Title:

Bio-instructive Materials Discovery

Abstract: **(Your abstract must use Normal style and must fit into the box. Do not enter author details)**

The range of biomaterials found in the clinic today are dominated by materials chosen on the basis of their availability and mechanical properties rather than positive interactions with surrounding cells and tissues. It would be desirable to design our way forward from this situation to new biomaterials. Unfortunately our understanding of the bio-interface is poor, with only isolated cases where a good understanding of cell-material interactions can be cited, and fewer still where material-tissue interactions are well characterised and understood. This paucity of information on the mechanism of biomaterials interactions with the body acts as a roadblock to rational design. Consequently we have taken a high throughput screening approach to discover new bio-instructive materials from large chemical libraries- this approach can be described as engineering serendipitous discovery.[1] These new candidate biomaterials provide a starting point for development of new medical devices and provide opportunities to study their mechanism of action to provide new information to tackle the rational design roadblock.

This screening approach has been used to identify bio-instructive materials in the discovery of polymers with application in expansion of pluripotent human embryonic stem cells and the identification of substrates on which to mature cardiomyocytes.[2,3] Other screening campaigns using macrophage differentiation have identified bio-instructive materials with pro- and anti-inflammatory characteristics with great potential in modulating the human immune system in novel therapies and devices.[4] Materials resisting bacterial attachment and biofilm have also been identified and will be presented, with early data on the investigation of their mechanism of biofilm formation resistance.[5] Work to integrate and expand this range of bio-instructive materials will be previewed, including movement to 3D screening.

1. Magennis, E.P., Hook, A.L., Davies, M.C., Alexander, C., Williams, P., and Alexander, M.R. Engineering serendipity: High-throughput discovery of materials that resist bacterial attachment. **Acta Biomaterialia** 34, 84 (2016).

2. Celiz, AD, Smith, J., Patel, A, Hook, A, Rajamohan, D., George, V, Flatt, L, Patel, M, Epa, V, Singh, T, et al. Discovery of a Novel Polymer for Human Pluripotent Stem Cell Expansion and Multilineage Differentiation. **Advanced Materials** 27, 4006 (2015).

3. Patel, A.K., Celiz, A.D., Rajamohan, D., Anderson, D.G., Langer, R., Davies, M.C., Alexander, M.R., and Denning, C. A defined synthetic substrate for serum-free culture of human stem cell derived cardiomyocytes with improved functional maturity identified using combinatorial materials microarrays. **Biomaterials** 61, 257 (2015).

4. Rostam et al. in preparation.

5. Hook, A, Chang, C, Yang, Luckett, J, Cockayne, A, Atkinson, S, Mei, Bayston, R, Irvine, D, Langer, R, Anderson, D, Williams, P, Davies, M, and Alexander, MR Erratum: Combinatorial discovery of polymers resistant to bacterial attachment **Nature Biotechnology** 30 868 (2012).