloscope (5103N Tektronix Inc) and recorded on a tape recorder (Store 4DS, Racal Recorders Ltd).

The anterior buccal epithelium was stimulated for approximately 10 sec with 10 ml of the required solution maintained at body temperature delivered by a syringe place close to the epithelium. The solutions used were 1 M potassium, calcium, sodium and ammonium chlorides, 1 M fructose and sucrose, 0.1 M quinine hydrochloride, 0.05 M acetic, citric and hydrochloric acids, distilled water and Tyrode ringer (without glucose). Distilled water (pH 4.5) produced a pronounced response in most but not all preparations (fig. 1,i) whereas Tyrode ringer, had little or no effect (fig. 2,a). The salts and acids had of necessity to be made up in distilled water but all the other solutions were made up in ringer.

Neural activity was recorded for 2 min after the test solution had been placed on the preparation. After this, the buccal epithelium was washed with 30 ml of distilled water and followed by 20 ml of ringer. The preparation was allowed a 3-min period before another test solution was applied.

Results and discussion. An example of the electrical activity recordings is shown in figure 1,a. The other results are

presented as an analogue output by a ML255 rate meter (Digitimer Ltd) of the instantaneous nerve-spike rate in pulses/sec. This gives the approximate number of impulses produced together with the patterns of the activity. In most preparations there were relatively few active units, even though the recordings were made from the whole nerve. The relatively long latencies in activity after stimulation together with the absence of any burst of activity at the onset of stimulation suggest that the treatment did not affect the mechanoreceptors. Figure 1 shows the effect of acids and salts, and figure 2 the effect of ringer, fructose and quinine in a separate preparation. In the majority of preparations the acids, salts and quinine produced a pronounced neural activity which lasted for periods longer than 2 min. The overall level of the activity varied from animal to animal but potassium chloride (fig. 1,a and e) tended to have the largest effect whereas calcium chloride (fig. 1,c) had the smallest. Of the acids tested hydrochloric acid usually had the most marked effect but this was not always the case (fig. 1,h and g). The effect of the acids remained even after repeated washings with ringer and distilled water. This persistent activity may explain why, in a lingual nerve preparation[9,10] acetic acid suppressed subsequent activity in response to treatment with itself and with other chemicals. Any general increase in activity would tend to mask the integrated multiunit response from a subsequent stimulus. Fructose usually had a marked effect (fig. 2,b) in contrast to sucrose which seldom caused any activity.

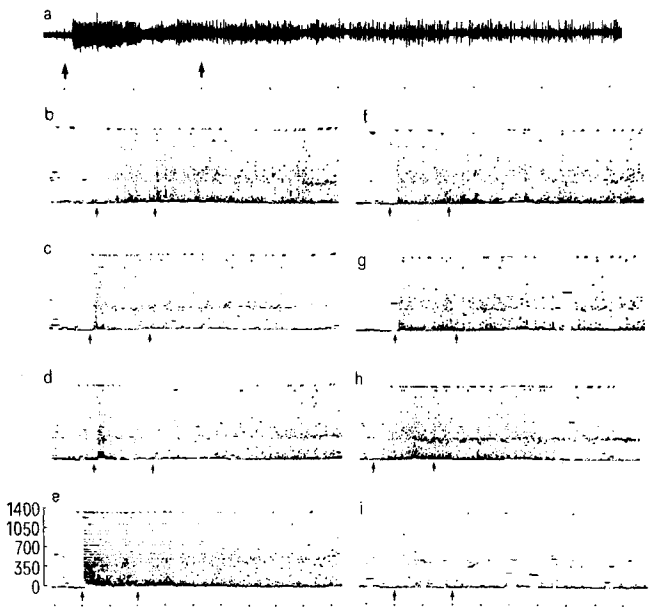

Figure 1. Electrical activity recorded from the chorda tympani nerve following chemical stimulation of the anterior mandibular buccal epithelium. The time marks are 5-sec intervals and arrows mark the beginning and end of the stimulus. Record a is the response following stimulation with 1 M potassium chloride and b, c, d, e, f, g, h and i are the responses from the same preparation presented as the instantaneous nerve-spike rate in pulses/sec. The stimuli used were: b, 1 M sodium chloride; c, 1 M calcium chloride; d, 1 M ammonium chloride; e, 1 M potassium chloride; f, 0.05 M citric acid; g, 0.05 M hydrochloric acid; h, 0.05 M acetic acid; i, distilled water.

A number of different patterns of response were seen. Thus sometimes in initial high level of neural activity was obtained which declined progressively with time (fig. 1,e and h); at others, a more gradual increase in activity occurred (fig. 2,b) which was followed by a sustained high level of activity (fig. 1,b, f and g), There did not appear to be any generalized pattern in the response to any of the substances tested.

It is difficult to compare the results from the chorda tympani nerve with previous reports from the lingual nerve[9,10,11] since different concentrations of test substances were used. Moreover 2 of the studies[9,10] used intergrator records, a technique which would not be appropriate for use with the chorda tympani because there were relatively few active fibers in the preparation. The chorda tympani nerve preparation did, however, have a pronounced activity in response to stimulation with each of the solutions tried. Thus, contrary to previous reports[1-6], the chorda tympani nerve seems likely to be important in relaying gustatory information in birds.

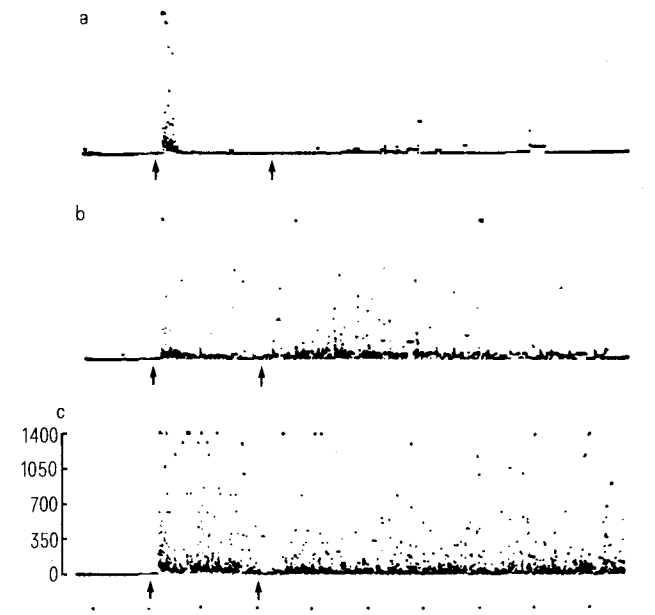

Figure 2. Electrical activity recorded from the chorda tympani nerve in response to a, tyrode ringer; b, 1 M fructose; c, 0.1 M quinine hydrochloride. Time marks and calibrations are the same as for figure 1.

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