Are We Making Progress in Defining the Role and Regulation of Myogenic Satellite Cells?

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Abstract

A more concerted effort is required in order to expedite our progress in determining the role and regulation of myogenic satellite cells, during muscle development, following some trauma (and hence repair) to a muscle, or during the aging process. Scientists 1) using divergent animal models, 2) studying satellite cells at different levels (i.e. cellular, molecular or comparative), and 3) evaluating satellite cells in applied, clinical or exercise procedures should join together in order to make more efficient gains in knowledge about satellite cells.

Key words: satellite cells, research progress, collaborative linkages.

Basic Appl Myol 10 (4): 201-202, 2000

Prior to 1960, the cellular mechanisms responsible for facilitating postnatal muscle growth and development had yet to be discovered [knowledge base prior to 1960, in part, summarized in 8]. It was not until the report of the existence of satellite cells [9, 10] that the cellular physiology of postnatal muscle growth or development could begin to be adequately defined. For years following the discovery of satellite cells, muscle biologists made tremendous advances in discovering satellite cells as independent cells residing in muscle via electron microscopy studies [introduced in 12], developing initial isolation and culture procedures for satellite cells [introduced in 2] and in determining the elementary regulation of isolated satellite cells [introduced in 1]. When the scientific participation was smaller, however, fewer scientific papers were published on a yearly basis. However, those involved in satellite cell research had a better understanding of the scientific questions being addressed in the laboratories of others in the field. Thus, when one laboratory made a technical advance, it could easily be shared with other laboratories in the same area. With the large number of laboratories presently working with satellite cells, however, the same sort of universal advancement is nearly impossible.

Who would have thought in 1961 that, as many scientists in as many countries as there are today would study satellite cells? Scientists in medical schools\clinical settings, research institutions, and agricultural and liberal arts colleges around the world are presently working to decipher the role and regulation of myogenic satellite cells. Papers are now being published about satellite cells in a wide variety of sources ranging from well-established medical and science journals to recently started publications and on-line journals. Satellite cells from rats, fish, cows, sheep, pigs, horses, humans, turkeys and a variety of other animals are being evaluated *in vivo* and *in vitro* [3, 5, 7, 11]. New satellite cell isolation procedures, media formulations, and cellular and molecular tools are also now being published at a staggering rate, instead of rarely, as was the case during the first twenty years of the existence of the field [introduced in 6]. Where does this plethora of research activity leave us in terms of developing an integrated idea of the role or regulation of satellite cells?

Satellite cells from different animals seem to have different properties [5]. Would one expect satellite cells from certain fish, that experience myofiber hyperplasia throughout their lifetimes, for example, to be regulated the same as satellite cells from humans, whose myofiber number seems to be fixed at birth? As there are numerous other examples whereby animals differ in their satellite cell characteristics [5], is an integrated idea about satellite cells feasible to come to in this area? Further, will it be possible to piece together one mechanism of satellite cell action, or regulation, based on data derived from different *in vivo* and *in vitro* methods or physiological models (i.e. normal muscle growth, muscle regeneration or muscle atrophy) from one laboratory to the next?

Who might be the one that puts the satellite cell story together? Likely no one scientist will be capable of doing the job adequately. As an alternative, I propose that scientists worldwide join together in order to make more efficient gains in knowledge about the role and regulation of satellite cells. The international effort in this area is very strong and can no longer be ignored. The advent of electronic communication to even the most remote parts of the globe is likely to facilitate the achievement of this goal. Further, as an additional benefit, establishing international research "teams" might also open-up new funding opportunities, which is something we could all use to help make progress in this important area [4].

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References

[1] Allen RE, Merkel RA, Young RB: Cellular aspects of muscle growth: Myogenic cell proliferation. *J Anim Sci* 1979; 49: 115-127.

[2] Bischoff R: Enzymatic liberation of myogenic satellite cells from adult rat muscle. *Anat Rec* 1974; 180: 645-660.

[3] Campion DR: The muscle satellite cell: a review. *Int Rev Cytol* 1987; 87: 225-251.

[4] Dodson MV: At the funding crossroads: a call for international collaboration in basic and applied myology. *Basic and Applied Myology* 1995; 5 (4): 375-376.

[5] Dodson MV, McFarland DC, Bandman E, Dayton W, Yablonka-Reuveni Z, Greene E, Doumit M, Bergen W, Merkel R, Vierck J, Velleman S, Koumans J: Status of satellite cell research in agriculture. *Basic and Applied Myology* 1995; 5 (1): 5-9.

[6] Dodson MV: Basic cell culture methods, in Dodson M (guest ed): *Methods in Cell Science*. 2000; 22: 25-81.

[7] Dodson MV, McFarland DC, Grant AL, Doumit ME, Velleman SG: Extrinsic regulation of domestic animal-derived satellite cells. *Domest Anim Endocrinol* 1995; 13 (2): 107-126.

[8] Various Contributors, in Gutmann E (ed): *The Denervated Muscle*. 1962; 1-486.

[9] Katz B: The terminations of the afferent nerve fibre in the muscle spindle of the frog. *Philos Transact Royal Soc London Ser (Biol)* 1961; 243: 221-240.

[10] Mauro A: Satellite cells of skeletal muscle fibers. *Biophys Biochem Cytol* 1961; 9: 493-495.

[11] McFarland DC: Cell culture as a tool for the study of poultry skeletal muscle development. *J Nutrition* 1992; 122: 818-824.

[12] Muir AR: The structure and distribution of satellite cells, in Mauro A, Shafiq A, Milhorat A (eds): *Regeneration of Striated Muscle and Myogenesis*. 1970; 91-100.