### Introduction

The development of biomaterials for regenerative medical constructs such as engineered tissue, as well as advanced biomedical devices such as sensors, will require exquisite control over material structure and biological function. Natural biological materials, such as the extra-cellular matrix (ECM) that surrounds cells in tissue, achieve such control by directing the assembly and function of proteins. It is often the case that the activity of the protein can be replicated by a short peptide, with potential advantages in terms of specificity and cost. It is therefore important to develop techniques to decorate biomaterial surfaces with peptides in a way that retains the peptide’s conformation and its activity. It is also a challenge to functionalize surfaces with multiple peptides with control over their micro- and nano-scale spatial organization, which is often essential for biological activity.

### Supported bilayers displaying peptides formed by vesicle fusion

Vesicle fusion is a facile way to create supported bilayers on solid surfaces using self-assembly. This method is scaleable and fairly robust, further, it can be used to create multi-component mixtures and gradients in membranes by simple physical means.

### Supported lipid bilayers for surface functionalization

Supported lipid bilayers have been studied extensively as model systems that mimic biological membranes. Self-assembly has emerged as a powerful way to create bilayers on surfaces that can be patterned on the micro- and nano-scale.


### Cell adhesion and growth

Optimal presentation of GRGDSP peptide

We are currently optimizing the length of the PEG spacer for GRGDSP binding, and exploring the effect of including the PHSRN peptide, which serves as a synergy binding sequence. Multi-component peptide surfaces for stem cell bioengineering: The culture of stem cells, especially human Embryonic Stem Cells (hESCs), in fully defined conditions free of animal-derived cells or growth factors, requires development of substrates that can support hESC adhesion and self-renewal. We are using our surface display method to screen combinations of RGD peptides with other adhesion-promoting peptides to develop substrates for stem cell bioengineering.