1. LSD 25 zeigte in den angewendeten Dosen beim Kaninchen keine curareähnliche Wirkung. Bis 20 min nach Verabreichung von LSD 25 konnten in den 3 angegebenen Dosierungen keine wahrnehmbaren Änderungen der Amplitude des muskulären Aktions-Potentials festgestellt werden.

2. LSD 25 hatte bei den unter partiellem Curareblock stehenden Tieren und in der angegebenen Dosierung keinerlei antagonistische Wirkung gegenüber Curare. Die Kurve, welche das Absinken und die allmähliche Wiederherstellung des muskulären Aktions-Potentials nach Verabreichung von 0,09/kg D-Tubocurarin wiedergibt, liegt höher als die entsprechende mittlere Kurve der Kontrolltiere.

3. LSD 25 hat endlich die geringe curareantagonistische Wirkung des 5-HT auf die neuromuskuläre Reizübertragung nicht beeinflusst, sei es unmittelbar vor oder nach i.-v.-Applikation von Serotonin verabreicht worden.

4. Die negativen Resultate lassen sich vielleicht durch die Beobachtungen von THOMPSON, TICKNER und WEBSTER[3,4] erklären, welche feststellten, dass LSD25 hauptsächlich bei Laboratoriumstieren einen geringen Einfluss auf die eigentliche Cholinesterase hat, während es elektiv die Pseudocholinesterase hemmt.

Sie bestätigen ferner die Möglichkeit, dass der Antagonismus oder Synergismus zwischen LSD25 und Serotonin sich nicht überall entfaltet.

C. PERRIS

Laboratorio di E. E. G. dell'Ospedale Psichiatrico Provinciale di Cremona, 24. April 1959.

Riassunto

In un lotto di conigli si è indagata, con tests elettromiografici, l'eventuale azione della LSD 25 a livello della giunzione neuromuscolare.

Dalle esperienze effettuate è emerso che la sostanza (alla dose di mg 0,05–0,1–0,15 endovena, in animali di kg 2 circa) non possiede nè un'azione curarosimile, nè un'azione anticurarica.

Si è potuto rilevare inoltre, con opportune ricerche che la LSD25 non interferisce, in alcun modo, sulla modesta azione anticurarica esercitata dalla serotonina e documentata in altra sede.

[3] R. HS. THOMPSON, A. TICKNER und G. R. WEBSTER, Biochem. J. *58*, 19 (1954).

[4] R. HS. THOMPSON, A. TICKNER und G. R. WEBSTER, Brit. J. Pharmacol. Chemiother. *10*, 61 (1955).

On the Decrement Function of an Action Potential in a Volume Conductor

In a recently published paper by HÅKANSSON[1], the potential field of an isolated frog muscle fibre surrounded by a volume conductor (Ringer solution) is investigated. It proved difficult to obtain a simple function, describing the decrease in amplitude of the action potential along a normal to the fibre. HÅKANSSON found that near the fibre ($y_0 < 0{\cdot}15$ mm) there is an approximative agreement with a function $\sim -\log y_0$. At a greater distance a function $\sim y_0^{-1,3}$ is more adequate. I have shown[2] that these difficulties can be overcome by introducing time (t) and impulse velocity (v = constant) into LORENTE DE NO's[3] formula for the spread of potential in a volume conductor and using its Fourier transform. Thus

$$\Phi(x_0, y_0, t) = h \int \frac{\partial^2 V e}{\partial x^2} \cdot \frac{dx}{\sqrt{y_0^2 + (x_0 - x - vt)^2}} \qquad h = -\frac{\omega}{4\pi} \quad (1)$$

where Φ = potential at x_0, y_0; y_0 = normal distance between electrode and fibre; V_e = external spike potential; ω = cross section of the fibre. The fibre is extended in the x-direction.

After Fourier transformation[2] we get

$$\tilde{\Phi}(x_0, y_0, p) = h \cdot \tilde{\Theta}(p) \cdot \tilde{\Omega}(p);$$

$$\tilde{\Theta}(p) = \int_{-\infty}^{\infty} \frac{\partial^2 V e}{\partial x^2} e^{\frac{-ipx}{v}} dx; \quad t = \tau - \frac{x}{v}$$

$$\tilde{\Omega}(p) = \int_{-\infty}^{\infty} \frac{e^{ip\tau} d\tau}{\sqrt{y_0^2 + (x_0 - v\tau)^2}} = \frac{e^{\frac{ipx_0}{v}}}{v} K_0 (py_0/v)(-2). \quad (2)$$

K_0 is a modified Bessel function, the graph of which is drawn in Figure 2. In eq. 2 $\tilde{\Theta}(p)$ depends only on the shape of the potential and $\tilde{\Omega}(p)$ only on the geometry at the recording and the velocity of the impulse. From eq. 2 it is evident that every frequency component follows its own decrement curve, which is a K_0 in its own scale, since the frequency is a factor in the independent variable of K_0.

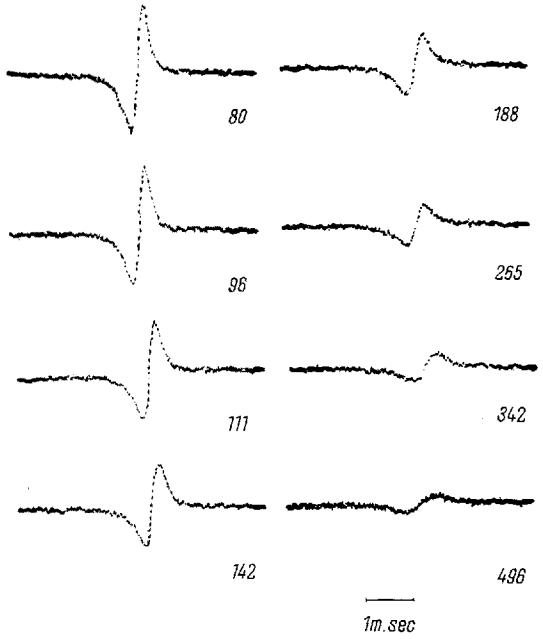

Fig. 1. – Action potentials from an isolated frog muscle fibre of radius 34 μ in a Ringer solution. The number on each curve denotes the distance between the fibre and the electrode (y_0) in μ.

Therefore, a higher frequency has a steeper decrement than a lower one, which explains the change of shape of the impulse with increasing distance. Theoretically the velocity of the impulse is uniquely determined by the

[1] C. H. HÅKANSSON, Acta physiol. scand. *39*, 291 (1957).

[2] C. E. T. KRAKAU, Kgl. Fys. Förh. *27*, 177 (1957).

[3] R. LORENTE DE NÓ, Studies Rockefeller Inst. Med. Res., New York *132*, 384 (1947).

amplitude of a single frequency at two different points at known distances from the fibre. As an illustration, an experiment performed by HÅKANSSON has been worked out. The action potential has been recorded at 8 different distances (80–496 μ) from the centre of a frog muscle fibre in Ringer solution (Fig. 1). The fibre is considered infinitely thin in relation to the electrode distance. For the 2 nearest points (80 and 96 μ) this means an error, which is estimated at as much as 10% for the highest frequencies. With increasing y_0 the error falls rapidly. During the experiment the value for the velocity was determined at 2·0 m/sec.

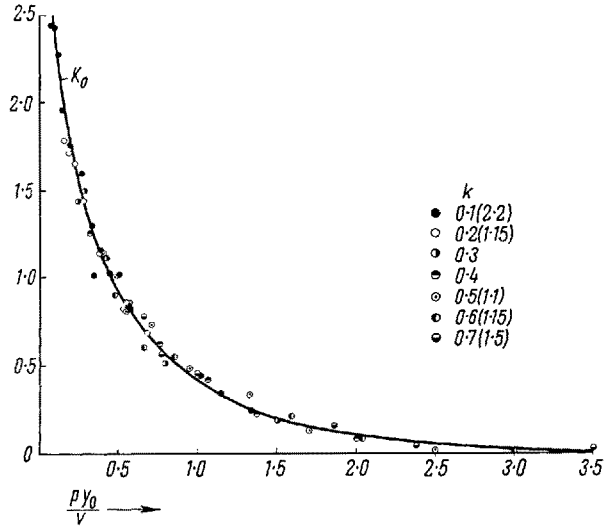

Fig. 2. – Full drawn line: the graph of the function K_0 (py_0/v). The number k is related to frequency p by $k = p/2\pi \cdot 4250$. A series of similar dots represents the decrease of a certain frequency (p) with increasing distance (y_0). In brackets: the factor necessary for curve fitting of the amplitude values.

The amplitudes of the curves (Fig. 1) have been measured at c:a 50 equidistant points on each. The absolute value of integral (2) has been calculated for seven frequencies in the range 425–2975 cps by means of a digital computer. Simpson's rule has been applied. The decrease of the amplitude for each frequency with increasing y_0 has to follow the K_0. The values for each frequency have thus been multiplied by a common factor so as to fit the same K_0. These factors are given in brackets in Figure 2. By means of this adjustment, the decrement curve for every frequency is brought into overlapping continuity with the following, and they all seem to follow a K_0 function well. However, the scale of K_0 that fits best is obtained by putting $v = 2{\cdot}57$ m/sec instead of 2·0 found at direct measuring. This discrepancy may be explained by a.o. the size of the electrodes (30–50 μ tip diameter), which reduces the exactness of the position determinations. The example demonstrates a consequence of LORENTE DE NÓ's field equation, namely that the decrement of the action potential is determined not only by the geometry at recording but also by the impulse shape and velocity.

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Eye Department, University of Lund (Sweden), March 16, 1959.

Zusammenfassung

Eine Modifikation der Feldgleichung von LORENTE DE NÓ wird einer Fourier-Transformation unterworfen. Dabei zeigt sich, dass das Dekrement einer jeden Frequenz eine K_0-Funktion in ihrem eigenen Maßstab darstellt. Die theoretische Dekrementkurve stimmt gut mit der experimentell ausgearbeiteten überein.

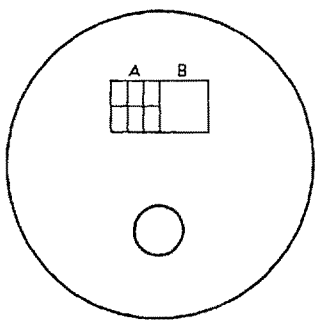
Determination of the Influence of Size in the Differentiation of an Isolate

Introduction. The significance of size in tissue differentiation is well known from various experiments.

DRAGOMIRROW[1] observed a failure of the pigmented epithelium of the eye to regulate into a cup if the isolate fell below a certain size. LOPASCHOV[2] found that an increase in the amount of head mesenchyme of an amphibian gastrula gave rise to a complexity of differentiation, whereas, one or two fragments developed into striated muscles. WEISS and AMPRINO[3] also found that below a certain size, there would be no differentiation of the prescleral mesenchyme into cartilage in the chick.

Results of ANDRES[4] and BERRILL[5] and others also show that the degree of differentiation is dependent upon the mass of tissue.

GROBSTEIN[6,7] and GROBSTEIN and ZWILLING[8] made an extensive study of the nervous tissue differentiation in the mouse embryonic shield and in the chick blastoderm. They found a decrease in the percentage of neural differentiation with a decrease of size of the explants. GROBSTEIN[6] observed that, when the fragmentation was carried out to 1/16 parts, differentiation was virtually eliminated with a 'dispersed cluster' and the percentage of neural differentiation was increased when these 1/16 parts were made into a 'close cluster'.



Mid gastrula of *Triturus alpestris* (A) represents the area which was subsequently cut into smaller bits and these are represented by horizontal and vertical lines. (B) represents the same area on the other side of (A). It was not cut into smaller parts and treated as the control.

It was decided to conduct experiments similar to GROBSTEIN and ZWILLING's[8] with amphibian presumptive neural plates by cutting a definite part of it into 1/2, 1/4, and 1/6 to determine the critical mass of these isolates to undergo neural differentiation. Some of these parts were left intact as controls.

Technique and experiments. A square piece of the presumptive neural plate (0·5 × 0·5 mm) was excised from *Triturus alpestris* gastrulae with rounded blastopore (comparable to 13C stage of *T. pyrrhogaster*, OKADA and ICHIKAWA[9]) as shown in the Figure (A). It was carefully

[1] N. DRAGOMIRROW, ROUX' Arch. *126*, 636 (1932); *129*, 522 (1933).
[2] G. LOPASCHOV, Biol. Zbl. *55*, 606 (1935).
[3] P. WEISS and P. AMPRINO, Growth *4*, 245 (1940).
[4] G. ANDRES, J. exp. Zool. *122*, 507 (1953).
[5] N. J. BERRILL, *Growth and form* (Oxford Univ. Press, England 1945).
[6] C. GROBSTEIN, J. exp. Zool. *120*, 437 (1952).
[7] C. GROBSTEIN, Ann. N.Y. Acad. Sci. *60*, 1095 (1955).
[8] C. GROBSTEIN and E. ZWILLING, J. exp. Zool. *122*, 259 (1953).
[9] YO. K. OKADA and M. ICHIKAWA, Jap. J. exp. Morph. No. 3 (1947).