males which have laid many fertilized eggs. The sperms cannot be found at all in some old females (Figure 4).

De Beauchamp[2] showed in 1910 that *D. conklini* (which is now identified with *D. apatris*) can reproduce by parthenogenesis; Hartmann[3] also obtained the same results in this species. No parthenogenetic development has been obtained in our strains in hundreds of essays consisting in the early removal of the male partner.

It appears, however, that a few of the numerous unfertilized eggs that are laid by old female individuals have a chance to develop parthenogenetically because they have a genetic tendency to parthenogenetic reproduction. It is therefore reasonable to assume that parthenogenetic strains can originate from such eggs laid by old females.

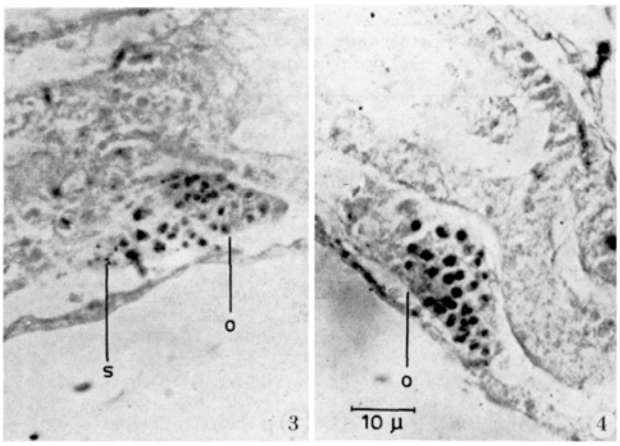


Fig. 3. Adult female: only a few sperms are left.

Fig. 4. Old female: all the sperms were utilized.
c, capsule; fe, female embryo; m, male; o, ovary; s, sperms.

Riassunto. La femmina di *D. apatris* è fecondata con un numero di spermi spesso insufficiente per tutte le uova che può produrre durante la sua esistenza, per cui le femmine vecchie depongono uova non fecondate che degenerano a stadi di sviluppo diversi. Questa può essere la causa dell'insorgenza di ceppi partenogenetici.

Renata Zunarelli Vandini

Istituto di Zoologia dell'Università di Modena (Italy), January 15, 1965.

[2] P. de Beauchamp, C.r. Acad. Sci. *50*, 739 (1910).
[3] M. Hartmann, *Allgemeine Biologie*, 2. Aufl. (Jena 1933).

Membrane Constants and Sodium Conductance of a Single Muscle Fibre[1]

Previous results[2] support the validity of 'ionic theory' for the muscle fibre of mammals and suggest that the depolarization is due to an increase of sodium permeability.

The aim of the present research was to measure the membrane electrical constants of the single muscle fibre and to calculate its sodium conductance: the latter was achieved with the results previously obtained[3].

Experiments were carried out on the obliquus abdominis internus muscle of the guinea-pig, separated in a thin layer and kept in a Tyrode solution (aerated with O_2 and CO_2) at 38°C. The membrane constants of a single muscle fibre were determined by the method of 'square pulse analysis'[4], with two intracellular glass electrodes: a rectangular current pulse was sent through a single fibre with one microelectrode, while the second, inserted at a distance of 50 μ and later moved to a distance of 500 μ and 250 μ from the first along the major axis of the fibre, recorded the membrane potential changes; a double-beam oscilloscope was used, the membrane potentials being recorded by one trace and the current monitored by the second channel.

An example of records obtained is given in the Figure showing the electrotonic potential changes due to three different current intensities: applying the cable theory (Hodgkin and Rushton[5]) to the experimental data, the potential changes, E, are related to the steady current, I, by the following equation:

$$E = \frac{1}{2} I \sqrt{r_m r_i} \exp\left[-\frac{x}{\sqrt{r_m/r_i}}\right]$$

where x = microelectrode separation; r_m = transverse resistance of unit length of membrane; r_i = internal longitudinal resistance per unit length of fibre.

Plotting $\frac{1}{2} I \sqrt{r_m r_i}$, on a logarithmic scale, against the interelectrode distance x, the value of $\frac{1}{2} I \sqrt{r_m r_i}$ at the zero distance may be obtained graphically; λ, the space constant, was calculated from the same plot, measuring the distance of the electrotonic potential drop to 1/e; the value of 125 Ω was used for R_i, myoplasm resistance[6]; finally, τ_m, the time constant of the membrane, was obtained from records, measuring the time taken for the potential to rise to 83% of its maximum steady value.

The results are given in the Table, where data obtained for seven different sets of measurements are summarized, each experiment being performed on the same muscle fibre: these data characterize the electrical properties of the resting fibre.

Comparing results from human intercostal muscles[7] and cat tenuissimus[6] it is clear that for the guinea-pig the membrane resistance is lower, while the capacity is the same ($C_m = \tau_m/R_m = 3.8 \pm 2\ \mu F/cm^2$).

[1] Partially supported by a grant from the Italian 'Consiglio Nazionale delle Ricerche'.
[2] A. Ferroni and D. Blanchi, Boll. Soc. ital. Biol. Sper. *40*, 211 (1963).
[3] A. Ferroni and D. Blanchi, Boll. Soc. ital. Biol. Sper. *40*, 1106 (1964).
[4] P. Fatt and B. Katz, J. Physiol. *115*, 320 (1951).
[5] A. L. Hodgkin and W. A. H. Rushton, Proc. Roy. Soc. B, *133*, 444 (1946).
[6] I. A. Boyd and A. R. Martin, J. Physiol. *147*, 450 (1959).
[7] D. Elmqvist, T. R. Johns, and S. Thesleff, J. Physiol. *154*, 602 (1960).

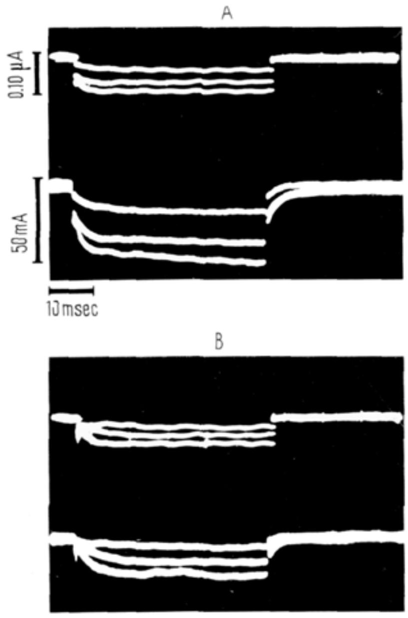
Since we can assume that the depolarization phase of membrane is due to the penetration of sodium ions inside the fibre, if the permeability to potassium and chlorine is nil when the depolarization rate is maximum, the equation of HODGKIN and HUXLEY[8] becomes:

$$I_i = -C_m \dot{V}_d = g_{Na}(V - V_{Na})$$

allowing the calculation of g_{Na}.

Using a capacity value, C_m, of 3.8 μF, a maximum depolarization rate, $\dot{V}_d$, of 790 V/sec ($V = -55$ mV = membrane potential; $V_{Na} = +30$ mV = equilibrium potential for $[Na^+]$) a mean value of maximum sodium conductance, g_{Na}, of 35.3 ± 18.8 mmho/cm² at 38°C is obtained.

Such a value is in good agreement with that determined in the giant axon of *Loligo*[9], but there are no data, in the literature, allowing a comparison with the striated muscle of mammals.



Electrotonic potential changes (lower traces in each record) for three different current intensities (top traces) in the same muscle fibre. Electrode separation: A = 50 μ, B = 530 μ.

Seven fibre data of guinea-pig muscle at 38°C. Bottom = means and standard deviations

$\frac{1}{2}\sqrt{r_m r_i}$ (Ω)	$\lambda = \sqrt{\frac{r_m}{r_i}}$ (mm)	τ_m (msec)	ρ (μ)	R_m (Ω cm²)	C_m (μF/cm²)
4.65 × 10⁵	0.8	2	18.4	860	2.32
5.10 × 10⁵	0.67	2	16.2	633	3.15
4.50 × 10⁵	0.56	3.75	15.7	500	7.5
4.30 × 10⁵	0.68	4.1	17.7	648	6.33
4.55 × 10⁵	0.76	2.3	18.2	792	2.9
6.00 × 10⁵	0.7	1.25	15.2	800	1.56
6.70 × 10⁵	0.78	2.9	15.2	1000	2.9
5.11 × 10⁵	0.707	2.61	16.6	747.4	3.8
± 0.83 × 10⁵	± 0.076	± 0.94	± 1.3	± 152	± 2.0

Riassunto. Nella singola fibra muscolare di cavia a 38°C sono state determinate, applicando la «square pulse analysis», la resistenza, la costante di tempo, la costante di spazio e la capacità della membrana a riposo. È stato inoltre possibile calcolare la massima conduttanza per il sodio, g_{Na}, che è risultata di 35,3 mmho/cm².

A. FERRONI, D. BLANCHI, and E. M. MEDA

Istituto di Fisiologia Generale dell'Università, Torino (Italia), March 1, 1965.

[8] A. L. HODGKIN and A. F. HUXLEY, J. Physiol. *117*, 500 (1952).
[9] A. L. HODGKIN and A. F. HUXLEY, J. Physiol. *116*, 449 (1952).

On the Use of Phosphamidon[1] for Eradication of Fresh Water Fish Predators

The importance of discovering specific chemicals which would help in eradicating unwanted and harmful fauna from fish nursery and rearing ponds, without causing damage to the fish being reared, cannot be over-emphasized[2]. The authors have conducted experiments with a number of poisons with a view to eradicating predatory insects and harmful or predatory fish commonly found in Indian fresh-water reservoirs in which profitable carps are being reared. The present report deals with the results obtained by experiments with a water-soluble, recent, systemic insecticide, phosphamidon (2-chloro-2-diethylcarbamoyl-1-methylvinyl-dimethyl phosphate), which promises to be highly useful for the purpose in view.

The poison was tried on a number of carps (fry and fingerlings), predatory fishes (of different age) and aquatic predatory insects. Experiments were carried out in the laboratory at room temperature (about 26–33.5°C) in battery jars in which, as a rule, five test animals were kept in 8 l of water containing different quantities of the insecticide for a maximum period of 168 h during which no artificial aeration was made, nor any food supplied. Several repetitions were made of each experiment, which was invariably accompanied by a control in which the same number of test animals, of the same species and of about the same age and size, were kept in the same quantity of water, but without poison.

The Table gives the minimum lethal doses of phosphamidon in ppm which caused complete or near complete mortality of only the more important animals experimented upon within the maximum experimental time.

[1] Prepared and sold under the name of 'Dimecron 100' by Ciba Basel, (Switzerland).

[2] JOHN F. LES VEAUX, Progr. Fish Culturist *21*, 99 (1959).