

# Journal of Biological Research

Bollettino della Società Italiana di Biologia Sperimentale



**86<sup>th</sup> SIBS National Congress**

Palermo, Italy, 24-25 October 2013

*Botanical Garden, Lanza Hall*

jbr

# Journal of Biological Research

Bollettino della Società Italiana di Biologia Sperimentale

eISSN 2284-0230

## EDITOR IN CHIEF

Marco Giammanco (*University of Palermo, Italy*)

## ASSOCIATE EDITORS

Renzo Antolini (*University of Trento, Italy*)

Massimo Cocchi (*Alma Mater Studiorum-University of Bologna, Italy*)

Proto Gavino Pippia (*University of Sassari, Italy*)

Luigi Pane (*University of Genoa, Italy*)

Emma Rabino Massa (*University of Turin, Italy*)

## EDITORIAL BOARD

James Anthony (*Michigan State University, USA*)

Maria Grazia Bridelli (*University of Parma, Italy*)

Dario Cantino (*University of Turin, Italy*)

David Caramelli (*University of Florence, Italy*)

Giuseppe Caramia (*G. Salesi Ancona Hospital, Italy*)

Emilio Carbone (*University of Turin, Italy*)

Brunetto Chiarelli (*University of Florence, Italy*)

Amelia De Lucia (*University of Bari, Italy*)

Andrea Drusini (*University of Padua, Italy*)

Luciano Fadiga (*University of Ferrara, Italy*)

Vittorio Farina (*University of Sassari, Italy*)

William Galanter (*University of Illinois, USA*)

Millie Hughes-Fulford (*University of San Francisco, USA*)

Gaetano Leto (*University of Palermo, Italy*)

Gianni Losano (*University of Turin, Italy*)

Mansoor A. Malik (*Howard University Hospital, USA*)

Gian Luigi Mariottini (*University of Genoa, Italy*)

Neville A. Marsh (*Queensland University of Technology, Australia*)

Bruno Masala (*University of Sassari, Italy*)

Alejandro M.S. Mayer (*Midwestern University, USA*)

Vincenzo Mitolo (*University of Bari, Italy*)

Werner E.G. Muller (*Johannes Gutenberg University, Germany*)

Kary B. Mullis (*Oakland Research Institute, USA*)

Giuseppe Murdaca (*University of Genoa, Italy*)

Giuseppe Palumbo (*University of Naples Federico II, Italy*)

Gian Luigi Panattoni (*University of Turin, Italy*)

Giovanni Pizzuti (*University of Naples Federico II, Italy*)

Massimo Pregnotato (*University of Pavia, Italy*)

Mark R. Rasenick (*University of Illinois, USA*)

Angela Maria Rizzo (*University of Milan, Italy*)

Giacomo Rizzolatti (*University of Parma, Italy*)

Aldo Rustioni (*University of North Carolina, USA*)

Salvatore Sapienza (*University of Catania, Italy*)

Pietro Scotto Di Vettimo (*University of Naples, Italy*)

Vinicio Serino (*University of Siena, Italy*)

Lynne Christine Weaver (*University of Western Ontario, Canada*)

Mario Wiesendanger (*University of Friburg, Germany*)

## Editorial Staff

Lucia Zoppi, Managing Editor

Claudia Castellano, Production Editor

Tiziano Taccini, Technical Support

## Publisher

PAGEPress Publications

via Giuseppe Belli 7

27100 Pavia, Italy

Tel. +39.0382.1751762 – Fax. +39.0382.1750481

info@pagepress.org – www.pagepress.org

# An HSF2-like factor is present in the invertebrates: characterization and purification in sea urchin embryos and its localization in primary mesenchyme cells

G. Turturici, G. Sconzo, F. Geraci

Department of Biological, Chemical and Pharmaceutical Sciences and Technologies, University of Palermo, Italy

The cells respond to environmental, pathological and physiological stresses by inducing the synthesis of the heat shock proteins (HSP) which are highly conserved among all the organisms.<sup>1</sup> The stress response is a common cellular defence mechanism against extracellular stress stimuli. The responsible for the stress-regulated synthesis is the transcription factors (HSF) which activate the transcription of the heat shock genes with a rapid synthesis of their encoded proteins (HSPs). The heat shock proteins are classified into different families on the basis of molecular mass, and one the most conserved during the evolution is HSP70 that is the most abundant and the most reacting HSP to both physiological and environmental stresses. The HSP70 and their cognate proteins (HSCs) function as molecular chaperones to protect cells by binding to partially denatured proteins and dissociating protein aggregates.<sup>2</sup> Single genes for HSF have been cloned from yeast,<sup>3</sup> fruit flies (*Drosophila*),<sup>4</sup> and frogs functionally homologous to mammalian HSF1. Four HSFs have been identified in mammalian and of these, HSF1 and HSF2, are ubiquitously expressed and conserved.<sup>5</sup> HSF1 functions as a classical stress-responsive factor, HSF2 is active during specific development processes and it has been proposed to have a role in developmental processes. Although HSFs are best known as stress-inducible transcriptional regulators, they are also important for physiological processes. HSF functions are from the heat shock response to development, metabolism, disease, especially cancer and neurodegenerative disorders.<sup>6</sup> HSFs contribute to multiple normal physiological processes and pathologies through direct regulation of their target genes. Since reproduction, the immune response and aging are the processes that are affected by the HSF activities an hypothesis would be that these new functions have been recruited during evolution in order to coordinate these processes.<sup>6</sup> In order to verified this hypothesis we investigated whether HSF2-like factor in addition to HSF1 is present in one invertebrate which precedes chordates in evolution. To this aim we demonstrat-

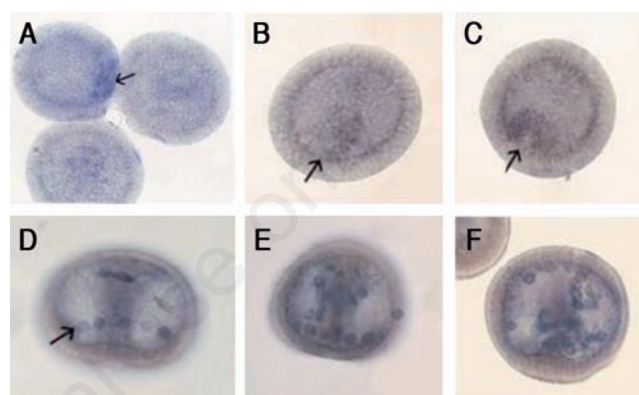


Figure 1. HSF2 localization during embryo development. A-C) Blastula embryos (arrows indicate the ingressing cells); D-F) Gastrula embryos (arrow indicates the primary mesenchyme cell).

ed that in sea urchin *Paracentrotus lividus* embryos are present HSF1 and also HSF2. After characterization and purification we found two HSF2 isoforms located both in the nucleus and in the cytoplasm.  $\alpha$  and  $\beta$  sea urchin isoforms seems to be similar to those present in mouse and their expression pattern varies during embryo development, similarly to those of the mammalian HSFs, which are developmentally regulated in a stage-specific manner. In sea urchin the  $\beta$  isoform has greater DNA-binding activity than the  $\alpha$  isoform. Moreover, in non-stress conditions the HSE-HSF complex present in early developmental stage embryos is composed predominantly of HSF2, whereas the late developmental stage binding activity is due to HSF1. Studies on territorial localization demonstrate that sea urchin HSF2 is maternal and that during embryo development, until gastrula, is more concentrated in primary mesenchyme cells (PMCs) (Figure 1). Interestingly, Hsp70 distribution shows no spatial correlation with HSF2 expression in non stressed conditions. However, in sea urchin embryos the particular HSF2 localization does not seem to be related to development, because the block of its function, by anti-HSF2 antibody microinjection in eggs, does not disturb the morphogenetic processes after fertilization. It is possible that at its appearance HSF2 did not have any role related to development and this may have been achieved later in evolution.

Correspondence: Giuseppina Turturici, Department of Biological, Chemical and Pharmaceutical Sciences and Technologies, University of Palermo, viale delle Scienze edificio 16, 90128 Palermo, Italy.

E-mail: g.turturici05@libero.it

©Copyright G. Turturici et al., 2015

Licensee PAGEPress, Italy

Journal of Biological Research 2015; 88:5161

This article is distributed under the terms of the Creative Commons Attribution Noncommercial License (by-nc 3.0) which permits any noncommercial use, distribution, and reproduction in any medium, provided the original author(s) and source are credited.

## References

- De Maio A. Heat shock proteins: facts, thoughts, and dreams. Shock 1999;11:1-12.

2. Bukau B, Horwich AL. The Hsp70 and Hsp60 chaperone machines. *Cell* 1998;92:351-66.
3. Wiederrecht G, Seto D, Parker CS. Isolation of the gene encoding the *S. cerevisiae* heat shock transcription factor. *Cell* 1988;54:841-53.
4. Clos J, Westwood JT, Becher PB, et al. Molecular cloning and expression of a hexameric *Drosophila* heat shock factor subject to negative regulation. *Cell* 1990;63:1085-97.
5. Morano KA, Thiele DJ. Heat shock factor function and regulation in response to cellular stress, growth, and differentiation signals.
6. Akerfelt M, Morimoto RI, Sistonen L. Heat shock factors: integrators of cell stress, development and lifespan. *Nat Rev Mol Cell Biol* 2010;11:545-55.

Non commercial use only