

Regenerative Medicine on the Verge of the 4th Industrial Revolution: What We May Envision When the Physical, the Biological and the Digital Converge

Carlo Ventura

National Laboratory of Molecular Biology and Stem Cell Engineering, National Institute of Biostructures and Biosystems (NIBB) – Eldor Lab, Innovation Accelerators, CNR, Bologna, Italy

Correspondence to:

Carlo Ventura, PhD
National Laboratory of Molecular Biology and
Stem Cell Engineering
National Institute of Biostructures and Biosystems
(NIBB) – Eldor Lab, Innovation Accelerators
CNR, Bologna, Italy
Tel: +39-3479206992
E-mail: ventura.vid@gmail.com, vcarlo.ventura@unibo.it

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Editorial

Rhythmic oscillatory patterns permeate the entire universe and sustain cellular dynamics at biological level. There is compelling evidence that our cells are sensitive to physical stimulation and can be exposed to physical energies to afford efficient rescue of damaged organs. A vivid example of such a novel view is provided by the unprecedented discoveries in the field of mechaobiology, and photobiomodulation. Seeing cell biology, and in particular stem cell biology, with the eyes of Physics may help developing a novel path in Regenerative/Precision Medicine. These issues are the main core of the 5th International Basic Research Meeting of the International Society for Medical Shock Wave Treatment (ISMST), scheduled in Bologna on June 28th-29th, 2018, entitled “Physical Tissue Stimulation, a path to self-healing” [1].

In the medium perspective, based upon the diffusive features of mechanical vibration, electric and electromagnetic fields, as well as electromagnetic radiation (light), we may envision to target and reprogram our stem cells *in situ*, where they already are, resident in all tissues of the human body. The consequent landscape will be a Regenerative Medicine afforded through the stimulation of the natural ability of tissues for self-healing.

Will this perspective only been going from the basic/translational science to the clinical application, or may it involve a deeper paradigm shift in our society? Will this perspective recruit future development in electronics, deep learning and Artificial Intelligence (AI)?

I believe we will see very soon a world where the Physical, the Biological and the Digital will converge, with unprecedented implications. The revolution we will be facing in the next few years will fundamentally transform the way we live, work and we are “connected to each-others”. Even more remarkably, the so-called 4th Industrial revolution, may change the way we are connected to ourselves, it may change our feelings in the way we perceive us.

Most of basic issues will be about electronics, about machines, about the future of AI. Are these machines going to make us slaves of their abilities? Will they be a danger to human beings? Are human beings going into a dark hole of their own creation, because they made machines that turned against humanity?

Simply we don't know yet. What's coming into the future is not predictable by anything we have experienced in the past. The evolution of AI circuitries, the tech evolution itself over the last decade won't necessarily apply to the evolution of the next decades.

It's conceivable that systemic paradigm shifts will emerge in parallel with, or even guided by the evolution of our consciousness, with consciousness that changes the expectations of what we want. We may therefore witness surprises

and major innovations in technology with unprecedented dynamics.

A main focus in the future of electronics will be going toward health technologies. Electronics will be directed inwards, with respect to human beings. Electronics will turn itself into the human ability to promote self-healing. In this sense, we may pave the way to a technology that will be benevolent and help us to heal. So far, technology has been pointing outwards, and it has been based upon the development/use of “something that accomplishes something”. This is an outward evolution.

Emerging technologies are helping contribute to an inward evolution. Electronics, machineries, algorithms are going inwards and turning into a deeper understanding of the human body. This goes beyond creating even the smallest robot (i.e. a nano-robot). In the very near future, we will be able to develop an intelligence from AI that in itself will be an evolving form of sentience of the human who is involved in the healing, in self-healing.

What if we can take a piece of a stem cell that is a “code” of the cell healthy status, of the cellular ability to cope with a hostile environment (i.e. oxidative stress, hypoxia...), or a code of the stem cell ability to differentiate along the most complex fates, like the heart, the brain and so on?

What if we use that piece of a stem cell code, that is you, that has a consciousness of you, to cure a form of disease that

would never be possible to treat so far, even with the most advanced pharmacological or surgical interventions? That piece of a cell code is a sort of information that may go into a machine, a “transducer” capable of deploying such information into mechanical, electric or light patterning to cure a damaged tissue. Such transducer won’t be a robot, a machine anymore. It will embed an intelligent part of our biology (i.e. the code that has been harvested from a differentiating stem cell) into an “actuator” that will be used to treat and regenerate a damaged tissue. It will be the way you “talk” with that part of you (the code) which is interactively delivered from the “machine”. This will change your self-perception, through the disease up to a self-healing path.

This is the re-merging of Physics with Biology. The Biology itself entails Physics: they have been separated for too long, and now they will finally rejoin into a human being. It’s like saying that the consciousness of that cell is guiding the rest of a bio-field in a diseased tissue to promote its regeneration. We are indeed at the cusp into a new connective revolution incorporating the synchronistic interchange of who we are and what we are able to become.

References

1. Physical Tissue Stimulation, a path to self-healing at 5th International Basic Research Meeting of the International Society for Medical Shock Wave Treatment (ISMST), June 28th-29th, 2018, Bologna, Italy.