Adult Endogenous Heart Regeneration: The Arabian phoenix or A Sisyphean task?

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The demonstration that new cardiomyocytes are produced in the adult mammalian myocardium, albeit in limited amounts, generated a flurry of interest in harnessing this adult neo-cardiomyogensis to foster adult myocardial regeneration and repair in order to ameliorate the devastating impact of myocardial damage and heart failure in an aging human population. This paradigmatic change, together with the identification and characterization of adult cardiac stem cells gave birth to the bourgeoning field of adult ***myocardial regeneration.*** Unfortunately, since its inception, myocardial regeneration in the adult has been hotly debated and controversial. The present crisis started with the publication of research questioning the existence, nature and role of the adult cardiac stem cells together with a number of papers claiming the replication of adult and terminally differentiated myocytes as main/sole source of the adult neo-cardiomyogenesis. This controversy has been further fostered by a recent scandal followed by retractions of a number of publications by a former leader of the field. Together, these three events have brought the field of adult myocardial regeneration/repair to its current state of disarray. The disappointing situation of a field expected to play an important role in charting the future of cardiovascular biology and medicine is, at least in part, due to the current tendency to “throw away the baby with the bathwater” and to overlook and/or ignore the data accumulated over the past two decades about adult cardiac cell biology and stem/progenitor cells together with an uncritical confidence on inadequately controlled technologies of cell-fate mapping applied to the myocardium. To address the present situation, this presentation aims to review the present state of the field of adult myocardial cell biology with a particular emphasis on the role of the cardiac stem cells on myocardial cell homeostasis and repair, as well as other sources of cardiomyogenesis.