

Living adult rat cardiomyocytes in culture: Evidence for dissociation of costameric distribution of vinculin from costameric distributions of attachments

Kyoko Imanaka-Yoshida, Barbara A. Danowski, Jean M. Sanger, Joseph W. Sanger \*

Department of Cell and Developmental Biology, Pennsylvania Muscle Institute, University of Pennsylvania School of Medicine, Philadelphia

#### Keywords

hearts; cardiomyocytes; alpha-actinin; vinculin; Z-lines; interference reflection contrast microscopy

#### Abstract

Adult rat cardiomyocytes were placed in tissue culture to determine the relationships of their vinculin positive costameres, their attachments associated with the costameres, and the fate of their myofibrils. The costameric structures were detected using interference contrast microscopy and by the visualization of the fluorescently labeled vinculin and alpha-actinin molecules. The cardiomyocytes isolated from the heart retained their myofibrils upon attachment to the cell surfaces. One group of cells then rounded up, only to respread after 6 days in culture. These cells initially demonstrated costameric distributions of attachments and vinculin. These relationships were lost during the rounding-up process only to be regained as the cells respread. The second group of freshly isolated cardiomyocytes did not round up but began to spread on the substratum by sending out lamellipodia from their rectangularly shaped body. These newly cultured cardiomyocytes initially exhibited costameric distributions of close attachments detected by interference microscopy. Over the next 3 days although the cells remain attached to the substratum, the costameric attachments were gradually lost. Nevertheless, when similar cells were injected with fluorescently labeled vinculin, costameric distributions of vinculin could be detected in the absence of costameric attachments. Cardiomyocytes, injected with fluorescent alpha-actinin, revealed that during the first few days in culture the existing myofibrils disassembled from the edges of the cell towards the middle. The center group of myofibrils was retained as the cells began to spread. Our observations of living cells support the hypothesis that proteins in addition to vinculin are needed for cardiomyocytes to generate costameric attachments to the cell surfaces. We speculate that the ability of the vinculin-attached Z-lines of adult cardiomyocytes to dissociate from the extracellular matrix may aid in the remodeling of the adult heart in the repair process after myocardial infarction and also in stress induced hypertrophic growth. © 1996 Wiley-Liss, Inc.

---

Received: 15 August 1995; Accepted: 1 December 1995

\*Correspondence to Joseph W. Sanger, Department of Cell and Developmental Biology, Pennsylvania Muscle Institute, University of Pennsylvania School of Medicine, Philadelphia, PA 19104-6058

Funding Agency: MDA

Funding Agency: NIH; Grant Number: HL-15835, HL-48954, GM-14142