Enrichment of Cancer Cells from Whole Blood Using a Microfabricated Porous Filter

SCIE, IF: 2.6

- Journal : Analytical Biochemistry (**IF: 2.6**)
- Date : September 2013.
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Study Aim: To develop and evaluate a new method for enriching circulating tumor cells (CTCs) from whole blood using a microfabricated porous filter.

Methods:

- Designed and fabricated a membrane filter with optimized pore size (6.5 μm) and gap distance based on computational fluid dynamics simulations
- Tested recovery rates by spiking known numbers of labeled cancer cells into blood samples and filtering
- Evaluated purity by counting remaining leukocytes after filtration
- Assessed overall efficiency including immunofluorescence staining steps

Key Findings:

- Average recovery rate after filtration was 82-86.7% across different cancer cell loads (1-100 cells)
- Limit of detection was approximately 2 cancer cells in the testing blood volume
- Overall efficiency including staining steps was 40-64% depending on cell load
- Purity (percentage of cancer cells vs leukocytes) was 4.5-11.8%
- Method worked for different cancer cell lines (lung, breast, colon)

Conclusions:

- Developed a microfabricated porous filter for efficient CTC enrichment from blood
- High porosity and optimized design allow effective cancer cell recovery
- Can detect as few as 3 cancer cells in a blood sample
- Promising for CTC characterization, molecular analysis, and clinical applications

Researchers developed an efficient microfabricated filter to isolate rare cancer cells from blood for potential clinical use.