BOTM: June 2010

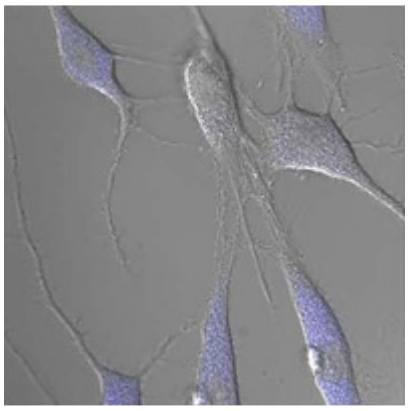

Fig. 1. Hyaluronic acid based drug conjugates for targeted drug delivery to the CD44 receptor (photo courtesy of Dr. Rebecca Bader, Syracuse University).

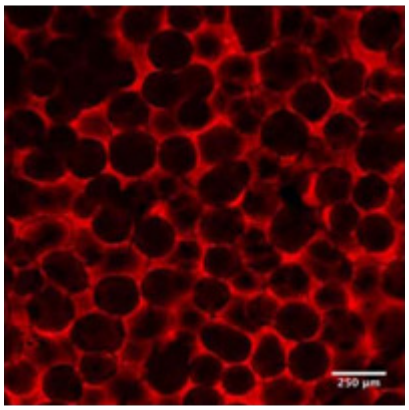

Fig. 2. Macroporous hyaluronic acid based hydrogels for tissue engineering (photo courtesy of Dr. Jason Burdick, University of Pennsylvania).

Hyaluronic Acid

Hyaluronic acid (HA), a linearly polysaccharide consisting of alternating B-1,4-D-glucoronic acid and B-1,3-N-acetyl-D-glucosamine units, is a primary component of numerous soft connective tissues, in addition to synovial fluid, the vitreous body, and the umbilical cord. HA is known to play a role in joint lubrication, cellular adhesion and migration, wound healing, and inflammation (1). As a result of its inherent biocompatibility, biodegradability, and bioactivity, HA has proven to be a versatile molecule in both drug delivery and tissue engineering applications.

Expression of HA binding receptors, such as CD-44 and RHAMM, is known to be up-regulated in various disease states, including cancer and inflammatory diseases. HA conjugates, nanoparticles, and microspheres have been widely used in the local and parenteral delivery of therapeutics to metastatic tissues that overexpress CD-44. The HA-drug vehicles permit co-internalization via receptor mediated endocytosis, thereby further increasing drug efficacy (2). Current investigations are exploring the use of similar HA based carriers in the treatment of other conditions (Fig. 1).

Hydrogels, meshes, and sponges formulated from HA are being used as scaffolds for tissue engineering applications, including stem cell differentiation (Fig. 2). HA can be modified and crosslinked to control degradation and alter the cellular response. Chondrocytes and mesenchymal stem cells, as well as neural progenitor cells, have been successfully incorporated into HA scaffolds (3-5). The scaffolds have also been used as depots for the controlled release of bioactive factors (6).

This month's biomaterial was provided by the Drug Delivery SIG.

References

1. Laurent, T. C., Laurent, U. B., and Fraser, J. R. (1996) The structure and function of hyaluronan: An overview, *Immunol Cell Biol 74*, A1-7.
2. Yadav, A. K., Mishra, P., and Agrawal, G. P. (2008) An insight on hyaluronic acid in drug targeting and drug delivery, *J Drug Target 16*, 91-107.
3. Chung, C., and Burdick, J. A. (2009) Influence of three-dimensional hyaluronic acid microenvironments on mesenchymal stem cell chondrogenesis, *Tissue Eng Part A 15*, 243-254.
4. Chung, C., Erickson, I. E., Mauck, R. L., and Burdick, J. A. (2008) Differential behavior of auricular and articular chondrocytes in hyaluronic acid hydrogels, *Tissue Eng Part A 14*, 1121-1131.
5. Pan, L., Ren, Y., Cui, F., and Xu, Q. (2009) Viability and differentiation of neural precursors on hyaluronic acid hydrogel scaffold, *J Neurosci Res 87*, 3207-3220.
6. Luo, Y., Kirker, K. R., and Prestwich, G. D. (2000) Cross-linked hyaluronic acid hydrogel films: new biomaterials for drug delivery, *J Control Release 69*, 169-184.