

Muscle growth during regeneration after mincing

E. Ghins and G. Marechal

!ICI., Ac. Hippocrate. B-1200 Bruxelles, Belgium

Rat gastrocnemius muscles were minced and orthotopically grafted. Tice tetanic isometric force of the regenerating muscle was 33 ± 5 g ($n = 3$) 30 days after the surgery. It increased linearly afterwards, being 69 ± 11 g at 60 days and 107 ± 10 g at 90 days (this is about one tenth of the force given by a normal gastrocnemius). The force-velocity relationship was measured in all the regenerates, and was characterized by a B constant quite low at 30 days, 13 ± 3 mm s⁻¹. It is increased to 19 ± 2 mm s⁻¹ at 60 days and 20 ± 1 at 90 days.

Thus, even after 90 days of regeneration, the muscles were rather slow, their B constant being half that of normal gastrocnemius. They were however still much faster than true slow muscles such as soleus (whose B constant is about 8 mm s⁻¹).

We have tried to obtain some information on the source of the cells responsible for the regeneration in the following way. If the mince is frozen in liquid N₂ and thawed just before the grafting procedure, the regenerates are very small and they cannot be stimulated ($n = 12$). Histologic examination showed that they are completely devoid of muscle cells. The freezing procedure kills all the cells that were spared by the mincing.

The absence of muscle regeneration indicates that the mince is not invaded by myoblast brought by the

circulation; therefore, the mince must contain the cells responsible for the regeneration.

In a third series of experiments, the mince was split into two halves before the grafting procedure. One of the halves was frozen in liquid N₂ and thawed. It was combined with the remaining half, and the mixture was orthotopically grafted. The regenerates were contractile: 30 days after the surgery, their Tetanic isometric force was 8 ± 1 g, i.e. one worth of that developed by regenerate originating from an untreated mince. The tetanic isometric force increased at 60 days (22 ± 5 g) and 90 days (58 ± 13 g) but remained much lower than that observed in regenerates arising from untreated minces. These regenerates contract rather slowly, their B constant being 6 ± 1 , 8 ± 2 and 16 ± 3 mm s⁻¹ respectively 30, 60 and 90 days after surgery.

These data indicate that the tetanic isometric force and the B constant of the force-velocity relation increase steadily during the regeneration, at least up to 90 days after surgery. The rate of *these* increases is slowed if half of the mince is frozen and thawed before grafting.

Growth of muscles regenerating from a mince seems thus to depend on the initial number of cells living in the mince.