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**Proprioceptive control of inspiratory activity of the
scaleni**

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Fisiologia. — *Proprioceptive control of inspiratory activity of the scaleni* (*). Nota di GIUSEPPE SANT'AMBROGIO, ENRICO CAMPORESI e JACOPO MORTOLA (**), presentata (***) dal Socio R. MARGARIA.

RIASSUNTO. — Potenziali d'azione di singole fibre dei muscoli scaleni sono stati registrati nel coniglio durante respirazione normale e con occlusione delle vie aeree. Questi muscoli risultano essere attivi ad ogni livello di attività inspiratoria. Quando il flusso inspiratorio viene ostacolato mediante l'occlusione delle vie aeree si osserva un aumento della durata e della frequenza di scarica della attività delle singole fibre degli scaleni. La vagotomia non abolisce queste risposte che vengono attribuite ad un meccanismo riflesso propriocettivo che può anche intervenire durante la attività inspiratoria di questi muscoli.

The relevance of proprioceptive influences in the control of respiration has been variously assessed [1, 2, 3]. Autogenetic excitation is present in the intercostal muscles and therefore the "follow-up length servo" mechanism might play some role in their breathing activity whereas for the diaphragm any attempts to reveal autogenetic excitation have so far failed although autogenetic inhibition can usually be shown [4, 5].

The inspiratory function of the scaleni and their contribution to inspiration in the rabbit has been established [6, 7]. These muscles originate from the transverse processes of the fourth, fifth and sixth cervical vertebrae and insert on the five upper ribs. These insertions suggest their involvement in the movements of the head and in the maintenance of its position; this leads to suppose the presence of a proprioceptive mechanism which, similarly to the intercostals, might be activated also during their respiratory activity.

In rabbits, anaesthetized with a mixture of urethan and pentobarbitone, the trachea was cannulated in the lower neck: the intratracheal pressure was recorded by a Sthatham transducer and action potentials from single muscle fibers of the scaleni were recorded by means of a bipolar needle electrodes inserted in the neck portions of these muscles.

A scanty number of fibers are active during quiet breathing in the scaleni, thus showing that these muscles are not truly accessory being active throughout the whole range of inspiratory activity. Similarly to the intercostals the probability of recording active fibers within the scaleni decreases with increasing levels of anaesthesia: at the deeper stage only the diaphragm is active [8].

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When inspiration is hindered by occluding the trachea there is a marked increase in the duration and in the peak frequency of discharge of scaleni fibers. After severance of both vagi this effect is reduced to the same extent as found in the intercostals [7]. In seven of the eight units tested with tracheal occlusion, after vagotomy, there was an increase in peak frequency (average

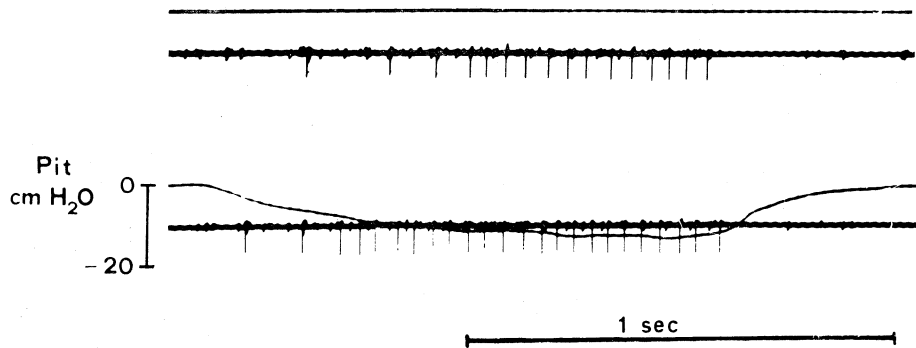


Fig. 1. - Anaesthetised rabbit: action potentials of a single fiber of the scaleni during a control breath (top) and during tracheal occlusion (bottom). Top tracing in each record shows the intratracheal pressure.

value of ratio between peak frequency of impulses of the occluded and control inspiratory efforts = 1.30 ± 0.12 , range from 1.14 to 2.02) and in four also an increase in duration of discharge (average value of ratio between durations of the occluded and control inspirations = 1.13 ± 0.02 , range from 1.10 to 1.18) (figg. 1 and 2). Proprioceptive influences should be

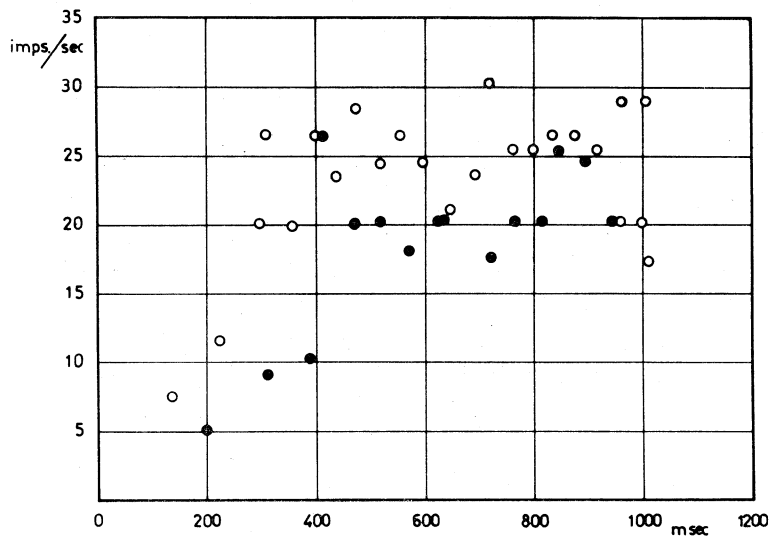


Fig. 2. - The instantaneous frequency of discharge (imps/sec) of the unit shown in fig. 1 is plotted against the time from the beginning of inspiratory activity (msec) in the control breath (closed circles) and during tracheal occlusion (open circles).

responsible of these effects: in fact during the occluded inspiratory effort the inspiratory muscles are kept at a fairly constant length, unlikely than in a normal breath, and therefore the spindle activity is increased leading to a greater activation of the corresponding alfa-motoneurones.

Autogenetic excitation seems therefore limited to the extra-diaphragmatic muscles of inspiration which altogether have been shown to give a smaller contribution throughout the whole range of inspiratory output [9] as compared with the diaphragm. Therefore the proprioceptive control might not be considered relevant to the general economy of respiration, but probably mostly concerned with the postural function of the muscles involved and, in man, also with phonation.

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