Zusammenfassung. Auf molekularer Basis wird die Energieübertragung und die Energieumsetzung in einem primären photosynthetischen System untersucht. Die Energieübertragung in den Pigmenten und im Chlorophyll-A wird mit der Energieübergangswahrscheinlichkeit und dem Diffusionsmodell eines intramolekularen «Exitons» mit Dipol-Dipol-Wechselwirkung behandelt. Bei einer Chlorophyllkonzentration von 0.1 M/l wird die Diffusionskonstante des «Exitons» $D_e \cong 1.1 \times 10^{-3}$ cm^2/sec und seine Diffusionslänge $l_e \cong 250$ Å. Als Energieumsetzung wird die Anregung eines $\pi - \pi$-Tripletts des Chlorophyll-A mit Hilfe eines paramagnetischen Metallenzyms vorgeschlagen und diskutiert.

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Pyramidal Activation of Interneurones of Various Spinal Reflex Arcs in the Cat

It is known that spinal reflexes can be controlled from supraspinal centres through inhibition at an interneuronal level. This effect is exerted through brain stem centres which, in the decerebrate state, tonically inhibit interneurons mediating effects from the flexion reflex afferents (group II and III muscle afferents, high threshold joint and cutaneous afferents), and from Ib afferents, but not the interneurones mediating Ia inhibition[1].

In the cat, pyramidal activation is known to facilitate flexor and extensor motoneurones through polysynaptic pathways[2]. Im addition fascilitation of three-neuron-arc reflex dischanges at internuncial levels has been described[3]. It will presently be shown that interneurones of reflex arcs are excited on stimulation of the sensory-motor cortex and that this effect is mediated by the pyramidal tract.

In this investigation, the effect of cortical stimulation on the synaptic actions by impulses in muscle, cutaneous and joint afferents has been investigated by measuring the effect of conditioning volleys on monosynaptic test reflexes and by intracellular recording from motoneurones. Figure 1 shows monosynaptic reflex discharges from gastrocnemius-soleus recorded at two sweep speeds. Record A shows the unconditioned test reflex and B the effect of a conditioning submaximal group I volley from the antagonist deep peroneal (tibialis anterior + extensor digitorum longus) nerve. In the corresponding records C and D, a train of 4 cortical stimuli was added with the result that the inhibitory effect of the deep peroneal volley increased from 5% in B to 55% in D. The inhibitory action in B and D is an example of the reciprocal Ia inhibition. In corresponding experiments with intracellular recording, cortical stimulation gave a large increase of the Ia IPSP. It is concluded that the increment in inhibition is due to a facilitation of the interneurones known to be interpolated in the Ia inhibitory pathway.

In similar experiments, it has been established that the inhibitory action exerted in extensor motoneurones by Ib muscle afferents, by group II and III muscle afferents, by cutaneous and by high threshold joint afferents are all

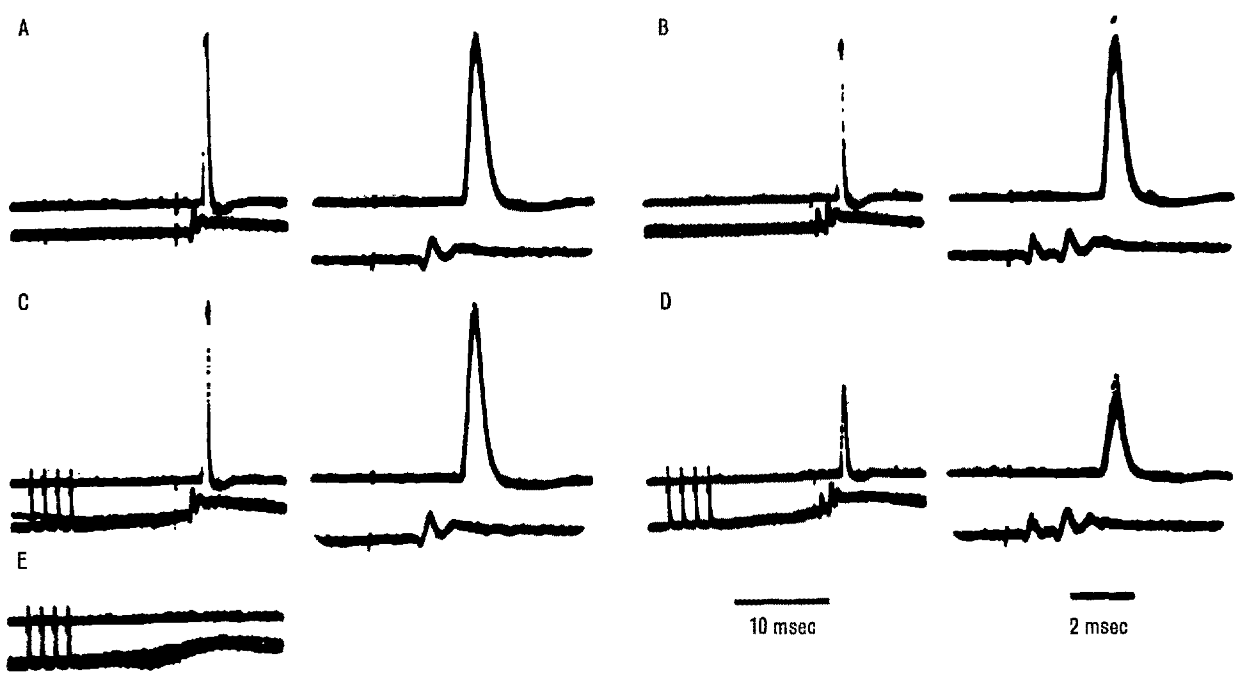

Fig. 1. The upper traces are monosynaptic reflex discharges evoked from the gastrocnemius-soleus nerve and recorded at two sweep speeds in the L7 ventral root. Lower traces were recorded from the L7 dorsal root entry zone. A shows the unconditioned test reflex and B the effect of a conditioning volley from the nerve to the antagonist muscles, extensor digitorum longus and tibialis anterior, evoked at a stimulus strength of 1.2 times threshold. In the corresponding lower records the contralateral postcruciate gyrus was stimulated in addition. E shows the effect of cortical stimulation alone.

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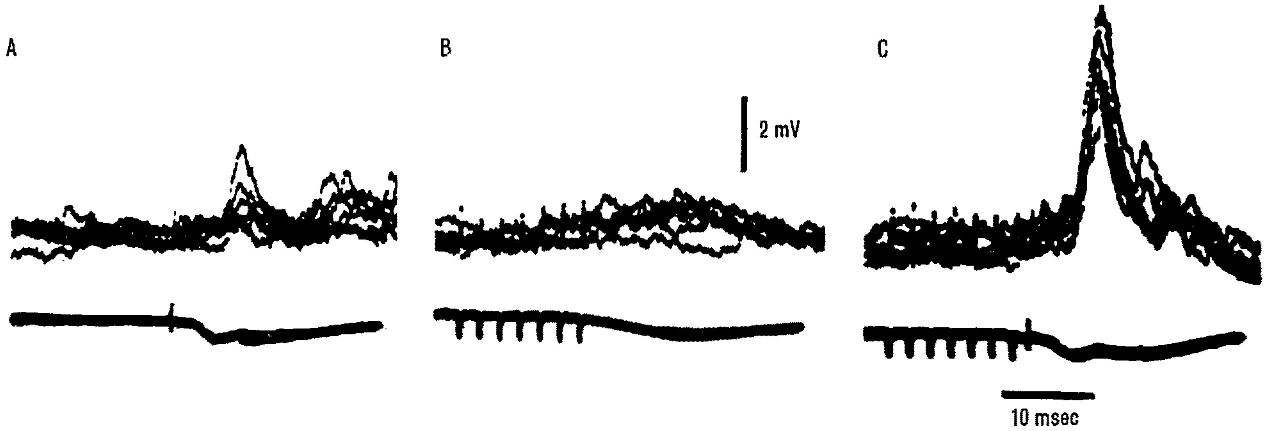

Fig. 2. These intracellular records (upper traces) are from a motoneurone of the posterior biceps-semitendinosus nucleus. Lower traces were recorded from the L7 dorsal root entry zone. The sural nerve was stimulated in A and C at a strength of 1.12 times threshold chosen to give the minimal excitatory postsynaptic potential in A. In C the sural volley was preceded by stimulation of the contralateral post-cruciate gyrus. The effect of cortical stimulation alone is shown in B.

increased by cortical stimulation. The same holds true for the excitatory actions evoked in flexor motoneurones by these afferents, as is illustrated in the intracellular records of Figure 2 for the excitatory action evoked by a suarl volley in a posterior biceps-semitendinous motoneurone. A shows the effect of the sural volley alone, B of cortical stimulation, and C of combined stimulation of cortex and the sural nerve. It is apparent that the excitatory post-synaptic potential increases markedly after cortical stimulation. Hence all these classes of interneurones are faciliated. This faciliatory action from the sensory-motor cortex was found to disappear after section of the pyramid just rostral to the crossing, but to remain after a section of the brain stem sparing the pyramids. Hence it is mediated by the pyramidal tract.

Activation of interneurones of reflex arcs is presumably an important part of the function of the pyramidal tract and probably also in part accounts for the excitability changes evoked in motoneurones by pyramidal activity. Excitatory effects were regularely more prevalent with flexor than with extensor motoneurones, and in some cats inhibition dominated in extensor motor nuclei, a finding which may be correlated with the dominance of excitatory spinal reflex pathways to flexor and of inhibitory to extensor motoneurones.

These results provide further indication of the importance of suprasegmental control of spinal reflex arcs, through facilitation or inhibition of their interneurones. Reflexes from different receptor systems may presumably be mobilized or inhibited according to need. It seems likely that regulation of motor performance in the cat is, to a considerable extent, exerted in this fashion.

Résumé. La stimulation du cortex sensori-moteur chez le chat facilite toutes actions synaptiques – excitatrices ou inhibitrices – qui sont provoquées dans les motoneurones par l'intermédiaire d'un ou de plusieurs interneurones. Ces actions peuvent prendre naissance dans des fibres afférentes d'origine musculaire I-a, I-b, II ou III, d'origine cutanée ou dans des fibres à seuil élevé provenant d'une jointure.

L'effet observé dépend de la mise en action du faisceau pyramidal qui facilite le fonctionnement de tous les interneurones intercalés dans les arcs réflexes mentionnés.

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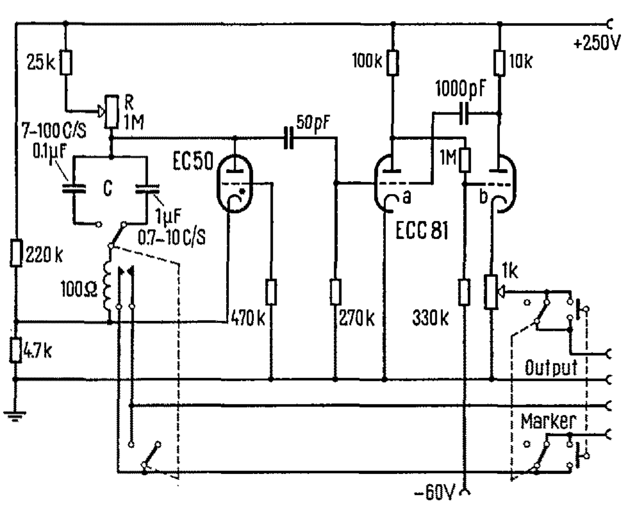
PRO EXPERIMENTIS

A Simple, Sturdy, and Inexpensive Stimulus Generator for Nerves and Muscles

Introduction. Most laboratories use induction coils for the stimulation of nerve-muscle preparations in physiology class experiments. Yet, on close inspection, these coils are thoroughly unsatisfactory for any really quantitative work. Firstly, the calibration of output voltage in terms of distance between coils is far from linear. Secondly, the coils give damped oscillations rather than single peaks. The frequency of these oscillations depends very strongly on resistance and capacity of the stimulated preparation. Finally, and worst of all, the amplitude of consecutive 'pulses' varies by as much as 30%, both when the coil is hand-operated and when the magnetic interruptor is used[1,2]. Therefore we developed the following simple and sturdy square wave generator which can replace the induction coil.



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