Age-related changes in skeletal muscle function: the sum of the parts could be greater than the whole

TO THE EDITOR: Grosicki and coworkers (1) report that power output of single muscle fibers is preserved or even improved in the vastus lateralis of oldest-old humans (age >85 yr). Indeed, this is an interesting study, and we are pleased to see the results are substantially in agreement, not only with previous work from this group (3), but also with our recent work that examined skeletal muscle function assessed both in vivo and in vitro from the upper and lower limbs of oldest-old humans (4).

The two hypotheses forwarded by Grosicki et al. regarding the preservation or even improvement of muscle fibers from the vastus lateralis of the oldest-old are both worthy of exploration. Specifically, they proposed that the good quality of the fibers exhibited by the oldest-old can be either the result of an inadvertent selection of the best fibers during the technical process or are the result of a compensatory adaptation that facilitated the survival of these fibers. Actually, as documented by our work (4), the changes are quite dramatic with the whole mass of the quadriceps being reduced to approximately half, whereas the size of most, although not all, surviving fibers is preserved. This implies that approximately half of the original fiber population disappears.

Moreover, our studies have compared muscle fibers from upper and lower limbs of oldest-old who are either mobile or have been confined to a wheelchair for 2 years. Interestingly, the preservation of the size and intrinsic strength of the single muscle fibers was evident in all conditions. This finding contrasts starkly with the marked limb-specific difference in muscle atrophy, with the leg exhibiting much greater muscle loss than the arm with age, and an exaggeration of this process in the leg of the immobile compared with mobile elderly. These observations highlight the importance of physical activity in the elderly to promote the actual survival of the muscle fibers rather than the preservation of fiber quality.

Two additional points related to the preserved or even improved skeletal muscle fiber function with age are worthy of mention. The first is that the preservation of contractile performance in the elderly is likely limited to the in vitro condition, likely due to optimal availability of energy substrates and the direct activation with calcium. In vivo, the impairment of nervous control and excitation contraction coupling place heavy limitations upon the performance of skeletal muscle in the elderly. The second point is that this preservation or even improved skeletal muscle fiber function with age seems to be specific to the oldest-old. Indeed, most studies of older adults, from our group and others, reveal that in the 6th and 7th decades, whole muscle atrophy is accompanied by a reduction in individual fiber size (see Ref. 2 just to quote the most recent work in this area).

Therefore, taken together, these findings support the concept that the limiting factors responsible for the reduction in force generation capacity with advanced aging resides predominantly outside the contractile machinery of the skeletal muscle cells.

DISCLOSURES
No conflicts of interest, financial or otherwise, are declared by the author(s).

AUTHOR CONTRIBUTIONS
M.V., R.S.R., C.R., and F.S. drafted manuscript; M.V., R.S.R., C.R., and F.S. edited and revised manuscript; M.V., R.S.R., C.R., and F.S. approved final version of manuscript.

REFERENCES

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