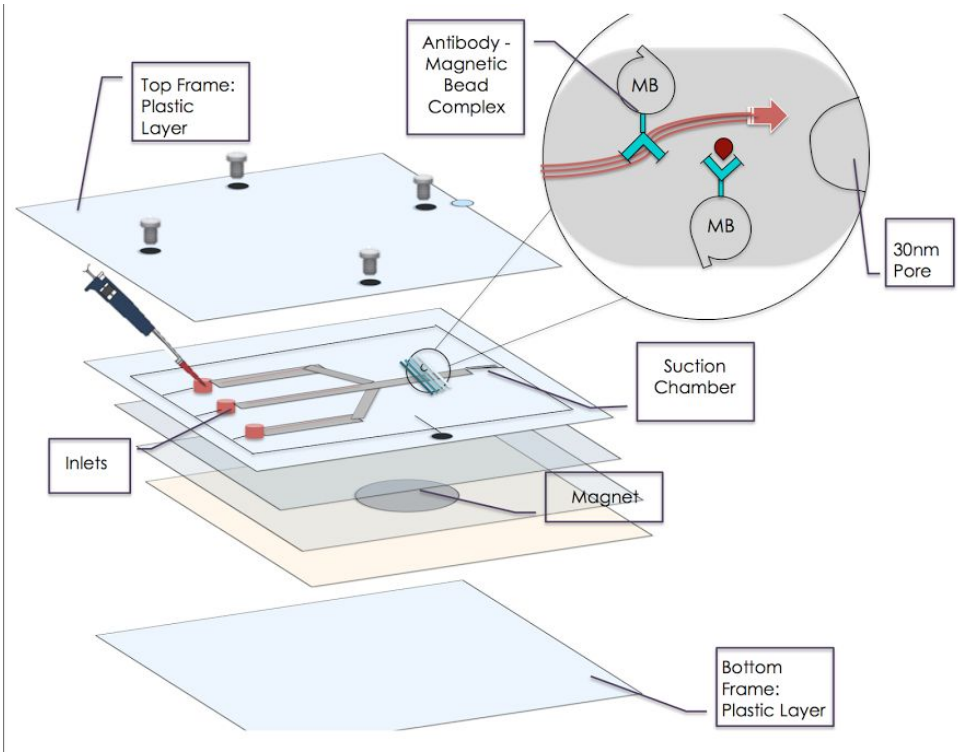
The Ovarian Cancer Research Center of the University of Pennsylvania analyzed fresh primary ovarian cancer cells collected from patient ascites and solid tumors, and established cell lines before and after in vivo passaging. Although results confirmed poor cell surface expression of B7-H4 on long-term cultured ovarian cancer cell lines, they found that B7-H4 was readily expressed at the surface of freshly harvested young tumor cells. Since the antigen is prominent on the surface of tumors, it acts similar to CA-125 in that it is readily shed into the bloodstream. Dernada Dangaj and his team of data analysts hypothesize the direct ovarian cancer cell eradication can be achieved by targeting B7-H4, and coupled with the presence of B7-H4 in the bloodstream, the detection can occur through a noninvasive blood test.

The proposed early-detection mechanism for ovarian cancer incorporates Fc Portion and a modified Sandwich ELISA test to determine the concentration of protein that remains in the sample post-modification. Utilizing the monoclonal antibody pair to B7-H4, the presence of the antigen is ascertained through nanoparticle fluorescence. Similar to Sandwich ELISA, each antibody binds to its respective epitope on the antigen, creating a sandwich. The capture antibody is conjugated to an iron oxide carboxylate magnetic bead via carbohydrate moiety and the detection antibody is linked to a fluorescent nanoparticle via spontaneous amide to thiol reaction. Regarding the former, a stable, shared amide bond is created using the carbodiimide crosslinker EDC along with the NHS-ester Sulfo-NHS. Once both antibodies are respectively linked, they are aliquoted into a single sample and the cancer-specific biomarker, B7-H4, is added and left to react for twenty-four hours. To further optimize the efficiency of the antibody conjugations, 10uL of antibody per 10uL of beads / nanoparticles should be used. Post-reaction, the sandwiched complex will have formed and a simple fluorescence intensity scan should reveal higher fluorescence values in the presence of the antigen as opposed to in the absence of it, because B7-H4 is metaphorically the glue that holds the sandwich together and prevents the antibodies and particles from being rinsed out.

Once the ELISA test is improved and outputs reliable B7-H4 concentrations (higher fluorescence values is equivalent to a higher B7-H4 concentration), the project involves the compacting of the entire mechanism into a microfluidic chip. A diagram is provided below to augment understanding.



This chip collects the B7-H4 biomarker found in blood samples. The iron oxide magnetic beads found dispersed through the chambers are attached via an EDC cross linker to the monoclonal capture antibody. As the blood sample runs through the three chambers, it passes through the detection area, where only binding antigens will remain behind as the blood flows through the 30nm pore towards the suction chamber and is cycled back to repeat the process. The pore is 30nm to prevent the 50nm iron oxide carboxylate magnetic beads from travelling with the blood. A magnet with the chip is initially covered with two sheets of PDMS. After the sample has been thoroughly run through the chip, the sheets are partially slide out, revealing the magnet. Because the beads are magnetic, they have a strong affinity towards the electrons from the magnet, and will all be concentrated directly above the magnet, allowing for quick extraction of the supernatant. The isolated beads are then coupled with the fluorescent nanoparticles linked to the detection antibody and, within twenty-four hours, the fluorescence will be ready to test.