

氏名	山下 晋
学位の種類	博士(体育学)
学位記番号	第2号
学位授与の要件	学位規則第4条第2項該当
学位授与年月日	平成 19 年 9 月 11 日
学位論文題目	Assembly of transverse tubule architecture in the middle and myotendinous junctional regions in developing rat skeletal muscle fibers
論文審査委員	主査 教授 竹倉 宏明 副査 教授 齋藤 和人 副査 准教授 田巻 弘之

論 文 概 要

The transverse (t)-tubule is responsible for the rapid inward spread of excitation from the sarcolemma to the inside of the muscle fiber, and the compartments of the t-tubule become highly and regularly organized during development. Although it is known that skeletal muscle fibers lengthen by adding sarcomeres at the myotendinous junction (MTJ) during development, no specific model exists for the assembly of new t-tubule architecture at the MTJ. We performed an electron-microscopic examination of the assembly of t-tubule architecture at the MTJ in developing rat skeletal muscle fibers. Although the longitudinally oriented t-tubule elements represent only a small fraction of the total t-tubule system in adult muscle fibers, they were observed at both A-band and I-band regions of middle and MTJ regions in early developmental stages, and gradually disappeared in the middle regions of muscle fibers during development; however, they remained in the MTJ even in adult muscle fibers. The frequency of pentads and heptads (two or three t-tubule elements with three or four elements of terminal cisternae, closely aligned with terminal cisternae of the sarcoplasmic reticulum) decreased during development, with sudden decrease between 7 and 10 weeks of age in the middle regions. Interestingly, although the frequency of decrease appeared to be higher in the middle region than in the MTJ regions in early (3- to 7-week) development, this pattern reversed, and the frequency of decrease was higher in the MTJ in later development (after 10 weeks of age). The MTJ maintained the features of immature membrane systems involved in e-c coupling much longer than the middle region of the fiber during development. The assembly of t-tubule architecture during postnatal development thus follows different processes in the middle and MTJ regions of skeletal muscle fibers.

論 文 審 査 の 要 旨

学位論文の「Assembly of transverse tubule architecture in the middle and myotendinous junctional regions in developing rat skeletal muscle fibers.」は、2007年発行のJ.Muscle Res. Cell Motil. の第28巻に原著論文として掲載予定である(電子版には掲載済み)。研究内容は、骨格筋細胞の発育期において筋腱移行部の Calcium Release Units(CRUs)の形態変化を機能的特性と関連させ、組織化学的手法により検討したものであり、最新のバイオイメーキング技術を駆使して実施した極めて独創性の高い研究成果であった。骨格筋細胞の発育に伴う CRUs の形態変化は、筋繊維タイプ別に異なることが報告されているが、筋腱移行部の形態的特性も大きく異なることに加え、生理的・非生理的刺激に応答して比較的容易にその形態的特徴を変化させることによって機能的特性の変化を引き起こしていると推察された。よって、学位論文の研究内容に加えて関連する研究成果を総合的に判断し、本論文は博士の学位を授与するに十分な研究成果を含む内容であると判定した。