

### 4.2.3 NANOPARTICLE-BASED BIO-BARCODE AMPLIFICATION ASSAY FOR QUANTITATIVE MEASUREMENTS OF HUMAN IMMUNODEFICIENCY VIRUS TYPE 1 ANTIGENS IN SERUM OR PLASMA

K.-B. Lee, E.-Y. Kim, J.-M. Nam, J. D. Lifson, C. A. Mirkin, and S. M. Wolinsky, "Detection of Human Immunodeficiency Virus Type 1 p24 and p7 Antigens in Plasma by Nanoparticle-based Bio-Barcode Amplification Testing," Submitted to *Nature Biotechnology*.

This group developed a nanoparticle-based bio-barcode amplification (BCA) assay for quantitative measurements of HIV-1 antigens in serum or plasma. The BCA assay employs magnetic microparticles (MMPs) functionalized with antibodies against HIV-1 p24 or p7 antigens as target capture probes and gold nanoparticles (NPs) functionalized with both anti-p24 or anti-p7 capture probes directed to a non-overlapping region of the cognate target antigen and hundreds of bar code capture oligonucleotides that are hybridized to a specific bar code DNA sequence. In the presence of the HIV-1 target antigen, the MMPs and the gold NPs form sandwich structures that are magnetically separated from serum/plasma and washed with water to remove the hybridized barcode DNA. The DNA barcodes (hundreds to thousands per target antigen) are quickly identified by a NP-based colorimetric detection method. The group applied this approach to the rapid detection of HIV-1 p24 and p7 Gag proteins in plasma after disruption of the HIV-1 antigen-antibody complexes. It found measurable amounts of HIV-1 p24 and p7 antigens in blood samples obtained from patients with less than 50 copies of RNA per ml of plasma, which demonstrates the highly sensitive and selective semi-quantitative detection possible using this methodology.

