Barcode Chip for Biomarker Detection

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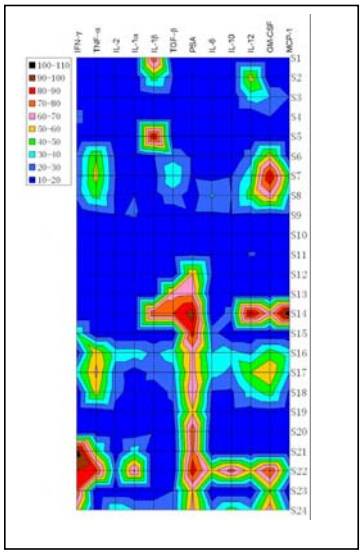
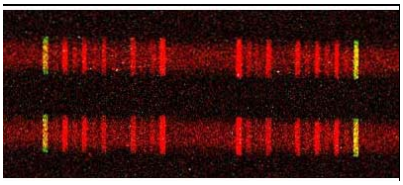
The Heath Laboratory in conjunction with Leroy Hood from the Institute of Systems Biology developed the Integrated Blood-Barcode Chip (IBBC) to stratify cancer patients using profiling of a dozen biomarkers from ~300 nanoliters of serum. The IBBC is about the size of a microscope slide and is made out of a glass substrate covered with silicone rubber. It contains a microfluidics circuit that separates blood from plasma, measuring dozens of protein biomarkers in only a few minutes as the blood quickly travels through the microcircuits.

This revolutionary device can dramatically improve diagnostic medical testing. Traditional blood tests require one or more vials of blood to be taken from the patient. The samples are then sent to a clinical laboratory where the blood is centrifuged to separate whole blood cells from the plasma. The plasma is then assayed for specific proteins. Current testing methods are time-consuming as well as expensive (about $50 for a single diagnostic protein).

The IBBC chip, however, collects and analyzes one pinprick's worth of blood at a cost of about 20 to 30 cents per protein test. Additionally, the microfluidic circuit in the device separates the blood from plasma eliminating the current step of centrifuging the blood sample and cutting down the length of time necessary to obtain results.

The researchers used the IBBC to analyze the blood of 12 breast cancer patients and 12 prostate cancer patients; the results are shown in the Figure below. This assay allows for patient stratification according to cancer type and degree of accompanying inflammation. The researchers plan to increase the number of proteins that the IBBC can identify and measure. The researchers predict that by the time the assay size is ~40 proteins, the profiling will begin to reveal fundamentally new diagnostic information on these types of patients and would enable personalizing the treatment.





The strip of data above shows one of the bar-code readouts for a single prostate cancer patient. For each patient sample, the dozen proteins were measured 50 times on chip. 4 such measurements are shown above. The red stripes are 20 micrometers wide, and correspond to individual protein measurements. The yellow stripes are location markers for assay readout. Digital DEAL, in which individual proteins are counted so that the assay is quantitative, will be implemented in the next human trial.