Presence of Heat Shock Protein 72 in Cardiomyocytes After Heat Stress

To the Editor:

It is well-known that prior in vivo heat stress induces the synthesis of heat shock protein (HSP) 72 in the rat heart, but the precise content in the various cell-types has not yet been measured. It is therefore of great importance to conduct experiments as performed in the paper by Leger et al.1 However, the overall conclusion that heat pretreatment does not lead to HSP72 synthesis in cardiomyocytes is unjustified. In addition, the statement that blood vessels play a primary role in the heat shock–induced cardioprotection is preliminary.

The double-labeling experiments of Leger et al, staining HSP72, as well as HSP27, clearly indicates the presence of both proteins in the same area, which the authors define as cardiomyocytes in the case of HSP27. Indeed, other studies indicate that cardiomyocytes do overexpress HSP72 after stress: cardiomyocytes of intact hearts are capable of overexpressing HSP72 after heat treatment.2 Although the increase of HSP72 normalized for protein content was lower in cardiomyocytes than in endothelial cells, the absolute HSP72 amount was 3 times higher in the cardiomyocyte than in the endothelial cell pool. Furthermore, isolated cardiomyocytes increase their synthesis of HSP72 after heat treatment.2 Those results are consistent with the increase of HSP70 in blood vessels after heat shock treatment, HSP70 is mainly found in blood vessels of the heart. Cornelussen and colleagues do not directly address this finding but rather interpret our findings as supporting the conclusion that heat pretreatment does not lead to HSP72 synthesis in cardiomyocytes. In relative terms, our data show that most of the increase in HSP70 is in blood vessels. Consequently, our finding of increased HSP70 in blood vessels after heat shock treatment led us to propose that blood vessels play a role in heat shock–induced cardioprotection.

Our study used confocal microscopy and immunofluorescence to localize heat shock protein (HSP) 27 and HSP70 in the heart after heat shock treatment.3 One of our conclusions is that after heat shock treatment, HSP70 is mainly found in blood vessels of the heart. Cornelussen and colleagues do not directly address this finding but rather interpret our findings as supporting the conclusion that heat pretreatment does not lead to HSP72 synthesis in cardiomyocytes. In relative terms, our data show that most of the increase in HSP70 is in blood vessels. Consequently, our finding of increased HSP70 in blood vessels after heat shock treatment led us to propose that blood vessels play a role in heat shock–induced cardioprotection. Our study was designed to localize anatomically HSP70 (and HSP27) in hearts, and our anatomical findings suggest a greater increase of HSP70 in blood vessels after heat shock treatment compared with cardiomyocytes, a finding that is consistent with the report of Amrani et al.4 We agree with Cornelussen and colleagues that verification, by quantitative means, of the relative amounts of HSP70 in cardiomyocytes and endothelial cell fractions after heat shock is important.

With respect to our hypothesis, given the findings of Amrani et al2 and our findings of HSP70 localized in blood vessels, it seems logical to propose that blood vessels play a role in myocardial protection. We agree with our colleagues that transgenic mice overexpressing HSP70 in blood vessels need to be generated and that experiments blocking HSP70 in cardiomyocytes will be essential to assess the relative contribution of increased HSP70 in blood vessels versus that in cardiomyocytes to myocardial protection, but this was beyond the scope of our study.

The letter of Cornelussen and colleagues draws attention to the importance of broadening the discussion on the contribution of each cell type in a complex organ to the phenomenon of stress-induced protection. Our work supports the notion that each cell type in an organ can have a cell-type specific response to injury. While our study shows that after heat shock treatment, HSP70 is primarily evident in cardiac blood vessels and light or no HSP70 is detected in neurons or cardiomyocytes, we agree that in response to other types of injury, such as ischemia, both neurons and cardiomyocytes express HSP70, suggesting that the cell-type specific expression of HSPs is also dependent on the kind of injury.

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Response

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