Lodestone Biomedical LLC
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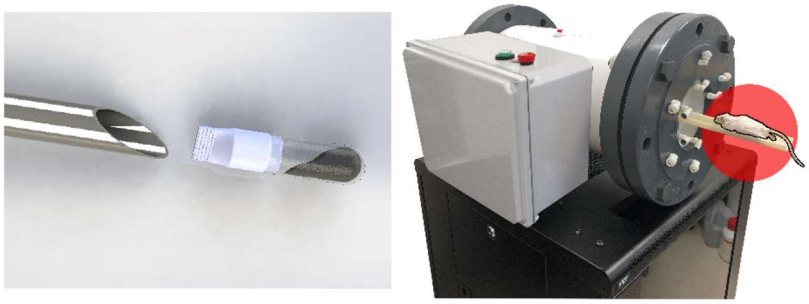
Measuring the Tumor Microenvironment

Magnetic nanoparticles shed light into the complex world of the immune system. US-Startup develops first of its kind biosensor that will guide the development of new immuno-therapy treatments.

Immunotherapy is a new form of cancer therapy which activates the body's immune system to fight tumor cells. Targeting specific immune regulatory molecules, such as PD-L1, helps the immune system to detect and fight malignant cells. However, in a significant number of patients these therapies won't produce the intended outcome. Invasive tissue biopsies are often the only way for the clinician to investigate the complex tumor micro-environment. Developing the next generation of immunotherapy treatments requires insights into cellular messaging processes on a local level.

Lodestone Biomedical, a spin-off from Dartmouth College, is currently developing the tools to address these key needs of drug development: **an *in vivo* bioassay**. Situated in Lebanon New Hampshire, the startup designed and patented an implantable biosensor that can be read out with a low-intensity magnetic spectrometer. In an example application it can be implanted before the patient begins cancer treatment with immune therapy. The sensor then quantifies the presence of biomarkers such as interferon gamma, that are related to a successful activation of the immune system. With the sensor in place the clinician can now regularly check the patient's biomarker levels and adjust the treatment accordingly.



The **Implantable Biosensor** (left) contains a magnetic *in vivo* assay which can be read out with the **small animal spectrometer** (right)

"The system can detect virtually any cytokine

The **biodegradable sensor** is small enough to be injected with a syringe and stays at the tumor site for several weeks before it disintegrates. During that time the magnetic nanoparticles within the sensor bind to the targeted cytokine. When even picogram amounts of the targeted cytokine are present the nanoparticles change their magnetic properties. This change can then be detected, independent of the tissue depth, with the help a magnetic spectrometer. Like conventional ELISA assays, the magnetic nanoparticles can be functionalized for virtually any cytokine in the human body. In its current form the sensor can be read out in Lodestone's small animal spectrometer. With this device the technology can already help pharma companies in early stages of drug development. Important questions about the presence and activity of the drug, the dose-response, and general prove-of-principle can be answered in mouse models and accelerate drug development. Lodestone is currently developing the next generation of the measuring system for human application.

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