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Colin Crist, PhD

Principal Investigator, Lady Davis Institute
Assistant Professor, Department of Human Genetics,
McGill University

Cell Stem Cell

Muscle Satellite Cells Are Primed for Myogenesis but Maintain Quiescence with Sequestration of *Myf5* mRNA Targeted by microRNA-31 in mRNP Granules

Colin G. Crist, Didier Montarras, Margaret Buckingham

Regeneration of adult tissues depends on stem cells that are primed to enter a differentiation program, while remaining quiescent. How these two characteristics can be reconciled is exemplified by skeletal muscle in which the majority of quiescent satellite cells transcribe the myogenic determination gene *Myf5*, without activating the myogenic program. We show that *Myf5* mRNA, together with microRNA-31, which regulates its translation, is sequestered in mRNP granules present in the quiescent satellite cell. In activated satellite cells, mRNP granules are dissociated, relative levels of miR-31 are reduced, and *Myf5* protein accumulates, which initially requires translation, but not transcription. Conditions that promote the continued presence of mRNP granules delay the onset of myogenesis. Manipulation of miR-31 levels affects satellite cell differentiation ex vivo and muscle regeneration in vivo. We therefore propose a model in which posttranscriptional mechanisms hold quiescent stem cells poised to enter a tissue-specific differentiation program.

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