Giant magnetoresistive biochip for DNA detection and HPV genotyping

Xu L., Yu H., Akhras M.S., Han S.-J., Osterfeld S., White R.L., Pourmand N., Wang S.X.

Department of Materials Science and Engineering, Stanford University, Stanford, CA 94305-4045, United States; Stanford Genome Technology Center, Stanford University, 855 California Avenue, Palo Alto, CA 94304, United States; Department of Biomolecular Engineering, University of California Santa Cruz, Santa Cruz, CA 95064, United States

Abstract: A giant magnetoresistive (GMR) biochip based on spin valve sensor array and magnetic nanoparticle labels was developed for inexpensive, sensitive and reliable DNA detection. The DNA targets detected in this experiment were PCR products amplified from Human Papillomavirus (HPV) plasmids. The concentrations of the target DNA after PCR were around 10 nM in most cases, but concentrations of 10 pM were also detectable, which is demonstrated by experiments with synthetic DNA samples. A mild but highly specific surface chemistry was used for probe oligonucleotide immobilization. Double modulation technique was used for signal detection in order to reduce the 1/f noise in the sensor. Twelve assays were performed with an accuracy of approximately 90%. Magnetic signals were consistent with particle coverage data measured with Scanning Electron Microscopy (SEM). More recent research on microfluidics showed the potential of reducing the assay time below one hour. This is the first demonstration of magnetic DNA detection using plasmid-derived samples. This study provides a direct proof that GMR sensors can be used for biomedical applications.

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Authors with affiliations:

1. Xu, L., Department of Materials Science and Engineering, Stanford University, Stanford, CA 94305-4045, United States
2. Yu, H., Stanford Genome Technology Center, Stanford University, 855 California Avenue, Palo Alto, CA 94304, United States
3. Akhras, M.S., Stanford Genome Technology Center, Stanford University, 855 California Avenue, Palo Alto, CA 94304, United States

4. Han, S.-J., Department of Materials Science and Engineering, Stanford University, Stanford, CA 94305-4045, United States
5. Osterfeld, S., Department of Materials Science and Engineering, Stanford University, Stanford, CA 94305-4045, United States
6. White, R.L., Department of Materials Science and Engineering, Stanford University, Stanford, CA 94305-4045, United States
7. Pourmand, N., Stanford Genome Technology Center, Stanford University, 855 California Avenue, Palo Alto, CA 94304, United States, Department of Biomolecular Engineering, University of California Santa Cruz, Santa Cruz, CA 95064, United States
8. Wang, S.X., Department of Materials Science and Engineering, Stanford University, Stanford, CA 94305-4045, United States