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AFM mapping the receptors on breast cancer cells

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Targeted cancer therapy is a powerful tool to localize drugs to the tumor site. In this project, we identified some of very important receptors as therapeutic targets, such as, CXCR4 (C-X-C chemokine receptor type 4), ICAM1 (Intercellular Adhesion Molecule 1) integrins, etc., they are all overexpressed on breast cancer cells and either trigger cell migration or/and promote metastasis. To date, the dynamic assembly of those receptors on the cell surface as the mediators of receptor binding is not well characterized. The objective of this work is to quantify the density, spatial organization and magnitude of binding of those receptors on live metastatic breast cancer (MBC) cells. We measured the Young's modulus, the receptors surface density and their unbinding forces on MBC cells by atomic force microscopy. We conclude that the receptor density, spatial organization and matrix stiffness are paramount to achieve strong binding.

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Novel sustainable biopolymer based 3D printable materials

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The plant derived biopolymer, polylactic acid (PLA) has experienced a rapid growth in the area of disposable food container applications due to its biodegradability. In the area of consumer grade 3D printing based on fused deposition modeling (FDM) technology, PLA is rapidly becoming the material of choice due in part to its perceived safety as compared to acrylonitrile butadiene styrene (ABS). As is the case with many other polymers, the applicability of PLA is hindered due to restrictions related to the physical properties of the material. The work presented here explores the modification of PLA through the addition of sustainable additives. Retaining compatibility with 3D printing systems at the same time augmenting the physical properties of the biopolymer is addressed. Materials characterization of the novel PLA based composites involving mechanical testing and fractography carried out through scanning electron microscopy (SEM) will be used to understand the effect of the additives on physical strength and failure modes. The effect of additives on biodegradability of 3D printed test coupons will also be presented.

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