NEW MODEL OF DYNAMIC WORK FOR SMALL LABORATORY ANIMALS

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A new method of enforced continuous dynamic work for rats and mice is suggested. The animal, fixed by its tail in a vertical position above the surface of the water, which it touches only with its snout and forefoot, is compelled to do continuous muscular work. The onset of total fatigue is shown by the cessation of muscular activity, as the result of which the animal drowns. The method is suitable for mass screening of compounds with adaptogenic properties and to study the mechanisms of increasing the endurance and working capacity of animals, and it enables physiological parameters to be recorded in the course of the experiment.

KEY WORDS: *muscular fatigue; screening of adaptogens.*

During the study of mechanisms of increasing the endurance and working capacity of animals it is particularly important to choose a model of dynamic muscular work which will enable laboratory animals to be brought into a state of total muscular exhaustion [2]. Among the many different methods of producing muscular fatigue and measuring endurance [1-4] the model of swimming by small laboratory animals [5-8], which is distinguished by its experimental simplicity, continues to attract increasing attention. The writers' experience has shown that the different variants of swimming by rats and mice (free swimming and swimming with an extra load attached to the tail, or less frequently to the chest) so far described have certain disadvantages: 1) The rapid adsorption of air (gas) bubbles by the thick hair cover, with the formation of a sort of "air cushion" enables the animals to remain on the surface of the water without any visible movement; 2) the large scatter of the time of onset of complete muscular fatigue in animals of the same weight, depending on the ratio between the dense tissues and fat; 3) the difficulty of recording the physiological parameters of animals moving about and immersed in water.

The writers have developed a new model of enforced continuous dynamic work for rats and mice. The principle of the method is as follows: The animal, fixed by its tail in a vertical position above the surface of water, which it touches only with its snout and forefoot, is compelled to carry out continuous muscular work (Fig. 1). After a certain time of intensive muscular activity the animal becomes exhausted, its head is immersed in the water, and it drowns.

A bath 150 cm long, 100 cm wide, and 20 cm high with a valve for controlling the water level is used. A removable wooden rod, parallel to the surface of the water and at a distance of 12-15 cm from it in the experiments on rats (depending on their size) and 8-10 cm in experiments on mice, rests on the opposite end of the bath. To fix the rats' tails to the rod devices made from short lengths of thick-walled rubber (vacuum) tubes 20-25 mm long and with a longitudinal cut in their side wall are provided. To fix the animals the rubber tube is opened, the tail is introduced into the lumen of the tube, which is compressed by a U-shaped clip made from 1-mm stainless steel. In this way the tail can be securely fixed without disturbing its blood supply.

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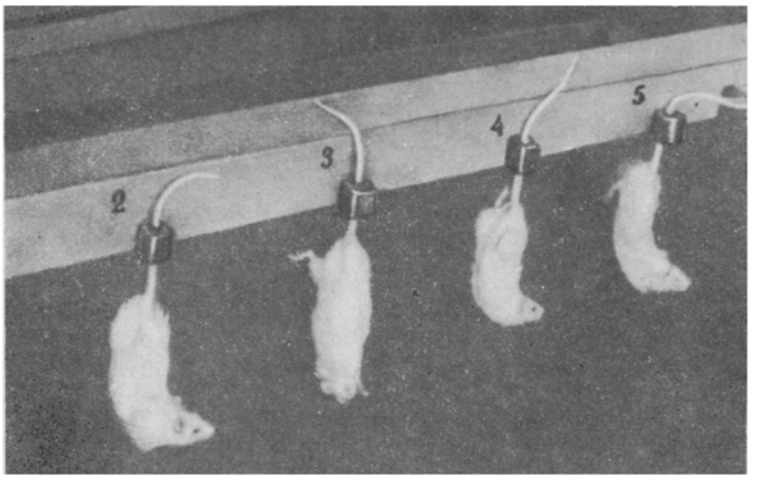

Fig. 1. General view of apparatus. Rat No. 3 has drowned after muscular fatigue; remainder of animals still hold their head above the water surface by intensive muscular activity.

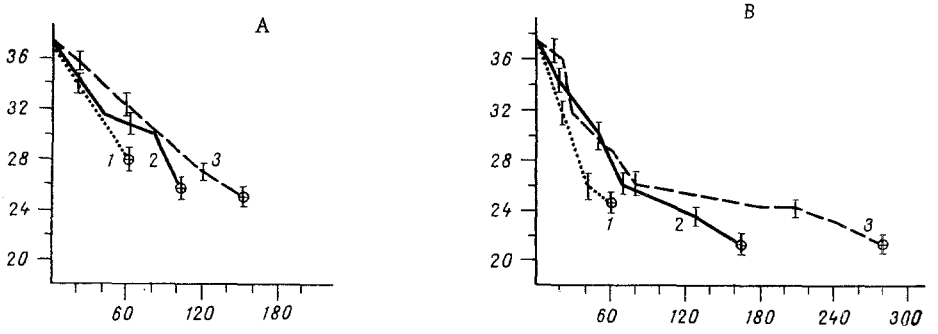

Fig. 2. Changes in body temperature and time of onset of total muscular fatigue of mice (A) and rats (B) under different temperature conditions. Abscissa, time of experiment (in min); ordinate, body temperature (in °C). Water temperature in bath: 1) 14°C; 2) 18°C; 3) 22°C; circles indicate death of animals. Values of M ± 2.5 m given.

TABLE 1. Effect of Adaptogens during Dynamic Work by Rats

Preparation	Dose (per kg body weight)	Mode of administration	No. of experiment	Increase in working capacity compared with control, % (M ± m)	P
Amphetamine	2 mg	Intraperitoneally	10	47±12	<0,05
Piridol	1,25mg	"	10	53±14	<0,01
Extract: of Rhodiola	1,0 ml	Subcutaneously	10	70±15	<0,01
of Eleutero-coccus	1,0 ml	Subcutaneously (over 24 h)	10	65±9	<0,01

By means of the proposed method, depending on the aim of the investigation, the duration of onset of complete muscular fatigue and death of the animals can be shortened or lengthened by changing the water temperature (Fig. 2).

To study the suitability of the model for the screening of substances increasing endurance, substances known to possess adaptogenic properties were used. Amphetamine, piridrol, and liquid extracts of *Rhodiola* and *Eleuterococcus*, freed from alcohol, were injected into rats 10 min before the experiment in doses of 0.3-10 mg/kg. The results of the experiments with the most effective doses of these adaptogens are given in Table 1.

The suggested model of enforced dynamic work is thus suitable for mass screening of compounds in order to study their stimulant properties. The stable experimental conditions and the possibility of setting the precise level of muscular activity mean that this model can be used to study the biochemistry and physiology of endurance.

Because the animals are in a fixed position, their physiological parameters (rectal temperature, blood pressure, pulse rate in the tail of rats) can be recorded and manipulations performed (substances injected) in the course of the experiment.

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IMPROVED HISTOCHEMICAL METHOD OF DEMONSTRATING OPEN CAPILLARIES

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A modification of Pickworth's method for demonstrating open capillaries is described. The distinguishing feature of this method is freezing the organ in situ with liquid propane, cooled with liquid nitrogen, followed by lyophilization of the specimen and fixation with gaseous formaldehyde. The sections are stained strictly in accordance with Pickworth's method.

KEY WORDS: *open capillaries, their demonstration; Pickworth's method, modification.*

Existing methods of detection of capillaries are not free from defects because they require the introduction of foreign materials (suspensions of ink, polymerized plastics, etc.) into the blood stream and use of a high perfusion pressure, outside physiological limits [1,

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