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Editorial

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Encouraging Submission of Studies Seeing Stem Cell Biology in the Light of Physical Energies and Nanoscale Approaches: Towards a Regenerative Medicine without the Needs for Stem Cell Transplantation

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Compelling evidence demonstrate that our cells are able to generate electromagnetic signals [1-5] and mechanical oscillations [6-9], affording essential modulation of *cell polarity*.

At the level of somatic cells and tissue resident stem cells *cell polarity* results from, and acts on the modulation of cellular ion fluxes, electric fields, and microtubular dynamics of the cytoskeleton and nucleoskeleton. *Cell polarity* is crucial in the physiological modulation of stem cell differentiation and aging, as shown by the fact that altered cell polarization invariantly associates with disease, pathological aging and cancer [10-13]. To this end, the cytoskeletal and nucleoskeletal microtubular network form a major dynamic environment to establish and preserve cell polarity.

Using artificial cell-like environment that works as a cavity (a replica of a living cell), within an *ad hoc* designed setting capable of pumping electromagnetic frequencies to a growing microtubule, in conjunction with scanning tunneling microscopy (STM), it has been possible to detect how different frequencies change the local density of states in the tubulin protein structure [3]. Similarly, STM analyses have shown that single microtubule tunneling "current images" are produced when different resonance frequencies are pumped simultaneously [3]. The frequency region selectivity for engaging particular kinds of conformational changes establishes that pure mechanical changes can be remotely controlled in an atomically precise fashion by using electromagnetic fields remotely.

Compounding the relevance of the microtubular network as an *information-transporting-system* is the evidence for high-frequency electric field and radiation characteristics from microtubuli [4] and even the detection of multi-level memory-switching properties in a single brain microtubule [5].

DNA itself, considered as an electrically charged vibrational entity, despite its role of storage and expression of genetic information, may conceivably contribute to *cell polarity*, also by virtue of its continuous assembly in multifaceted loops and domains that are essential features of the nano-mechanics and nano-topography imparted to this macromolecule by the timely intervention of transcription factors and molecular motors. Accordingly, electromagnetic resonance frequency spectra have been detected for DNA, which was found to exhibit electromagnetic resonances in the wide frequency range from THz, GHz, MHz and KHz [14].

Within this context, we have provided evidence that properly conveyed radioelectric fields are able to: (i) modulate the gene transcription of essential growth regulatory peptides in adult myocardial cells [15], (ii) enhance the differentiating potential of mouse embryonic stem cells [16, 17], (iii) induce pluripotency in human adult stem cells, promoting their differentiation into cardiac, neural, skeletal muscle and endothelial cells [18], (iv) afford direct reprogramming towards the same lineages in human somatic cells (dermal fibroblasts) [19], (v) reverse human stem cell aging *in vitro* [20], (vi) reprogram

PC12 cancer cells into dopaminergic neurons [21], and (vii) optimize stem cell polarity [22].

Due to the diffusive nature of electromagnetic fields and mechanical vibrations, the chance is emerging to target and reprogram the stem cells where they are, in all tissues of the body. This strategy will promote our natural ability for self-healing, affording a regenerative medicine without the needs for stem cell transplantation.

Consonant with this approach, we would like to encourage the submission of novel original *research articles*, *reviews* and *commentaries* seeing stem cell biology in the light of physical energies, using electromagnetic fields, mechanical vibrations and light to maximize the multilineage potential of stem cells, affording their efficient reprogramming with enhanced regenerative capabilities and secretion of *trophic* mediators for tissue repair. Accordingly, the submission of studies investigating stem cell dynamics within the context of nanoscale technologies and nanotopography assessment are also highly encouraged.

On the whole, we would like to emphasize the needs for studies that may pave the way to a Regenerative Medicine based upon the unfolding of our intrinsic, endogenous regenerative potential.

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