Conference: From bioengineering for regenerative medicine to regenerative algorithms?

Reial Acadèmia de Ciències i Arts de Barcelona

As far as biomaterials are concerned, one of the greatest challenges facing regenerative medicine is quite possibly the development of scaffolds that are able to release signals that will trigger cellular responses to guide tissue regeneration in a controlled manner within biological environments.

This type of scaffold is described as instructive, and the question at hand is whether its biological functionality rests mainly on the properties of the biomaterials of which it is composed or if its geometrical, structural and mechanical properties are also in some way involved.

Requirements made on scaffolds depend on the specific tissue to which they are applied, which means that scaffolds must be specifically designed and manufactured. Then again, the ability to produce signals and stimuli that control the fate of cells is generally considered the role of intelligent biomaterials.

This presentation will cover how knowledge of biomaterials' physiochemical properties, together with the relevant development of manufacturing techniques, will allow the production of truly instructive scaffolds for bone and skin regeneration.

A question we may ask ourselves is whether, in the near future, we will approach regenerative medicine under the same paradigm. Information technologies and the internet in particular have led us to what we might call the information revolution, as a way of comparison to the industrial revolution, and the arrival of the information society is raising new questions in terms of education and research.

The application of complexity theory as well as machine learning and artificial intelligence is shifting science, especially biology, from solely reductionist approaches to more holistic ones.

Complexity theory provides insight into the complexity of regulatory networks. However, the idea that biology is governed by algorithms is garnering new perspectives on regeneration.

From this point forward, machine learning can reverse-engineer cascades of cellular activity as well as predict stem cells' aspect and fate.

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These tools should enable regenerative medicine researchers to carry out their work more quickly, more precisely and with more available information. Ultimately, this integrative and holistic approach should give way to an entirely new perspective on the design of biomaterials and scaffolds.