rent volleys from various hip extensor and knee flexor muscles. EPSP's were evoked in this motoneurone by volleys from its own muscle (*A*), from the other hip extensors, adductor femoris (*B*), anterior biceps (*C*), and characteristically also from the knee flexors, posterior biceps (*D*), gracilis (*E*) and semitendinosus (*F*). Inhibitory actions to semimembranosus neurones were

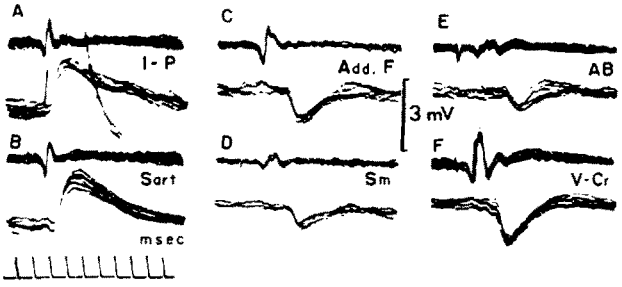

Fig. 1. – Intracellular recording from an iliopsoas motoneurone. Ventral roots were left intact for identification of the motoneurones. All records consist of many superimposed traces. Record *A* was obtained at a stimulus strength that was maximal for the Ia fibres and also at threshold for the motor axon. It illustrates the EPSP and the earlier arising spike evoked when the motor axon occasionally was excited. Record *B* shows the monosynaptic EPSP evoked by a maximal group *I* volley in the sartorius nerve. In records *C–F* are shown the IPSP's evoked by volleys from the adductor femoris (*Add. F.*), semimembranosus (*Sm*), anterior biceps (*AB*) and vasto-crureus (*V.Cr.*) nerves.

contributed by group Ia volleys from its antagonists iliopsoas and sartorius and also by rectus, which is not only a knee extensor, but being a double joint muscle, also a potential hip flexor. The Ia afferents from rectus will therefore be discharged either by flexion of the knee or like those of the proper hip flexors by an extension of

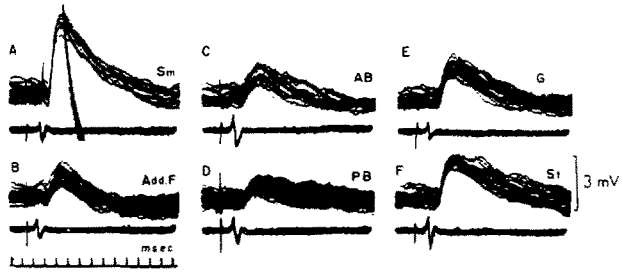

Fig. 2. – Intracellular recording from a semimembranosus motoneurone. Ventral roots were left intact for identification of motoneurones. All records consist of many superimposed traces. Record *A* was obtained with stimulation of the semimembranosus nerve at a strength that was maximal for all Ia fibres and also at threshold for the motor axon. It shows the EPSP and also the spike evoked when the motor axon occasionally was excited. In records *B–F* are shown the EPSP's evoked by volleys from the adductor femoris (*Add. F*), anterior biceps (*AB*), posterior biceps (*PB*), gracilis (*G*), and semitendinosus (*St*) nerves.

the hip, but most effectively by a combination of both movements. A further indication that this combined movement provided very effective inhibition of semimembranosus motoneurones was the finding that Ia impulses from the pure knee extensor, vasto-crureus, often produced some inhibition. Summarizing the reflex actions of the Ia-afferents, semimembranosus motoneurones are maximally excited by hip flexion combined with knee extension, and maximally inhibited by the opposite movement. The motoneurones of another hip extensor, adductor femoris, received no appreciable excitatory action from the knee flexors, but a considerable monosynaptic innervation from the knee extensor, vasto-crureus. The maximal contribution of excitation by Ia afferents to adductor femoris motoneurones would therefore occur during hip flexion combined with knee flexion.

The general conclusion to be drawn from this study is that the reflex innervation of motoneurones by the Ia system is not necessarily limited to muscles operating on the same joint either in its excitatory or inhibitory aspects. However, the reflex interconnexions between muscles operating at different joints are of a type which suggests that the Ia system subserves a sequence of coordinated movement and that these connexions have evolved to assist in the reflex coordination of stepping. For example the inhibition exerted by knee extensor afferents on hip flexor muscles can be seen to have functional significance if one considers that the step is initiated by hip flexion resulting in stretch of hip and knee extensors. This leads to discharge of impulses in Ia fibres from these latter muscles and initiates the next phase of the step beginning with inhibition of hip flexors and contraction of knee extensors and, presumably, of the hip extensor, adductor femoris.

R. Eccles and A. Lundberg

Department of Physiology, The Australian National University, Canberra, June 25, 1957.

Zusammenfassung

Es werden die intrazellulären Potentiale an Motoneuronen von Hüftmuskeln abgeleitet. Motoneurone des Hüftstreckers *Semimembranosus* werden von Ia-Impulsen der Hüftstrecker und Kniebeuger erregt, Motoneurone des Hüftstreckers *Adductor femoris* dagegen von den Hüftstreckern und Kniestreckern. Motoneurone der Hüftbeuger werden von Ia-Impulsen gehemmt, nicht nur von deren Antagonisten, sondern auch vom Kniestrecker *Vasto Cruralis*.

New Method for Determination of Radioactivity in Vegetal and Animal Tissues

This note is intended to give some preliminary information about the fairly satisfactory results obtained concerning radioactive substrata set in a Langsdorf diffusion chamber (modified type), used for the first time in the biological field.

This method is very sensitive and indicates even radioactivities of very low energy.

While the normal detectors are characterized by a threshold of energy, the diffusion chamber makes it possible to observe with the naked eye, or to photograph, any type of ionizing particles independently of their energy.

A great advantage of this method is being able to see the rising of radioactive particles on the surface of the substratum.

It is possible to identify, by means of the 'chamber', some characteristics of the radiation emitted (charge, mass, energy of the particles) and possibly to count the events which occur during the period of observation. The

modified Langsdorf chamber, being at continuous sensitivity, may present some advantages over the Wilson chamber which becomes sensitive only by expansion.

The instrument I have used, which was built at the Institute of Experimental Physics of the University of Milan (Milan Section of the National Institute of Nuclear Physics[1]), works at atmospheric pressure.

It consists of a double-glass-walled container with circular section, 35 cm inside diameter, 18 cm height, closed by a metallic bottom and by a 'roof'. The bottom is cooled down to – 45°C about by a Freon 22 single-phase compressor, having a power of 2 kW; the 'roof' presents a circular opening (20 cm diameter), closed by a crystal through which the events can easily be observed, photographed or filmed.

Some frame electrodes are set in the chamber, in order to produce a clarifying field, the intensity of which may be varied from 20 to 100 V/cm. There are also some annular trays containing liquid ethyl alcohol which is evaporated by armoured resistance.

Alcohol vapor diffuses in the whole chamber and falls downwards owing to gravity and is found in zones of progressively lower temperature.

The fall velocity is such that in a certain stratum, near the bottom, the vapor remains at the aeriform state, while it should be at the liquid state, according to the conditions of pressure and temperature (supersaturated vapor). In such conditions, the vapor is in unstable equilibrium and condenses on any nucleus of condensation.

In the supersaturation zone, the condensation first occurs on the atmospheric dust—the phenomenon lasts a short time (about 5 min)—and afterwards on the ions which happen to be present in the zone. If an ionizing particle passes into this zone, the ions it produces act as nuclei of condensation along its whole trajectory, giving rise to a trace formed by small drops of alcohol well visible to the naked eye.

The observation of the traces requires transverse lighting of the zone by means of an incandescent lamp, while for photography the field is lighted up with linear flashes.

Both flashes and release of the photographic shutter are synchronized by an automatic device. It is also possible to obtain stereoscopic photography of the images.

For determining the energy of the particles, the chamber contains a couple of Helmholtz coils, that are able to generate a magnetic field with a maximal intensity of about 1000 Gauss.

The substrata to be observed are set on special supports, refrigerated with liquid CO_2 and then let directly into the chamber; a few minutes are sufficient to reestablish the inner equilibrium of the instrument and, consequently, the best conditions for observation.

In order to set up the new method, I made several observations of letting into the chamber various substrata: bioptical drawings of animal and vegetal tissues, anatomic particles, vegetal seeds, young small plants, drops of liquids and mineral fragments, taking precautions not to contamine the chamber.

Among the most significant data obtained as yet, I wish to note that we found the presence of Thorium in the inner organs of a man who died owing to a hepatic sarcoma, 20 years after he had been inoculated with Thorotrast.

[1] A. LOVATI and C. SUCCI, Il Nuovo Cimento *11*, 163 (1954).

The absorption of Uranium salts on the part of *Cicer arietinum* and *Faseolus vulgaris* young small plants, experimentally treated in the laboratory, was equally evident.

The method derived from the employment of the modified Langsdorf chamber may, in my opinion, prove very useful for research on ionizing radiations, both to obtain a new orientation and as a complement of the other radiobiological techniques.

Another work in press describes the instrument with full details and also the technique I have set up and the first data I have obtained.

I wish to thank the staff of the Institute of Experimental Physics (Milan University), which put the instrument at my disposal, and particularly Dr. C. GIORI[2], who kindly helped me in this research work.

A. PASINETTI and C. GIORI

Institute of Anatomy and Pathological Histology of the University of Milan (Italy), and Institute of Experimental Physics of the University of Milan (Italy), May 29, 1957.

Riassunto

L'autore descrive un nuovo metodo per l'osservazione di substrati biologici radioattivati, basato sull'impiego della camera a diffusione.

Questo strumento presenta notevoli vantaggi su quelli sinora impiegati in radiobiologia, perchè permette di osservare ad occhio nudo, fotografare ed identificare le caratteristiche di qualsiasi tipo di particelle ionizzanti, indipendentemente dalla loro energia.

La camera a diffusione è particolarmente indicata per lo studio delle radiazioni ionizzanti di bassa energia.

I risultati ottenuti dall'autore durante le osservazioni su organi animali e vegetali, su liquidi e minerali, sono stati assai soddisfacenti.

[2] National Institute of Nuclear Physics, Milan.

A Method for the Incorporation of Radioactive Isotopes in the Sea Urchin Egg

The usual method of incorporating radioactive isotopes in sea urchin eggs or embryos consists in incubating them in sea-water containing the isotope (among others LINDBERG[1]; HULTIN and WESSEL[2]; HULTIN[3]; TYLER and MONROY[4]). The chief disadvantages of this procedure are: (a) the aging of the unfertilized eggs during the 3 to 5 h of incubation necessary to obtain a measurable uptake; (b) the possibility that the uptake may vary in the different stages of development because of differences in permeability to the given labelled compound.

We have now worked out a method which seems to circumvent these difficulties and we wish to describe it briefly.

The experiments have been carried out with S^{35}-DL-methionine (purchased from the Radiochemical Centre, Amersham, England) in DL-methionine carrier at the

[1] O. LINDBERG, Exper. Cell Res. *1*, 105 (1950).
[2] T. HULTIN and G. WESSEL, Exper. Cell Res. *3*, 613 (1952).
[3] T. HULTIN, Ark. f. Kemi *6*, 195 (1953).
[4] A. TYLER and A. MONROY, Biol. Bull. *111*, 296 (1956).