



## VitaCapsule: A Synthetic Hydrogel for Supporting Human Stem Cells ID:4045

Featured Innovators: Prashant Kumta, PhD, Ipsita Banerjee, PhD, and Thomas Richardson, PhD

With ongoing clinical trials using human pluripotent stem cells (hPSCs), there is a need for rapid and controlled expansion of the cells to meet demand. Current approaches towards scalable hPSC culture use undefined animal products or expensive human-based proteins. Additionally, these products don't support single-cell culture – which is necessary for large scale biomanufacturing – and result in only about 30 percent cell survival. Unlike these traditional substrates, VitaCapsule is low cost, free of animal products, and supports single cell viability in both planar (2D) and suspension (3D) culture.

### Technology Description

VitaCapsule is a low cost synthetic peptide-conjugated hydrogel system for hPSC manufacturing. The goal of our technology is to enhance the viability of hPSCs, which in turn promotes clonal expansion – generating many copies of a single cell – and enables mass production. Isolated hPSCs do not survive well on their own because they lack cell-cell contact signals, which triggers cell death. VitaCapsule mimics these intercellular interactions using short peptides that bind with hPSCs and then encapsulate them, forming a protective barrier. This support system doubles hPSC survival rate compared to current culture methods.

### Advantages

- Low cost
- Free of animal products
- Applicable to both 2D and 3D cell cultures
- Enhanced viability and pluripotency
- Protects cells against harsh high throughput conditions

### Applications

- Biomanufacturing
- Laboratory research involving cell culture

### Stage of Development

We are currently gathering proof of concept data in 2D and 3D, and are working towards developing a prototype.

### IP Status

Two US provisional patents have been filed

### Notable Mentions

Pitt Ventures First Gear

## Innovators



### Prashant Kumta, PhD

Edward R. Weidlein Chair Professor  
Bioengineering  
Chemical and Petroleum Engineering  
Mechanical Engineering and Materials  
Science  
Oral Biology, School of Dental Medicine  
McGowan Institute of Regenerative  
Medicine  
University of Pittsburgh

Dr. Kumta has over 27 years of experience in the field of materials science and engineering with particular expertise in the innovative synthesis, design and engineering of novel materials (ceramics, metals and polymers) and systems for a variety of electrochemical applications such as energy storage, conversion as well as bioengineering and biotechnology related applications including bioresorbable materials for bone tissue engineering, non-viral gene delivery, stem cell plasticity and delivery platforms. He is an American Ceramic Society (ACerS) and American Institute of Medical and Biological Engineering (AIMBE) Fellow, and is Editor in Chief of International Journal Materials Science and Engineering B, Advanced Functional Solid-State Materials. He has published over 290 peer reviewed publications, over 485 abstracts and presentations with over 140 invited talks on subjects related to electrochemical and biotechnology systems.

#### Education

PhD University of Arizona  
MS University of Arizona  
BTech Indian Institute of Technology, India

#### Publications

- Candiello J, Richardson T, Padgaonkar K, Task K, Kumta PN, Banerjee I. Alginate encapsulation of chitosan nanoparticles: a viable alternative to soluble chemical signaling in definitive endoderm induction of human embryonic stem cells. Journal of Materials Chemistry B. 2016;4(20):3575-83.
- Richardson T, Barner S, Candiello J, Kumta PN, Banerjee I. Capsule stiffness regulates the efficiency of pancreatic differentiation of human embryonic stem cells. Acta biomaterialia. 2016 Apr 15;35:153-65.
- Richardson T, Kumta PN, Banerjee I. Alginate encapsulation of human embryonic stem cells to enhance directed differentiation to pancreatic islet-like cells. Tissue Engineering Part A. 2014 Jul 15;20(23-24):3198-211.



### Ipsita Banerjee, PhD

Associate Professor  
Bioengineering  
Chemical and Petroleum Engineering  
University of Pittsburgh

Dr. Banerjee has significant technical expertise in the area of pluripotent stem cell expansion and differentiation. Banerjee has been working with human pluripotent stem cells (hPSC) over 10 years and is recognized for her contributions in stem cell therapy for diabetes. She has significant contributions in identifying materials (natural or synthetic) and culture configurations conducive for hPSC propagation and differentiation.

#### Education

PhD Rutgers University  
MS Indian Institute of Science  
BChE Jadavpur University



### Tommy Richardson, PhD

Bioprocess Scientist  
Lonza

Dr. Richardson's research focuses on stem cell biology and biomaterials for use with tissue engineering and cellular therapy. In particular, he works with cell-encapsulation, hydrogels, immune-isolation, and 3D cell culture. He is the entrepreneurial lead for the VitaCapsule project.

#### Education

PhD University of Pittsburgh  
BS Texas A&M University

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