

4.2.2 NANOARRAYS FOR HIGHLY SENSITIVE AND SELECTIVE DETECTION OF HUMAN IMMUNODEFICIENCY VIRUS (HIV) TYPE 1 IN PLASMA

K.-B. Lee, E.-Y. Kim, C. A. Mirkin, and S. M. Wolinsky, "The Use of Nanoarrays for Highly Sensitive and Selective Detection of Human Immunodeficiency Virus Type 1 in Plasma," *Nano Lett.* **2004**, *4*, 1869 – 1872.

Arrays of antibodies with well-defined feature size and spacing are necessary for developing highly sensitive and selective immunoassays to detect macromolecules in complex solutions. These researchers successfully applied nanometer-scale antibody array-based analysis to determine the presence of the human immunodeficiency virus type 1 (HIV-1) in blood samples. Dip-pen nanolithography (DPN) was used to generate nanoscale patterns of antibodies against the HIV-1 p24 antigen on a gold surface. Feature sizes were less than 100 nm, and the activity of the antibody was preserved. HIV-1 p24 antigen in plasma obtained directly from HIV-1-infected patients was hybridized to the antibody array *in situ*, and the bound protein was hybridized to a gold antibody-functionalized nanoparticle probe for signal enhancement. The nanoarray features in the three-component sandwich assay were confirmed by atomic force microscopy (AFM). Demonstration of measurable amounts of HIV-1 p24 antigen in plasma obtained from men with less than 50 copies of RNA per ml of plasma (corresponding to 0.025 pg per ml) illustrates that the nanoarray-based assay can exceed the limit of detection of conventional enzyme-linked immunosorbent assay (ELISA) based immunoassays (5 pg per ml of plasma) by more than 1000-fold.

