A New Paradigm for Cell Architecture: Celloidosomes®

Manuel Marquez [1,2,3], Samantha M. Marquez[1], Tommy Angelini[2], Sergio Martinez[3], Tony Garcia[3]

(1) YNANO LLC, (2) Harvard University and (3) Arizona State University, USA

Manuel.Marquez@YNano.com

The cornerstone of this research project lies in the ability to design and fabricate 3D organized cell structures we call Celloidosomes®. The methodology employed to obtain core-shell structures from colloids (**Col**loidosomes) [1] has been used to design three dimensional cellular architectures (**Cell**oidosomes®) [2]. The Celloidosomes® is, by definition, a "living capsule" with a biomembrane (tissue) shell and a unique core that acts as container or reservoir. We present some of the new research and opportunities that arises by precisely controlling fluid flow and mixing using microfluidic devices. We describe studies to elucidate mechanisms of droplets and bubbles formation and use these to create Celloidosome's structures. We focus on showing the potential of this emerging and enabling technology to design complex systems as reactors and templates in chemistry, materials science and bioengineering [3]. One of the examples is a revolutionary Cell Architecture process for the design & fabrication of core/shell multicellular structures based on a "bottom-up strategy".. By definition, these systems are ideal-models for the design of Bio-Microreactors, Artificial Microglands and could be used as independent units for 3D, scaffold-less Tissue Engineering. Our process is based on cells-self-assembly on Liquid-Liquid, Liquid-Gel, and/or Liquid-Gas interfaces. The Celloidosomes® could be considered part of the new Synthetic Biology research field. We have developed several key strategies to drive & organize living cells (yeast, fibroblast, etc) to the surface of a Gel, Liquid or Gas (Bubble) buy controlling the cells and templates surfaces a) using LbL polyelectrolyte decoration, b) selective gelation using $CaCO_3$ nanoparticles–Cells composites, c) Hydrophobic deposition, etc. The ability to control the chemistry and physics of the interface at the nanoscale level, allow us to tune, drive and direct assembly of cells into Celloidosomes® by gels, liquid or bubbles templates using capillary microfluidics. One of the most important contributions of this proof of concept is that the Celloidosomes® are potential model structures, which serve as a tool for the future design and control of Stem Cell Fate: stem cell behavior and cellular differentiation [4,5]

References:

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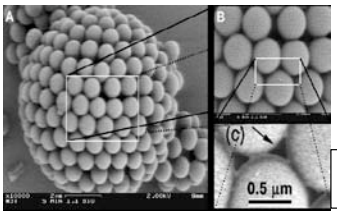
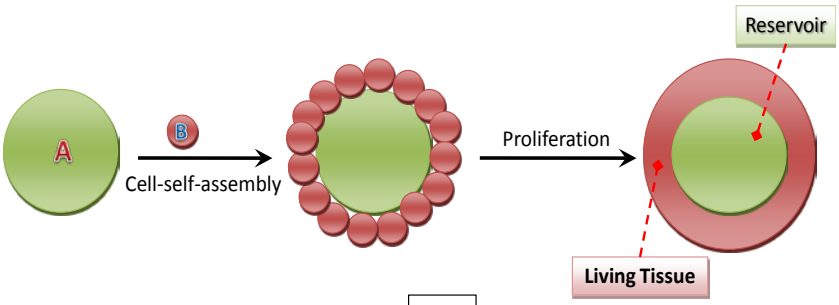


Figure 2: (1.a) SEM image of a dried, 10 micrometer diameter **Coll**oidosome composed of 900 nm diameter polystyrene spheres. The Colloids have been assembled on a droplet's surface. (1.b) By analogy, a **Cell**oidosomes, is the self-assembly of living-cells on a template's surface.

2.a



2.b

A = Template (Volvox, Gel or Liquid)
B = Fibroblast Cells

CELLOIDOSOME:
ARTIFICIAL GLAND
and/or
BIOREACTOR

celloidosomes®