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NEURAL REGULATION OF PROTEINS IN THE SKELETAL MUSCLES OF FROG,
RANA HEXADACTYLA (LESSON)

K. SATYANARAYANA, K. V. RAMANA RAO, Y. FRAMESELAMMA AND K. S. SWAMI

Department of Zoology, S.V. University, Tirupati

ABSTRACT

Electrophoretograms of normal and denervated gastrocnemius and peronius muscles of frog showed the existence of 6 bands, which are discernable into four relatively slow moving and two relatively fast moving types. Following neurectomy, the changes in the protein fractions were conspicuous in both the muscles. The atrophy effects were more prominent in the peronius than in the gastrocnemius muscle. The probable significance of the protein characters on neurectomy have been discussed.

The effect of innervation on the biochemical, metabolic and physiological properties of the muscle has received considerable attention. However there are only few reports on the changes in the electrophoretic pattern of cell proteins following peripheral nerve section. The present study of the denervation induced changes in the protein fraction of the muscle was undertaken to have a better understanding of the range of control exerted by the nervous system on the innervating tissues, since this will throw light on the mechanism of the neural regulation of the biochemical attributes of skeletal muscle.

Two muscles were chosen for the present study, namely, (1) the gastrocnemius, which is a mixed muscle with high proportion of slow fibres and (2) the peronius, which is essentially a fast muscle, both being innervated by the common sciatic nerve.

Polyacrylamide disc electrophoresis was conducted by the method of Davis and Orstev.0 ml protein extract was directly applied, followed by a small quantity of 40% sucrose solution. A direct current of 1.5 m Amps per tube was applied for 60 minutes at 4°C in 0.05 M tris-glycine buffer at pH 8.9. After electrophoretic run, the gels were removed and stained in 1% amido black in 7% acetic acid. The excess stain was removed by repeated washings with 7% acetic acid until the non-protein part of the gel became transparent.

RESULTS AND DISCUSSION

The electrophoretic mobility patterns of cell proteins of the gastrocnemius muscle revealed the existence of 6 bands. Of the bands, 3 of the bands are relatively slow moving type (a, b and c), one is intermediary (d) and the remaining two are fast moving types (Fig. 1). The pattern remains similar in the denervated muscle suggesting that the major classification of the cell proteins remains unchanged. However some of the protein bands indicate physical changes involving electromobility and the quantitative aspects. The bands 'd', 'e' and 'f' in the denervated peronius showed a tendency of increased electromobility while in the gastrocnemius similar changes could not be evinced on denervation. However on the quantitative point of view, as visualized in terms of the density of the band it is likely that bands 'd', 'e' and 'f' could be increasing on denervation in both the muscles. Thus the increase in...
fast moving fractions in both types of muscles on
denervation .atrophy compared to the respective
controls seemed to be an essential consequence of
neurectomy, and similar changes have been reported
previously9-12. The apparently negligible change
in the protein level of the 'a', 'b' and 'c' bands
may indicate the lack of neurotrophic control on
them and as suggested by Guth and Watson9 they
may be under the control of intrinsic factors present
in the muscle6.

Fig. 1. Polyacrylamide disc electrophoretograms
of soluble protein fractions of normal and denervated
skeletal muscles, viz., Gastrocnemius denervated
(G.D.), Gastrocnemius normal (G.N.), Peronius
denervated (P.D.), and Peronius normal (P.N.).
The markings a, b, c, d, e and f, indicate protein
fractions.

By comparison with the electromobility pattern
of the frog serum it is likely to consider bands
'c' and 'f' to belong to the albumin and pre-albumin-
types while 'a', 'b', 'c' and 'd' belong to that of
globulin-type protein. The band 'd' is comparable
to the globulin-type of protein. The increase in
the globulin-type of cell proteins especially that of
'd' band may correspond to the increased proteolytic
enzyme content which is globulin in nature14. Similar
positive modulation of proteolytic enzymes by
globulin-type proteins was reported in the amphibi-
gastrocnemius muscle15 and the elevated protease
activity in the denervated muscle could be
under similar situation.

The elevated albumin and prealbumin-types as
revealed by the density of 'd' and 'f' bands may
probably contribute to the divalent ion complex
and the increased Ca++ content reported in the
denervated muscle is in agreement16. Even though
the sciatic nerve innervates both the peronius (fast)
and gastrocnemius (mixed) muscles, the denerva-
tion-induced response appear to be different in the
fast muscle as compared to the mixed muscle.

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SHORT TERM GEO-STIMULATION AND P³² DISTRIBUTION IN ALASKA PFA SEEDLINGS
SYED MUSHTAQ HUSAIN
Biology Department, University of Mosul, Mosul, Iraq

PLANTS exhibit two growth responses—geotropism and gravimorphism, when their 'preferred' orientation with respect to gravity is disturbed. A number of changes in the cell and tissues probably underlie these responses.

Curr Sci-3

Auxin moves to the lower side of the stimulated organ12 and increases the extensibility of the lower epidermal cells3 with a concomitant enhancement of cellulase activity4. Induction of differences in the electrical potential5 and redistribution of growth