



(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2006/0020371 A1**

**Ham et al.**

(43) **Pub. Date: Jan. 26, 2006**

(54) **METHODS AND APPARATUS FOR MANIPULATION AND/OR DETECTION OF BIOLOGICAL SAMPLES AND OTHER OBJECTS**

**Publication Classification**

(51) **Int. Cl.**  
*G05B 99/00* (2006.01)  
(52) **U.S. Cl.** ..... **700/266; 235/488**

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(57) **ABSTRACT**  
Methods and apparatus for manipulation, detection, imaging, characterization, sorting and/or assembly of biological or other materials, involving an integration of CMOS or other semiconductor-based technology and microfluidics. In one implementation, various components relating to the generation of electric and/or magnetic fields are implemented on an IC chip that is fabricated using standard protocols. The generated electric and/or magnetic fields are used to manipulate and/or detect one or more dielectric and/or magnetic particles and distinguish different types of particles. A microfluidic system is fabricated either directly on top of the IC chip, or as a separate entity that is then appropriately bonded to the IC chip, to facilitate the introduction and removal of cells in a biocompatible environment, or other particles/objects of interest suspended in a fluid. The patterned electric and/or magnetic fields generated by the IC chip can trap and move biological cells or other objects inside the microfluidic system. Electric and/or magnetic field generating components also may be controlled using signals of various frequencies so as to detect one or more cells, particles or objects of interest, and even the type of particle or object of interest, by measuring resonance characteristics associated with interactions between samples and one or more of the field-generating devices. Such systems may be employed in a variety of biological and medical related applications, including cell sorting and tissue assembly.

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(21) Appl. No.: **11/105,322**

(22) Filed: **Apr. 13, 2005**

**Related U.S. Application Data**

(60) Provisional application No. 60/561,704, filed on Apr. 13, 2004. Provisional application No. 60/611,370, filed on Sep. 20, 2004. Provisional application No. 60/627,940, filed on Nov. 15, 2004.

