Nanoscale Test Strips for Multiplexed Blood Analysis

Enables real-time, comprehensive health monitoring

A critical component of the DNA Medicine Institute’s Reusable Handheld Electrolyte and Lab Technology for Humans (rHEALTH) sensor are nanoscale test strips, or nanostrps, that enable multiplexed blood analysis. Nanostrps are conceptually similar to the standard urinalysis test strip, but the strips are shrunk down a billionfold to the microscale. Each nanostrap can have several sensor pads that fluoresce in response to different targets in a sample. The strips carry identification tags that permit differentiation of a specific panel from hundreds of other nanostrap panels during a single measurement session.

In Phase I of the project, the company fabricated, tested, and demonstrated functional parathyroid hormone and vitamin D nanostrps for bone metabolism, and thrombin aptamer and immunoglobulin G antibody nanostrps. In Phase II, numerous nanostrps were developed to address key space flight–based medical needs: assessment of bone metabolism, immune response, cardiac status, liver metabolism, and lipid profiles. This unique approach holds genuine promise for space-based portable biodiagnostics and for point-of-care (POC) health monitoring and diagnostics here on Earth.

Applications

**NASA**
- Routine assessment of bone biomarkers
- Rapid assessment of altered immune response biomarkers
- Detection of infection, immunocompromised states, and hematological malignancies
- Measurement of cardiac biomarkers
- Liver function assessment
- Lipid measurements

**Commercial**
- Detection of acute myocardial damage
- POC monitoring of bisphosphonate therapy for patients with osteoporosis
- Diagnoses of acute cholecystitis
- Daily assessment of immune functions for patients with autoimmune disorders
- Study of bone remodeling for patients with Paget’s disease
- Evaluation of effects of drugs and diet on liver function

Phase II Objectives

- Implement rapid nanostrap assay capability
- Develop mix-and-run assays
- Establish in-house aptamer production
- Develop lyophilized nanostrap technology with lyoprotectant:
  - Perform accelerated stability tests on lyophilized reagents
  - Perform extended testing on antibody and aptamer nanostrps
- Develop bone antibody, bone aptamer, immune antibody, and immune aptamer nanostrap panel
- Develop cardiac, liver, and lipid assay nanostrap panels

Benefits

- Enables massive multiplexing that has the potential to allow hundreds of measurements from a single session
- Facilitates home-based tests and measurements
- Contributes significantly to the evolving needs of space medicine, biomedical research, and POC diagnostics

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