

Enzymatic Conversion of Human Whole Blood at the Point of Need

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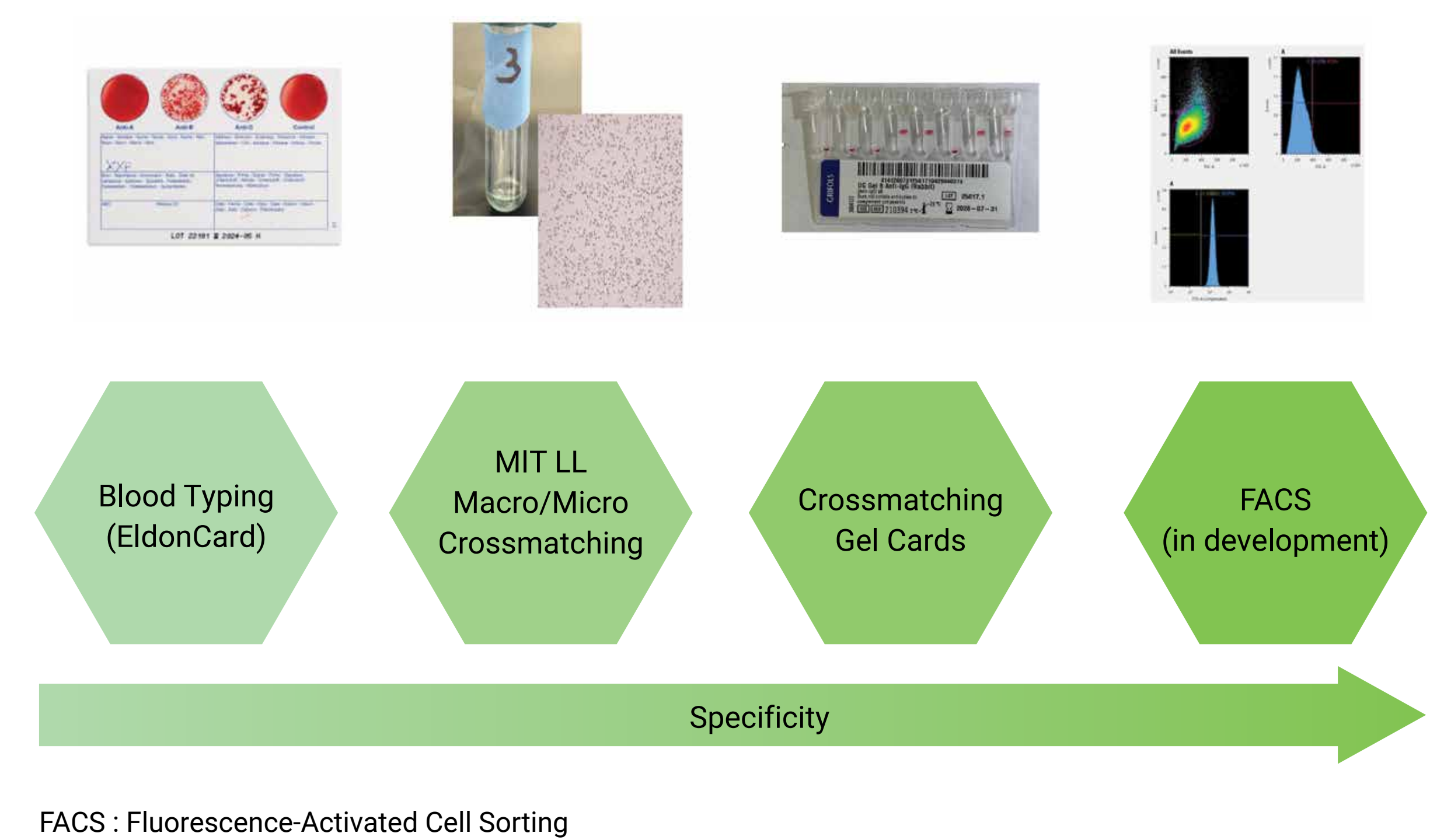
Motivation

- Current blood-supply technologies are insufficient to meet the demands of anticipated large scale combat operations (LSCOs)
- This capability gap is expected to lead to an increase in preventable hemorrhage-related deaths
- To mitigate this risk, we aim to expand the availability of universal blood supplies by developing technologies to convert type B whole blood into type O whole blood using enzymes at the point of need

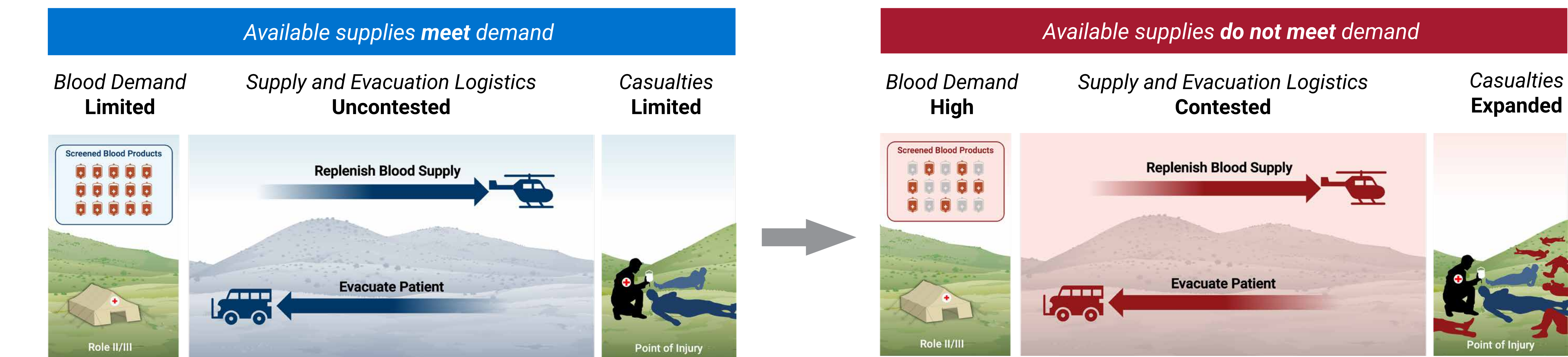
Method and Materials

Evaluate: Experiments Using Sensitive Assays

- A series of increasingly specific assays to evaluate enzymatic conversion with increasing specificity were established
- The results from these assays were used to inform experiment protocols and prototypes

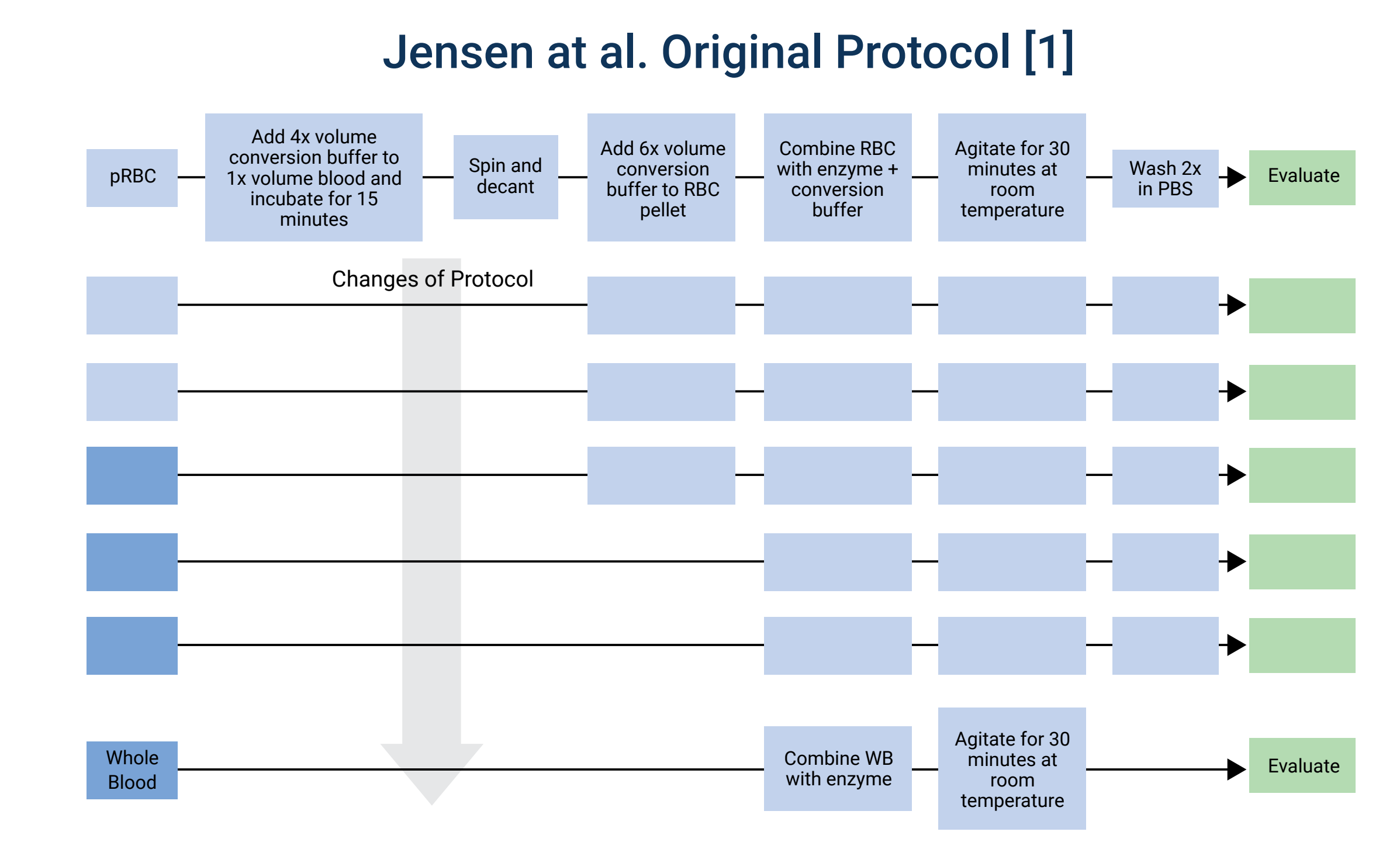


FACS : Fluorescence-Activated Cell Sorting



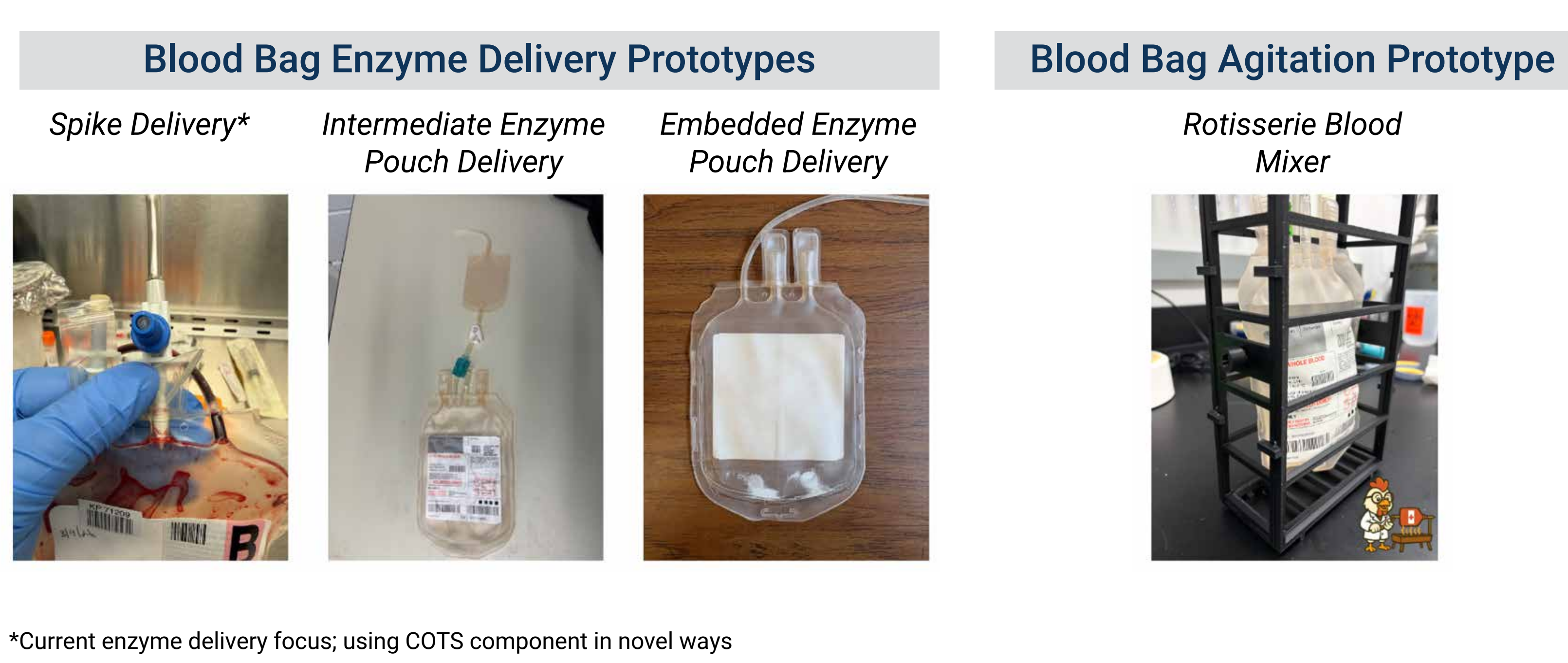
Simplify: Protocols for Point of Need (PON) Conversion

- Experimental protocols were reduced from six steps to two
- Multiple experiment parameters such time, agitation method, and enzyme formulation were tested
- The simplified process now requires only the direct addition of the enzyme to the blood sample and 30 minutes of agitation



Prototype: Devices to Enable PON Conversion

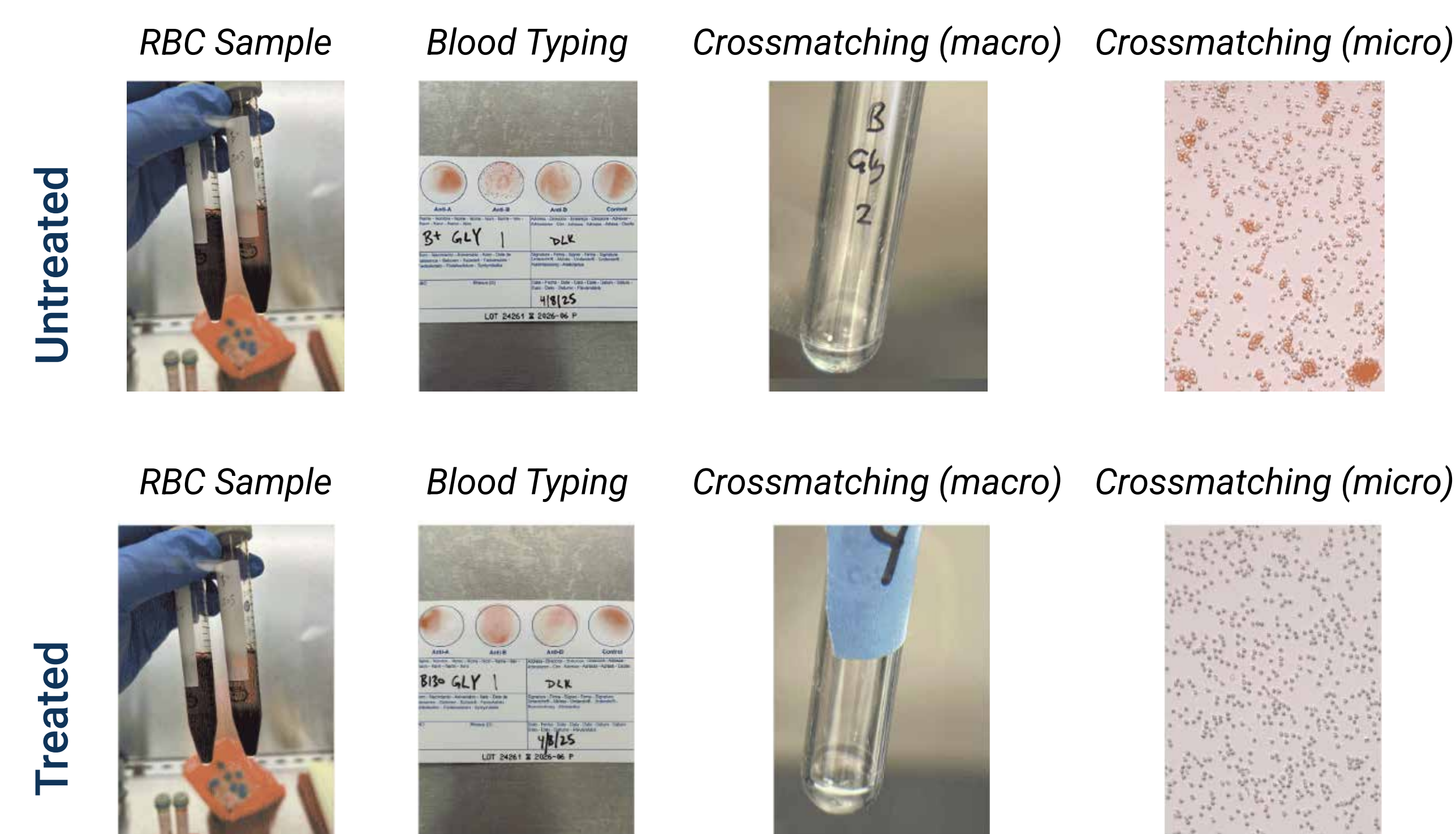
- Prototypes that enable the direct delivery of enzymes into blood bags and novel agitation techniques were developed



Results

Validation of Enzymes on packed red blood cells (pRBCs)

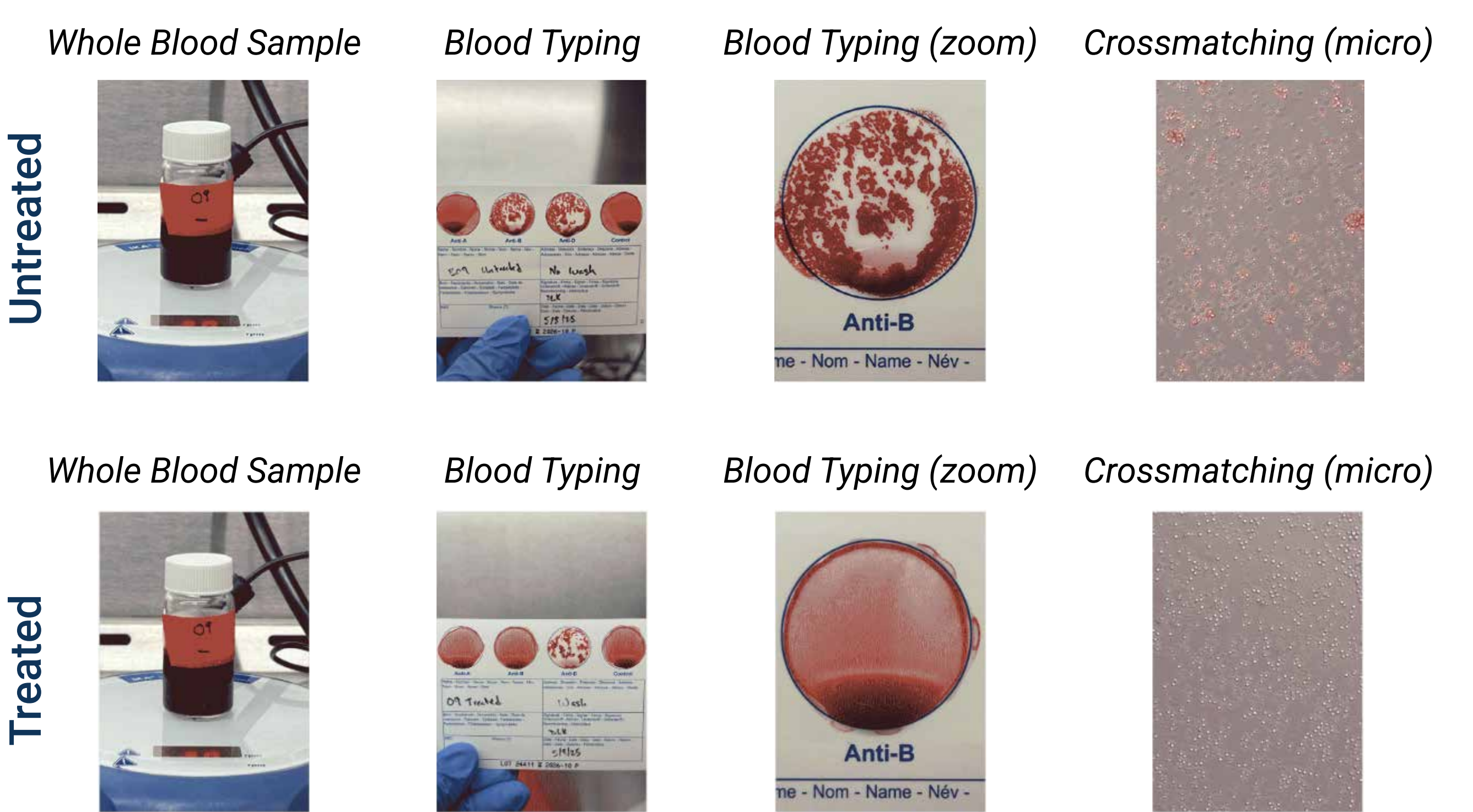
- The enzymatic protocols published by Jensen et al. [1] were replicated to evaluate their efficacy
- The resulting data suggest that the protocol is capable of converting type B pRBCs into type O pRBCs, as observed via Eldoncard and serum crossmatching assays (antigen levels below assay LODs)



Enzymatic conversion of type B pRBCs was replicated.
No agglutination was observed in the Anti-B circle during blood typing or crossmatching in the treated samples, which suggests the successful conversion of type B pRBCs to type O.

Application of Enzymes and PON Protocol on Whole Blood

- The simplified PON protocols and enzymes published by Jensen et al. [1] were applied to type B whole blood
- The results suggest that this protocol successfully converts type B whole blood into type O whole blood as observed via Eldoncard and serum crossmatching assays (antigen levels below assay LODs)



Enzymatic conversion of type B whole blood was demonstrated.
No agglutination was observed in the Anti-B circle during blood typing or crossmatching in the treated samples, which suggests the successful conversion of type B whole blood to type O.

Conclusions and Future Work

- Enzymatic conversion of type B whole blood to universal whole blood has been demonstrated
- Future work includes
 - Process refinement
 - Evaluate conversion on short-term blood storage
 - Assess antibody reduction technologies
 - Develop novel long-term RBC storage technologies

