microelectrodes were filled with 3M KCl and had a resistance of 30–50 MΩ. Suction electrodes were made of polyethylene tubing drawn under heat to 300–400 μm tip diameter; a silver wire passed to the tip of the electrode. A silver-silver-chloride electrode placed close to the tissue served as the reference electrode. DC electrical signals were recorded using WP-Instruments electrometers connected to a Beckman Dynograph or a Grass 7P Polygraph with DC amplifiers. Using this system, the suction electrodes recorded monophasic slow waves (5–10 mV) and action potentials (10–15 mV) from rabbit jejunum.

Results. Slow waves recorded from the isthmus of the post-ovulatory guinea-pig oviduct with microelectrodes (figure 1A) were 40–50 mV in amplitude, 1.5 sec in duration, had a rate of rise of approximately 0.2 V/sec and had a frequency of about 15/min. Slow waves recorded with suction electrodes (2–4 mV) were either notched on the rising phase (figure 1A, 1B) or had a single spike on the rising phase (figure 1C, 1D). Slow waves coincided with increase in longitudinal tension (1B) and propagated at about 7 mm/sec, usually in the fimbrial direction. In the ampulla slow waves were less frequent and decayed more rapidly (1E).

Slow waves recorded from the proestrus and estrus mouse oviduct with suction electrodes (0.2–1.5 mV) resembled those of the guinea-pig oviduct. They spread with a speed of 1–5 mm/sec. The frequency was higher in the isthmus (7–13/min) than in the ampulla. In the isthmus a spike component could often by distinguished on the rising phase of the slow wave (figures 2A, B, 3B) or on the top of the slow wave (figure 3A). The duration of the spike was 0.5 sec or more and since its amplitude in relation to that of the slow wave varied, as did the duration of the slow wave (figure 2E), the components of the resulting wave form were often difficult to interpret (figures 2C, D). Slow waves and spikes propagated in both directions. In some cases the spike appeared to spread independently of the slow wave (figure 3) and in the opposite direction. In such cases the spike appeared during the late phase of the slow wave. Slow waves of the immature baboon oviduct were more difficult to record (amplitude 0.1–0.5 mV), had a relatively high frequency (mean frequency in 5 oviducts was 46.4 ± 3.9/min) and propagated from the ampullary-isthmic junction in both directions at 10–13 mm/sec (figure 4). Only 1 oviduct showed local spontaneous contractions (observed with a dissecting microscope) and contractions coincided with single spikes in an electrode which did not show slow wave activity.

Discussion. Tomita and Watanabe[5] suggested that the notch on the rising phase of the slow wave of the guinea-pig oviduct was due to 2 separate components of the slow wave. However, our data suggest that notching may be due to activity of the 2 layers of muscle in the isthmus, since notching was not observed in the ampulla, where there is no inner longitudinal muscle layer, nor in intracellular recordings. Spikes and notches appeared to be related to visually observed contractions, but it is uncertain whether spikes originate in the inner longitudinal muscle or the thicker circular muscle layers.

Slow waves of the mouse oviduct were similar to those recorded from the guinea-pig oviduct, but in some cases spikes and slow waves can be dissociated. This phenomenon has been reported to occur in cat intestine[8]. Slow waves of the immature baboon oviduct propagated at a velocity similar to that observed for spikes in human oviducts[9]. Slow waves originated from the ampullary-isthmic junction (AIJ), and if such directionality occurs in the mature animal may account for the observation that the AIJ represents the major site of delay in ovum transport in this species[10]. Slow waves of the guinea-pig, mouse and baboon oviducts probably regulate the period of spikes and hence contractions as they do in other smooth muscles. Their ionic mechanism and regulation by hormones requires further investigation.

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The effects of age and nutritional state on m. e. p. p. amplitude

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Summary. A quantitative restriction of food intake for 7 days reduced the amplitude of spontaneous miniature endplate potentials by about $^1/_3$ in rats aged 30 days but not in rats aged 110 days.

The amplitude of spontaneous miniature endplate potentials (m.e.p.p.s) in rat phrenic nerve-diaphragm preparations decreases by more than $^1/_3$ as the animals increase in b.wt from 60 g to 300 g (i.e. from 23 to 56 days of age)[2]. In the present investigation a quantitative restriction of the food intake has also been found to reduce m.e.p.p. amplitude.

Materials and methods. Phrenic nerve-diaphragm preparations were removed under ether anaesthesia from male albino rats, strain CFHB, of known age and b.wt. Conventional glass capillary microelectrode recording techniques were used to record focal m.e.p.p.s from preparations bathed in oxygenated Liley saline at a temperature of 32 °C[2,3]. The amplitudes of m.e.p.p.s were corrected for nonlinear-summation[4] and to a standard resting membrane potential (RMP) of −71 mV to facilitate comparison of mean m.e.p.p. amplitudes between groups of rats. The daily restricted diet was always $^1/_2$ of the weight of food eaten by control rats of the same age.

Results and discussion. Animals placed on the restricted diet showed a decrease in b.wt for the first 3 days, after which there was an increase in b.wt but at a slower rate than control animals. Because of this loss of weight in comparison with control animals matched according to age, the weight of food per g b.wt. eaten by the experimental animals increased so that it approximated to control values by the end of the first week of dietary restriction. A summary of the results obtained from control rats and from rats placed on the restricted diet for 1 or 3 weeks is given in the table.

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Between the ages of 23 and 56 days there was a small but significant increase in the mean RMP and a 37% decrease in mean m.e.p.p. amplitude in control rats. Dietary restriction for 1 or 3 weeks was accompanied by loss of b.wt but had no effect on the mean RMP. The mean amplitude of m.e.p.p.s. in animals aged 30 or 44 days was significantly lower after 1 or 3 weeks respectively on the restricted diet than in control animals of the same age (figure 1), but dietary restriction in animals aged 110 days had no effect on m.e.p.p. amplitude (table), although it caused a significant decrease in b.wt.

These observations illustrate that the choice of the correct control animals is particularly important when an experimental procedure is continued for more than a few days, and when it also affects the food intake of the animals. Because dietary restriction for 1 week affects m.e.p.p. amplitude in 30-day-old but not in 110-day-old rats, these factors are more important when young animals are involved, as is the case in many experiments with rats, in which animals of 100 g to 200 g b.wt are frequently used. It is possible that the difference between the effects of dietary restriction on 30- and 110-day-old rats is due to larger reserves of stored nutriments being available in the older animals and to the more rapid growth rate in the younger animals[2,5]. The increase in b.wt of 30-day-old rats was 5–7 g per day compared with 1–2 per day in 110-day-old rats.

The reduction in m.e.p.p. amplitude observed after dietary restriction may have been brought about by a) a decrease in the amount of acetylcholine per quantum, b) decreased density of receptors, c) decreased input resistance of muscle fibres, or by a combination of any or all of the above factors. The decrease in m.e.p.p. amplitude with age was probably caused, at least in part, by the increase in muscle fibre diameter associated with the normal growth process[5,10,11]. After periods of dietary restriction it is possible that a decrease in plasma protein levels resulted in some degree of intracellular oedema and hence an increase in muscle fibre diameter, which in turn would have contributed to the decrease in m.e.p.p. amplitude.

The authors of recent papers dealing with experimental autoimmune myasthenia gravis have used a decrease in the mean amplitude of spontaneous miniature endplate potentials (m.e.p.p.s) as the main criterion for comparison with clinical myasthenia gravis[6–9].The induction of the immune response can take up to 3 weeks, during which time the experimental animals may be unable or have no desire to eat as much food as control animals[7]. The results of the present investigation raise doubts concerning the cause of the decreases in m.e.p.p. amplitude observed after induction of autoimmunity because animals having the same b.wt may have very different mean m.e.p.p. amplitudes due to differences of age and nutritional state (table and figure 2). These results suggest that the changes in m.e.p.p. amplitude observed after the induction of autoimmunity could be due (at least in part) to the altered food intake of the experimental animals. Further evidence for this suggestion is the finding by Elmqvist et al.[7] that the decrease in m.e.p.p. amplitude was greater than could be accounted for by the reduction in muscle acetylcholine receptor as estimated by the binding of *Naja naja* toxin. Induced autoimmune myasthenia can be of value as a model of clinical myasthenia gravis only if the effects of decreased feeding can be discounted, or at least quantified; this cannot be done unless appropriate control animals are selected and details given of the criteria on which the selection was made.

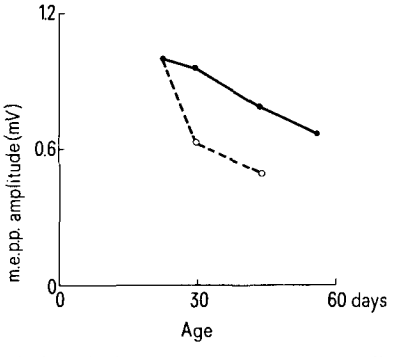

Fig. 1. The relationship between mean m.e.p.p. amplitude and age showing the effect of dietary restriction. Filled circles are control values and open circles are values after 1 and 3 weeks of dietary restriction (30 and 44 days of age). The SE of the values are within the symbols but may be seen in the table.

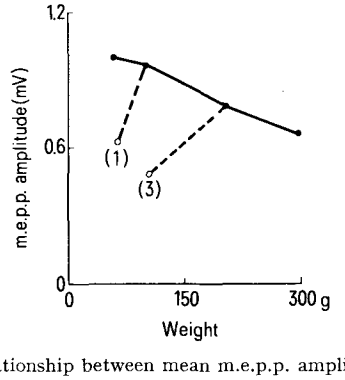

Fig. 2. The relationship between mean m.e.p.p. amplitude and b.wt showing the effect of restricted diet. Filled circles are control values and open circles are values after 1 and 3 weeks on the restricted diet (the number of weeks being shown in brackets). Broken lines connect groups of the same age. The SE of the values are within the symbols but may be seen in the table.

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Effects of age and diet on b.wt, RMP and m.e.p.p. amplitude

Age (days)	Treatment	B.wt (g)	RMP (mV)	m.e.p.p. amplitude (mV)
23	C	60 ± 2 (4)	−68.5 ± 0.8 (29)	1.06 ± 0.05 (45)
30	C	103 ± 2 (5)	−71.3 ± 1.0 (33)	0.97 ± 0.06 (22)
30	1S	63 ± 2 (3)	−71.2 ± 1.0 (36)	0.63 ± 0.04 (37)
44	C	205 ± 3 (3)	−71.7 ± 0.9 (28)	0.79 ± 0.06 (22)
44	3S	105 ± 4 (3)	−72.7 ± 0.7 (38)	0.49 ± 0.03 (31)
56	C	298 ± 5 (6)	−73.9 ± 1.0 (36)	0.67 ± 0.03 (38)
110	C	435 ± 3 (3)	−70.4 ± 0.9 (33)	0.51 ± 0.03 (33)
110	1S	369 ± 19 (3)	−70.0 ± 1.0 (26)	0.56 ± 0.04 (26)

Each value is presented as mean ± 1 SE with the number of observations in brackets. C, Control animals; 1S, animals after restricted diet for 1 week; 3S, animals after restricted diet for 3 weeks. The number of observations in the b.wt column is also the number of rats in each group.