The potential, and currently practical uses of immunomagnetic labels for detection

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The ability to analyze and separate a heterogeneous cell population based on cellular properties is a significant analytical and preparative resource. The key to being able to conduct such analysis or separation is the ability to identify or label the cell property of interest. In the case of separations, after labeling, one needs to exploit this label as a "handle" to remove the cell(s) from the rest of the population or environment. A variety of labels and handles are used in a number of different technologies. The most specific labels are those that bind only to specific cell associated molecules. While a number of these highly specific labels exist, the most commonly used are antibodies. These antibody labels are then usually covalently linked to either a molecule, a particle, or a support matrix. These covalent linkages can be classified into three categories reflecting the properties of the compound the antibody is linked to: **immunofluorescent, immunomagnetic,** or **immunosolid/immunomatrix.**

Immunomagnetic labels provide unique opportunities in that the method of detection of the binding of an immunomagnetic label(s) to a cell is the measurement of the actual movement of the cell. This is in contrast to immunofluorescent labels which require complex mechanism for detection and separation.

We have development a number of instruments for both the analysis and separation of immunomagnetic cells. The analytical instrument, Cell Tracking Velocimetry, allows the researcher to measure, on a cell-by-cell basis, the degree to which a cell is immunomagnetically labeled. With this instrument and earlier systems we have experimentally analyzed a number of commercial immunomagnetic labels, ranging from labels with paramagnetic particles on the order of 5 microns to molecular labels on the order of 10 to 20 nanometers. With the nanometer size labels, we have been able to detect on the order of 4,000 cell surface markers with the potential of even lower numbers of markers.

In parallel with these experimental studies we are developing theoretical models in which a number of variables and approaches can be varied which indicate the potential of this analytical and separation technology including labeling internal tragets.