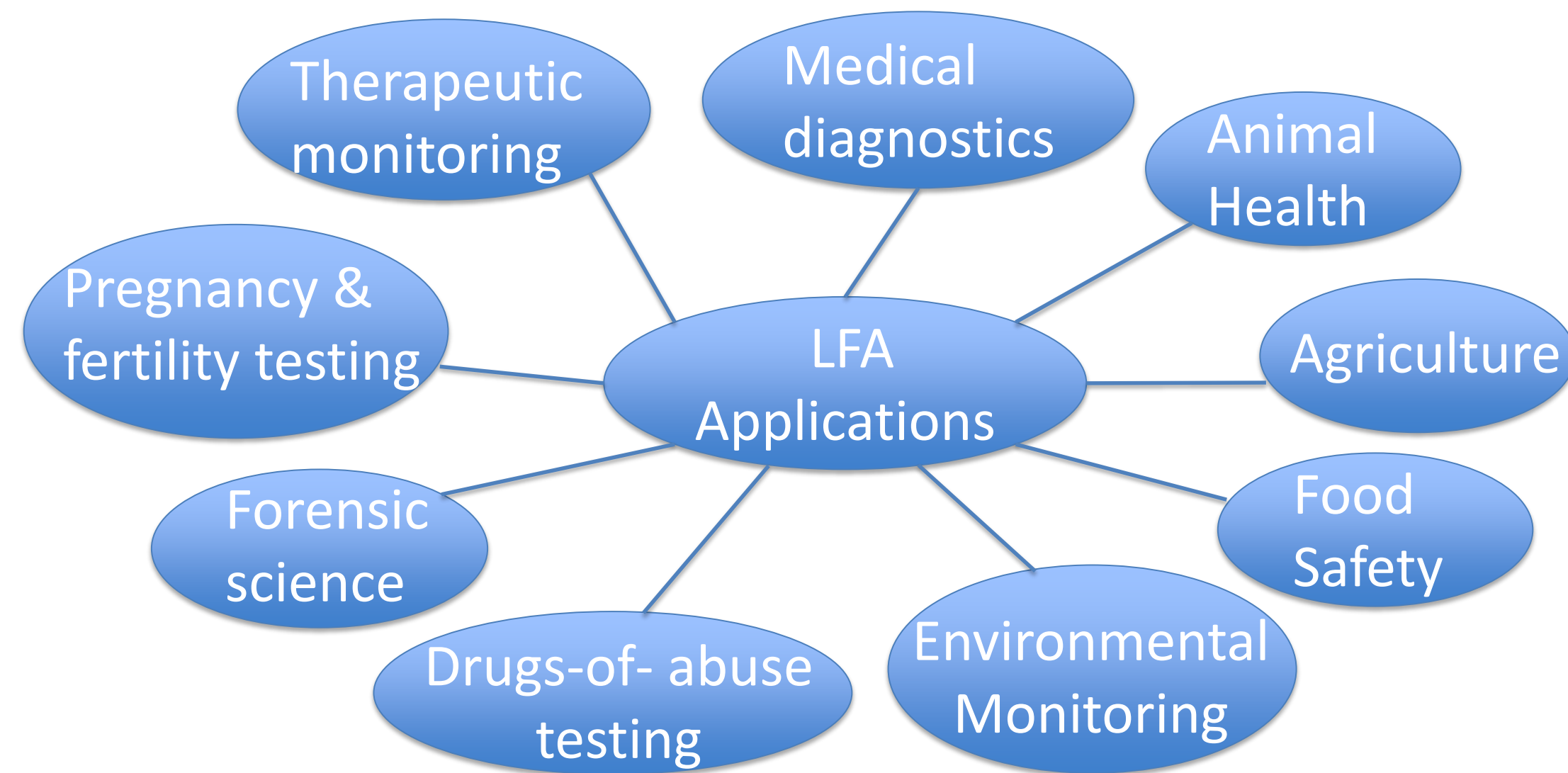
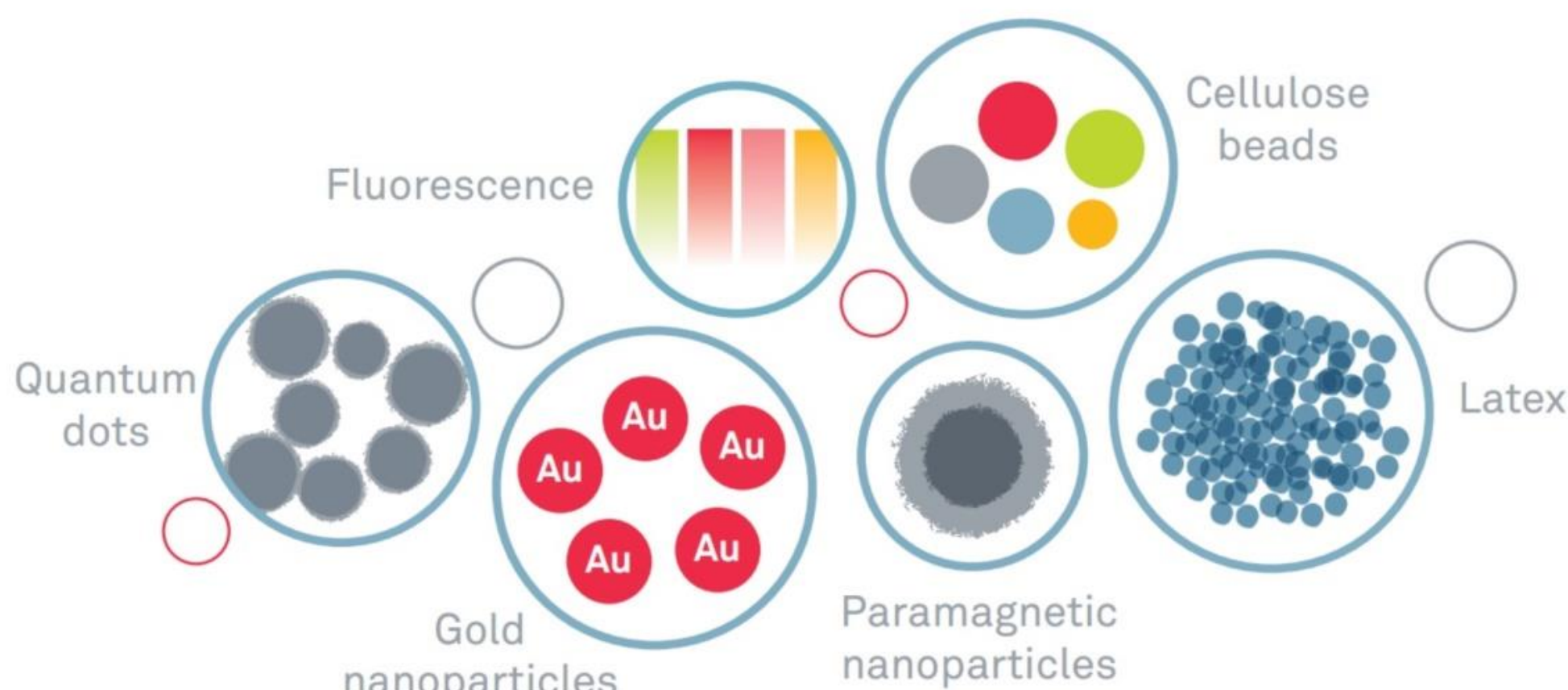


Introduction:

Key advances in healthcare have arisen from the implementation of point-of-care (PoC) testing in minimally equipped laboratories or at home. PoC tests are used in the detection of various analytes, biomarkers, and pathogens, and are widely used due to their convenience, low cost and reliability. One of the best-known PoC tests is a lateral flow immuno-chromatographic assay (LFA) for the detection of the pregnancy hormone, human chorionic gonadotropin (hCG). Readouts for LFAs have ranged from colorimetric, to magnetic readings, to chemiluminescence in order to achieve high sensitivity.



M13 Phage Reporters

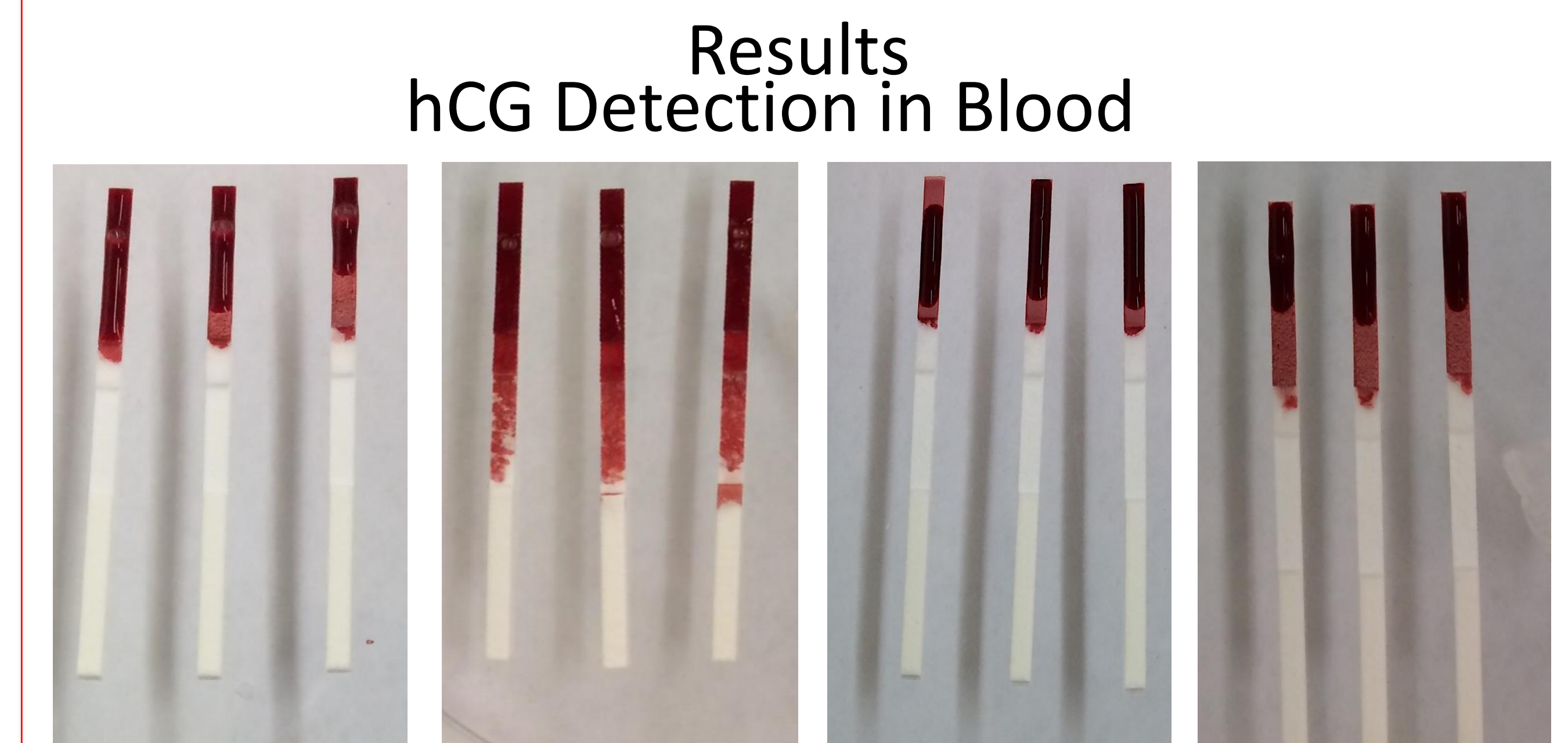
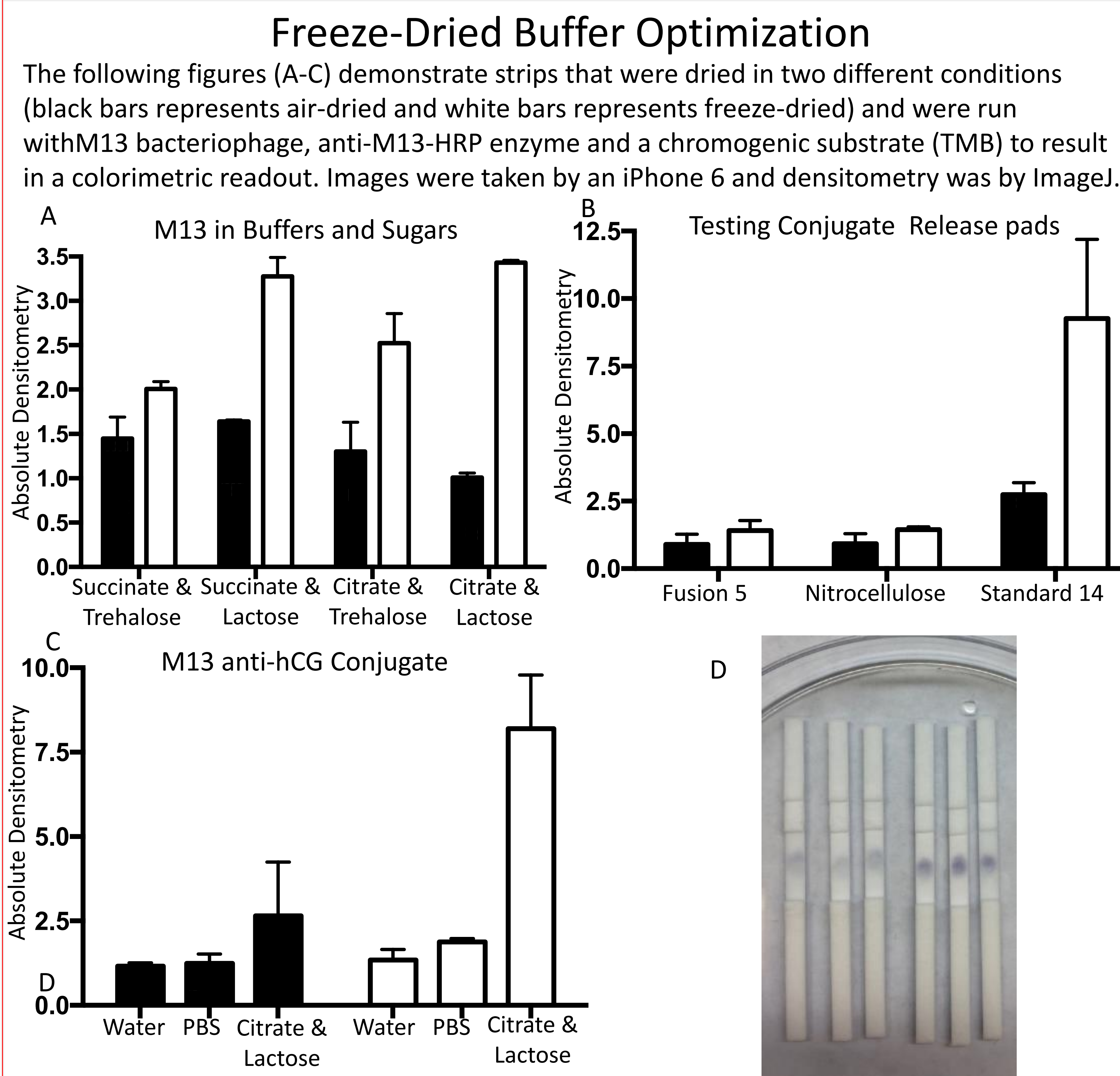
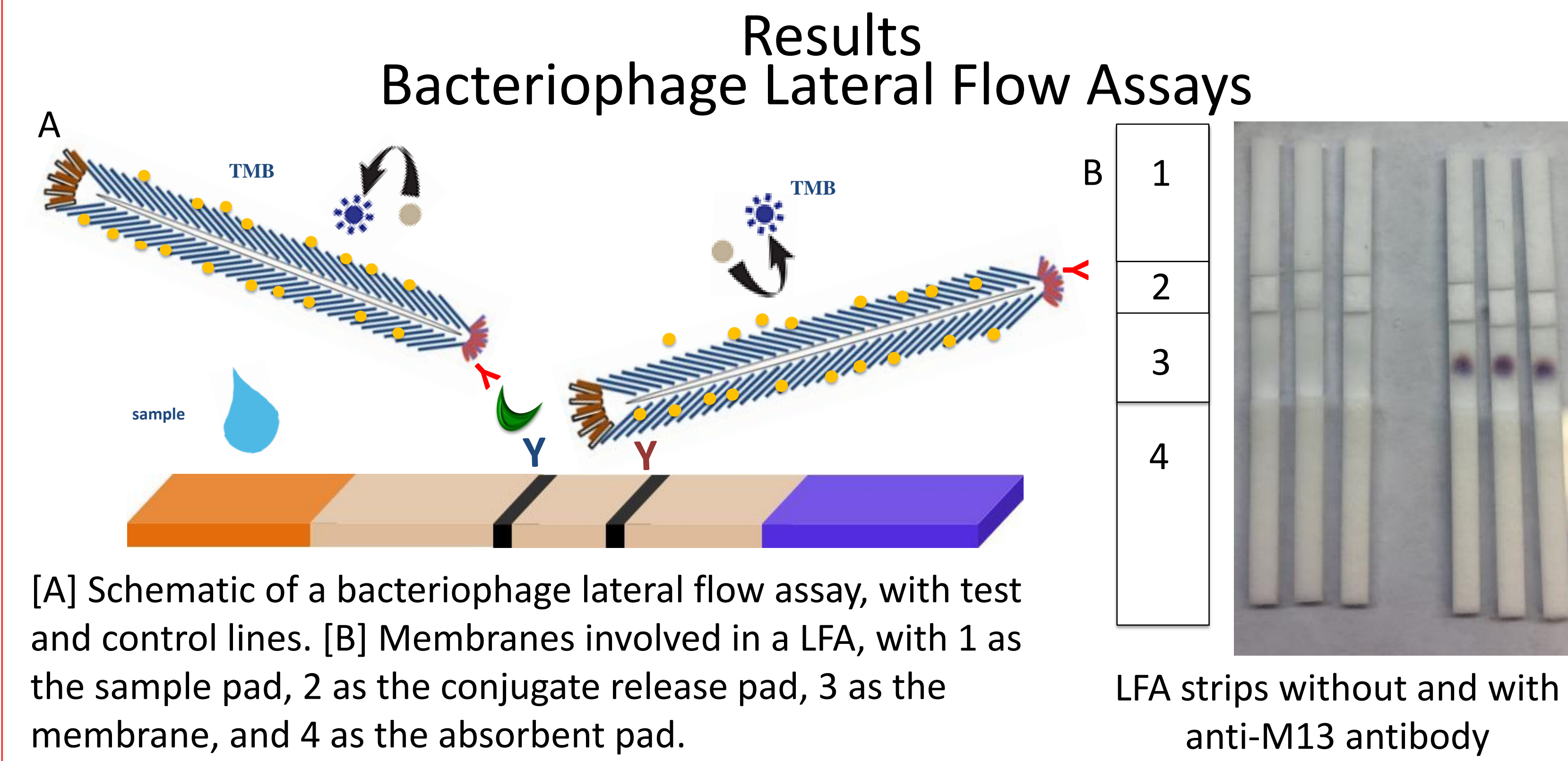
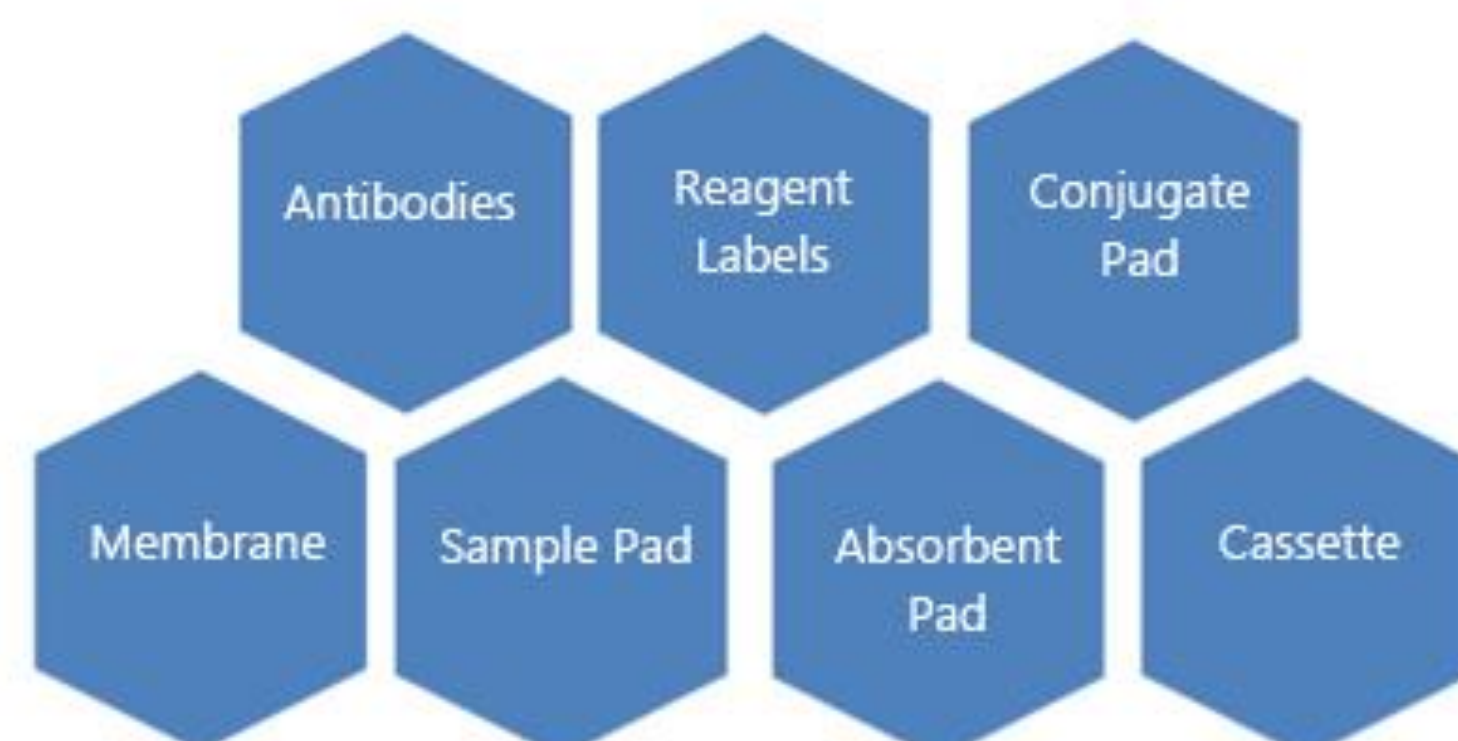


The figure above represents the many, diverse particles employed in LFAs.

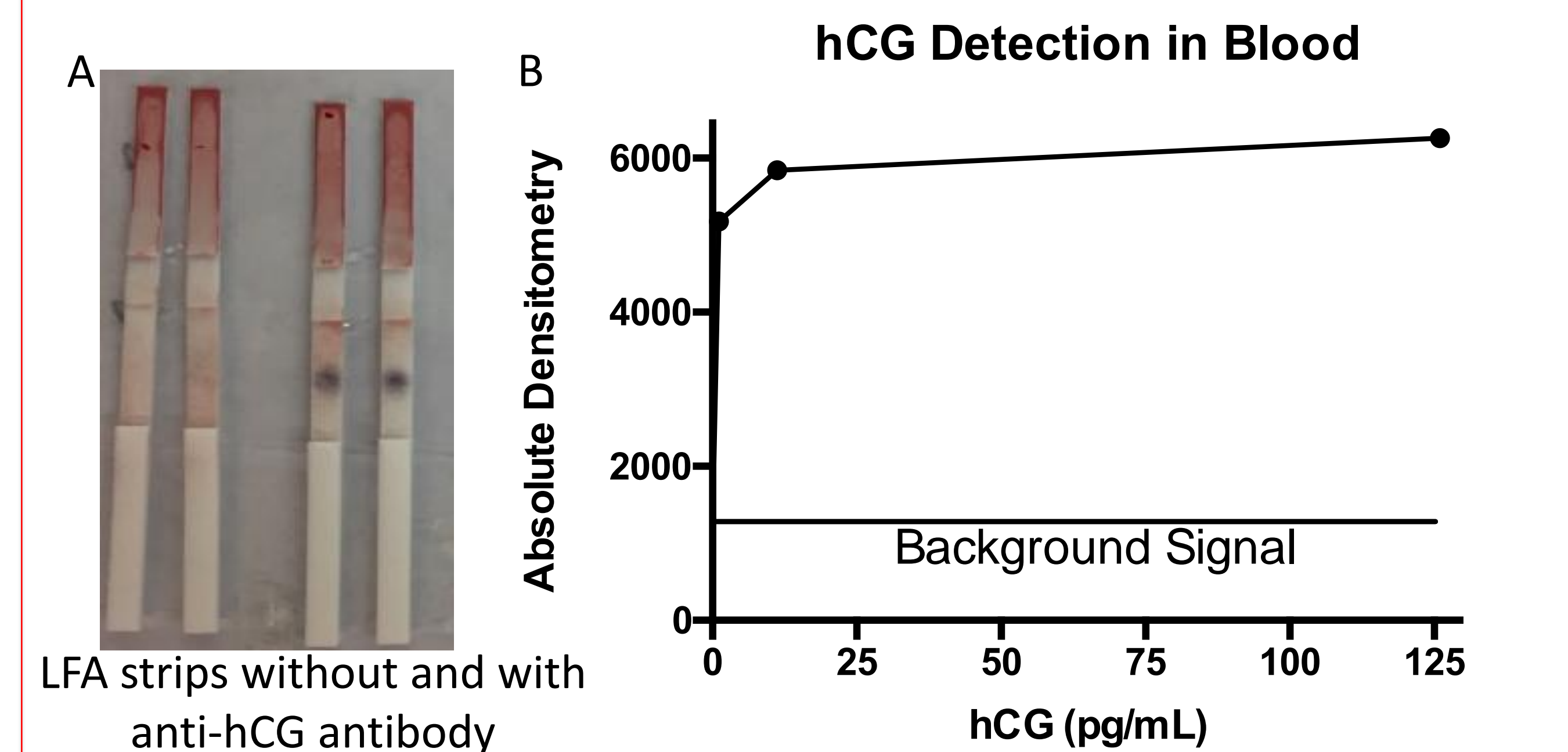
We noted that the structure of a M13 bacteriophage is advantageous in lateral flow due to its high surface area to volume ratio and its ability to be chemical modified. Bacteriophages have been explored in recent years as reporters for immunoassays that have enabled improved recognitions and enhanced signal readout.

Materials and Methods

Here, we developed a rapid and sensitive lateral flow assay, and demonstrated its stability and use in blood, through the optimization of lateral flow components.



The above figures demonstrate the blood-filtering capacities of filters from different manufacturers, (L-R; GX, MF1, GR, and NX).



The above figures demonstrate strips that were freeze-dried and run with bacteriophage in blood, anti-M13-HRP and a chromogenic substrate to result in a colorimetric readout. Images were taken by a iPhone 6 and densitometry was performed through ImageJ.

Conclusions:

- Validated M13 phage as a reporter particle
- Demonstrated a freeze-drying recipe for the best release of reporter particles
- Developed a full-fledged assay for the detection of human chorionic gonadotropin
- Demonstrated our assay's performance in blood
- Achieved a limit of detection of 1 pg/mL in blood

Acknowledgements:

Professor Richard Willson of the Chemical and Biomolecular Engineering department, the Willson lab, and the Biomedical Engineering department. Funded by the National Science Foundation (NSF), the National Institutes of Health (NIH), and the Center for Disease Control (CDC).

References:

- Adhikari, Meena, et al. "Aptamer-phage reporters for ultrasensitive lateral flow assays." *Analytical chemistry* 87.23 (2015): 11660.
- Adhikari, Meena, et al. "Functionalized viral nanoparticles as ultrasensitive reporters in lateral-flow assays." *Analyst* 138.19 (2013): 5584-5587.
- Kim, Jinsu, et al. "Detection of viruses by counting single fluorescent genetically biotinylated reporter immunophage using a lateral flow assay." *ACS applied materials & interfaces* 7.4 (2015): 2891.