STEM CELLS AND PLANT REGENERATION

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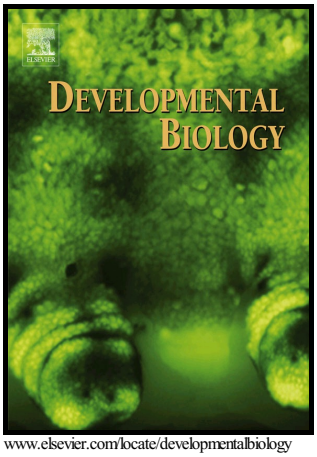

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Abstract

Multicellular organisms show the ability to replace damage cells, tissues and even whole organs through regeneration mechanisms. Plants show a remarkable regenerative potential. While the basic principles of plant regeneration have been known for a number of decades, the molecular and cellular mechanisms underlying such principles are currently starting to emerge. Some of these mechanisms point to the existence of highly reprogrammable cells. Developmental plasticity is a hallmark for stem cells, and stem cells are responsible for the generation of distinctive cell types forming plants. In the last years, a number of players and molecular mechanism regulating stem cell maintenance have been described, and some of them have also been involved in regenerative processes. These discoveries in plant stem cell regulation and regeneration invite us to rethink several of the classical concepts in plant biology such as cell fate specification and even the actual meaning of what we consider stem cells in plants. In this review we will cover some of these discoveries, focusing on the role of the plant stem cell function and regulation during cell and organ regeneration.

1. Introduction

Regeneration is the capacity of multicellular organisms of reconstituting or developing new cells, tissues or even complete organs upon damage and/or wound (Birnbaum and Alvarado, 2008). Every species shows different regenerative capacities and each organ of the same individual may respond differently during regeneration. In animals, specific areas of the brain do not appear to show regenerative potential while the surface of the gut is renewed every 3-5 days (Alvarado and Yamanaka, 2014). In contrast, plants show higher potential to regenerate, which is thought to rely in certain tissues or types of cells more broadly located throughout the plant (Pulianmackal et al., 2014). Interestingly, different plant organs vary in their regenerative properties suggesting there might be distinctive biological mechanisms used during regeneration (Kareem et al., 2016; Pulianmackal et al., 2014). Despite high regeneration potential of plants, spatial and temporal restriction of this process is also found which highly correlates with location of stem cells, their daughter cells, meristematic cells or highly reprogrammable cells. The specific role of stem cells