AccuDrop

Matching blood & saving lives, one drop at a time

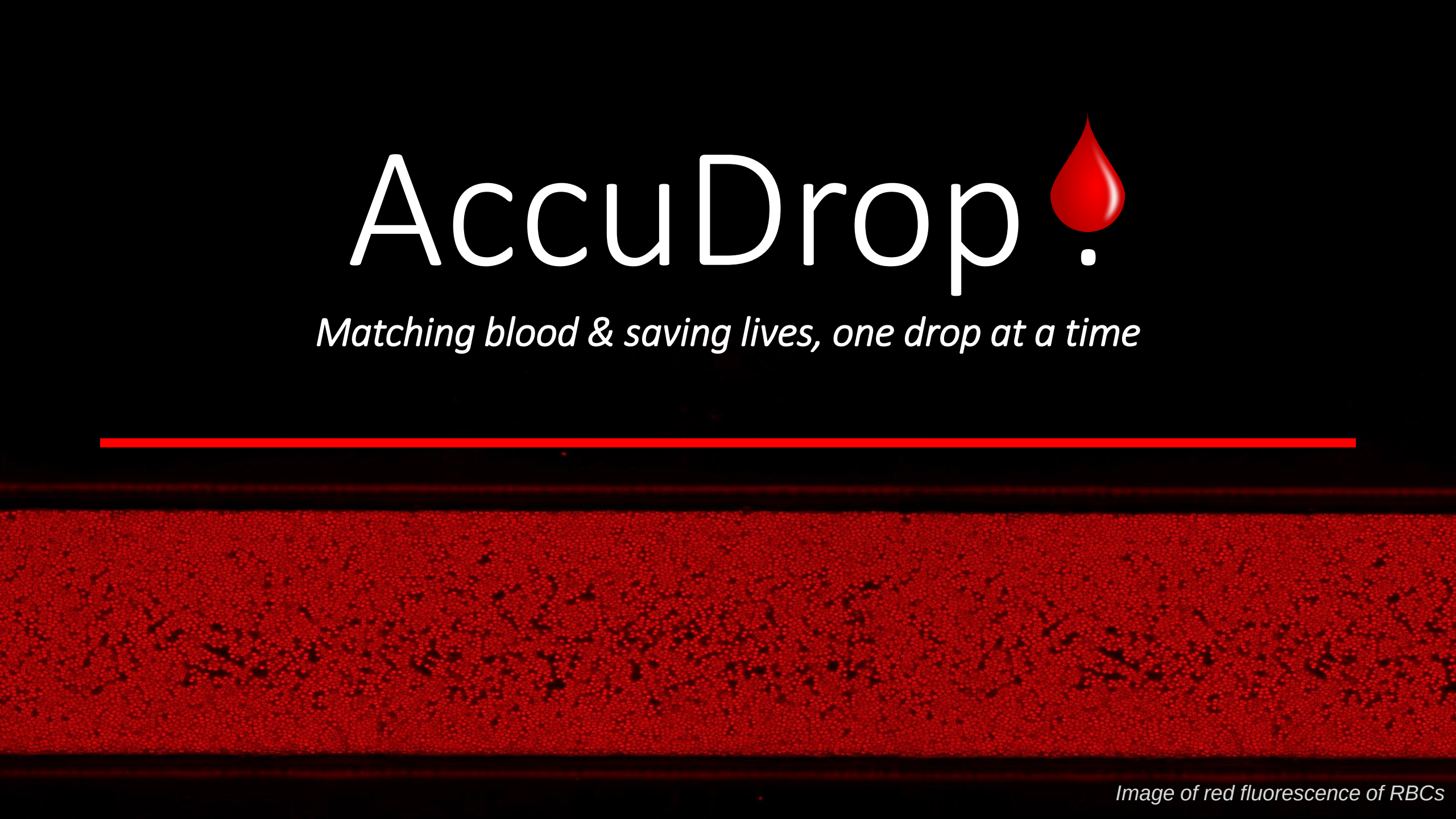


Image of red fluorescence of RBCs

Blood typing is more complex than you think

Significant need & market potential

14.5 Million

Blood transfusions
(per year in the US for surgeries, injuries or hemolytic illnesses)

3.93 Million

New births requiring prenatal blood screening
(per year in the US)

Basic ABO Typing

- 2 major antigens: A & B
- 4 blood types easy to screen (A, B, AB, O)

Less Characterized Minor Antigens

- 40+ clinically significant minor antigen groups
- **Often cause hemolytic reactions**

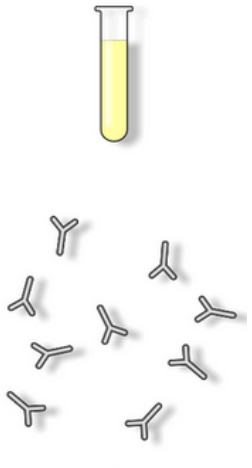
Donor-recipient Compatibility

- Blood serum contains antibodies
- **Antigens (major AND minor) on donor red blood cells (RBCs) must be compatible with patient antibodies**

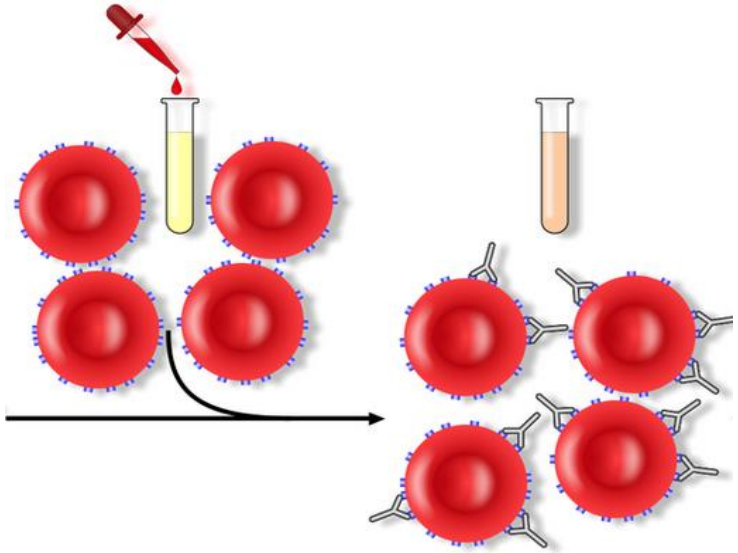
Source: CDC 2013 & 2015

Current standard: cumbersome Coombs' Test

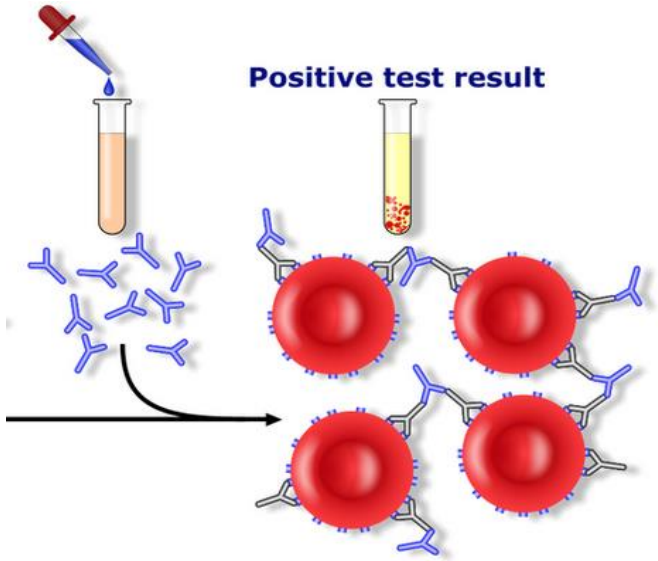
1. Recipient serum is obtained



2. Donor blood added to serum. Antibodies target RBCs



3. Add anti-human antibodies (Coombs' reagent). Agglutination occurs in positive reaction.

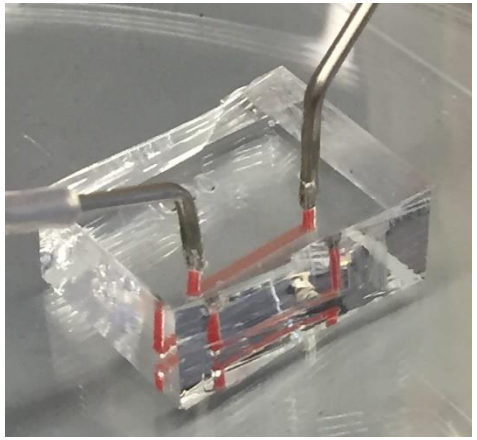


Source: Rad, 2006

1. **Expensive:** Requires lab space/equipment & trained technicians
2. **Subjective:** depends on technicians skill of reading agglutination
3. **Slow:** Speed is needed in emergency situations
4. **Binary Readings:** Yes/no for ONE antigen instead of full characterization of all 40+ antigens

AccuDrop: “Coombs-on-a-Chip”

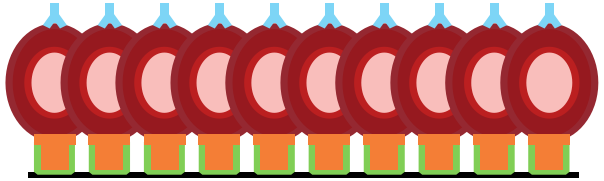
The Technology



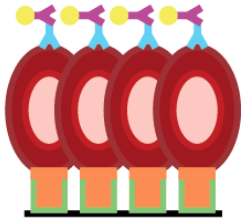
1) Photolithography to manufacture silicon master design
2) Poly (dimethylsiloxane) cast to create device with channels (200-1000 µm)

Source: Duffy DC, 1998

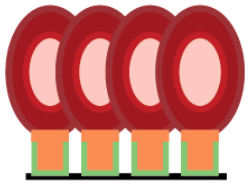
Introduce test serum to attached blood cells



Immunofluorescence using anti-human antibody

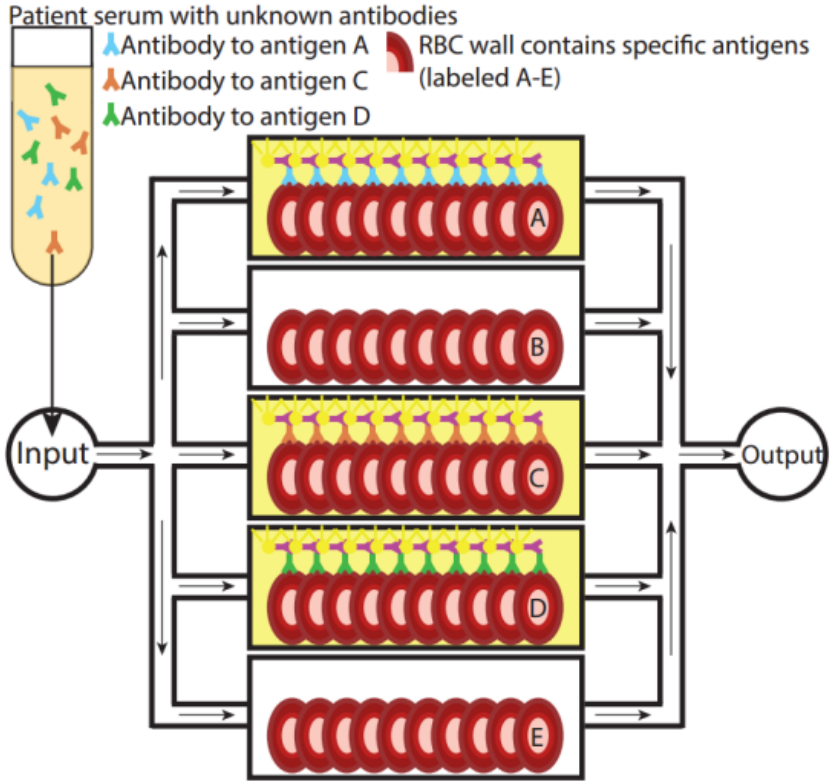


Positive result



Negative result

Device Schematic & Usage Steps

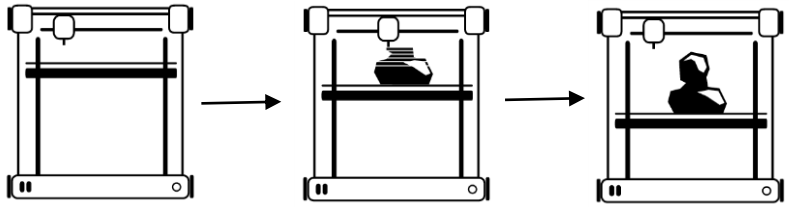


- Multiple channels with attached RBCs of different blood types.
- Channels that are highlighted in yellow (*representative color)* mark correctly identified antibodies in serum input (on the left) for donor-recipient compatibility.

An overarching snapshot of immunofluorescence shown on the left

2016 Development timeline and costs

February | March | April | May | June | July



- Design and validate prototype (cost: $325)
- Test alternative fluorescence methods (cost: $2000)

- Redesign and iterate prototype (cost: dependent on number of iterations; estimate $500)
- Recruit volunteers for ease of use device testing (cost: $0-$200 for initial studies)

- Conduct ease-of-use device testing
- Finalize device design
- File for provisional patent (cost ≈ $1000)

- Validate device data on larger populations
- Begin developing large-scale manufacturing options
- Seek financing options

- Continue larger population tests
- Develop manufacturing options
- Finalize early partnerships and customers

- Begin exploring FDA device approval options

An experienced team

Advisors

- Dr. Dongeun Huh (Principal Investigator, Professor of Bioengineering)
- Dr. Donald Siegel (Principal Investigator, HUP Division of Transfusion Director)

Team

- Woo Byun (Research Scientist in Huh Lab)
- Vahid Hoshmand (MSE & BSE Bioengineering)
- Liz Hwang (Healthcare Management & Bioengineering)
- Kush Mehta (MSE & BSE Bioengineering)
- Nicholas Perkons (MD/PhD in Bioengineering)
- Carla Winter (BSE Bioengineering)

References

CDC. "Births and Natality." CDC FastStats. Department of Health and Human Services, 20 July 2015. Web. 25 Nov. 2015. <http://www.cdc.gov/nchs/fastats/births.htm>.

CDC. "Blood Safety Basics." Blood Safety. U.S. Department of Health and Human Services, 31 Jan. 2013. Web. 25 Nov. 2015. <http://www.cdc.gov/bloodsafety/basics.html>.

Duffy DC, McDonald J, Schueller O, and Whitesides G. Rapid Prototyping of Microfluidic Systems in Poly(dimethylsiloxane). Analytical Chemistry 70, 1998.