A Magnetoresistive Biosensor for the Detection of Multiple Analytes

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Advances in the magnetic separation of biological compounds and in magnetoresistive technology for computer memory have created an opportunity to develop a single sensor that can detect a wide range of analytes. The Bead ARray Counter (BARC) employs biological recognition reactions such as DNA-DNA, antibody-antigen, or protein-ligand to tether micron-sized magnetic beads to a patterned solid substrate. An applied magnetic field then pulls on the beads removing those that are not specifically bound. The remaining beads are detected by an embedded array of giant magnetoresistive (GMR) sensors. Thus, by patterning various receptor DNA, antibodies, or ligands above this sensor array we can simultaneously detect several analytes. Soon, millions of these GMR sensors will be commercially available on a single chip. This will allow the detection of hundreds of analytes and will give us the flexibility either to scan for a wide variety of compounds to profile a single disease or to detect a number of pathogens simultaneously. Microfabrication will also allow the integration of detection with signal analysis that, ultimately, will trigger a response to a positive signal. Current work centers on patterning DNA onto a 64-element sensor array, developing the required microfluidics, and incorporating these components into a compact system useful for on-site testing.

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