

Evolution of human blood grouping techniques



So far in our course ...

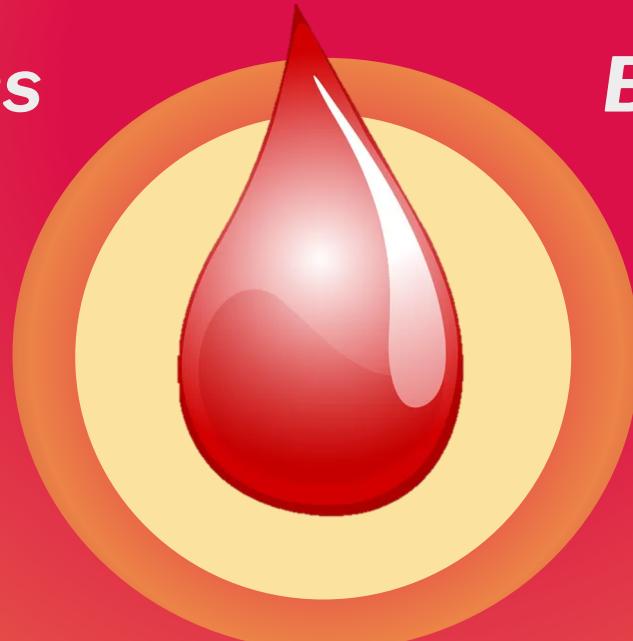
A quick recap

Non-ABO antigens

RBC antigens

Variability of blood

History of discovery

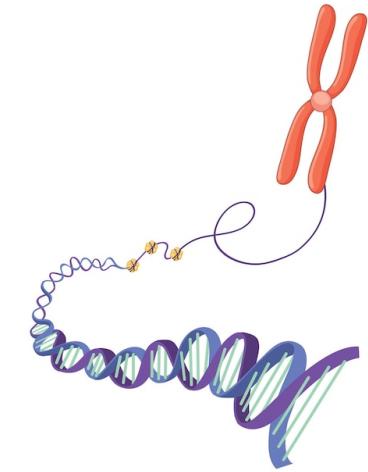
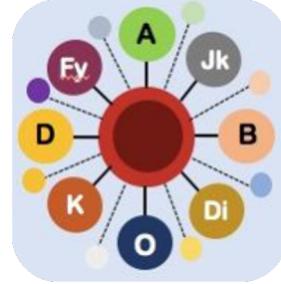
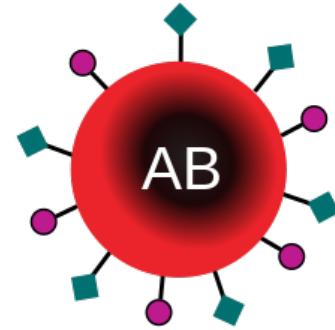
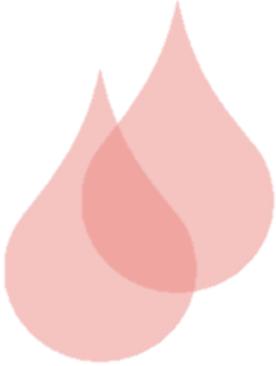


Blood group systems

Genes & blood groups

Genetic variations

In today's lecture ...



Presence of antigenic determinants



Serological techniques



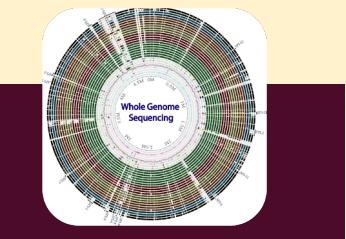
Discovery of genetic background



Molecular techniques



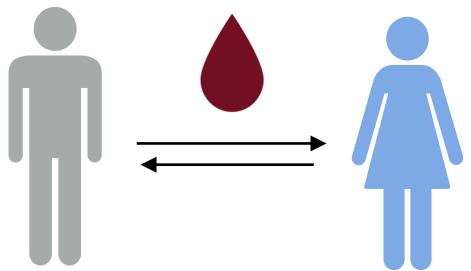
Opportunity for novel discoveries



Sequencing (NGS) techniques

Blood grouping techniques

Evolution & roadmap



Compatibility of blood components between donor and recipient

Serological blood grouping

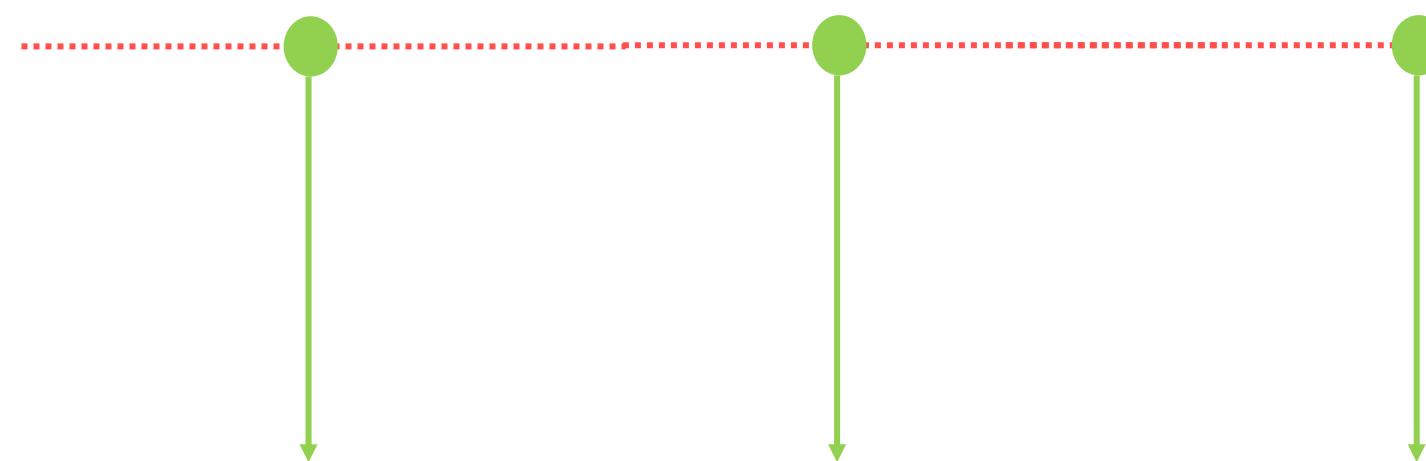
*Gold standard technique
for more than 2 decades*

Molecular level diagnostics

*Using allelic variations
as diagnostic markers*

Identifying novel players

*Advent of next
generation sequencing*



Serological blood testing

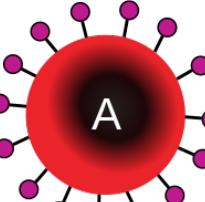
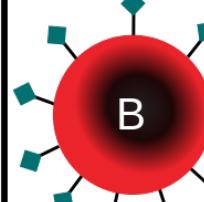
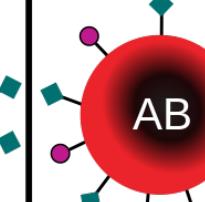
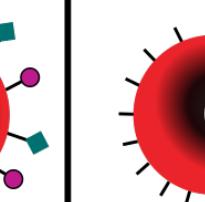
The gold standard approach

Routine method based on the **hemagglutination reactions** between RBC antigens and specific antibodies

"A reaction that causes clumping of RBCs. Occurs when specific antibodies bind to specific binding sites on the RBC antigens"

Basic concept behind agglutination depends **2** major factors

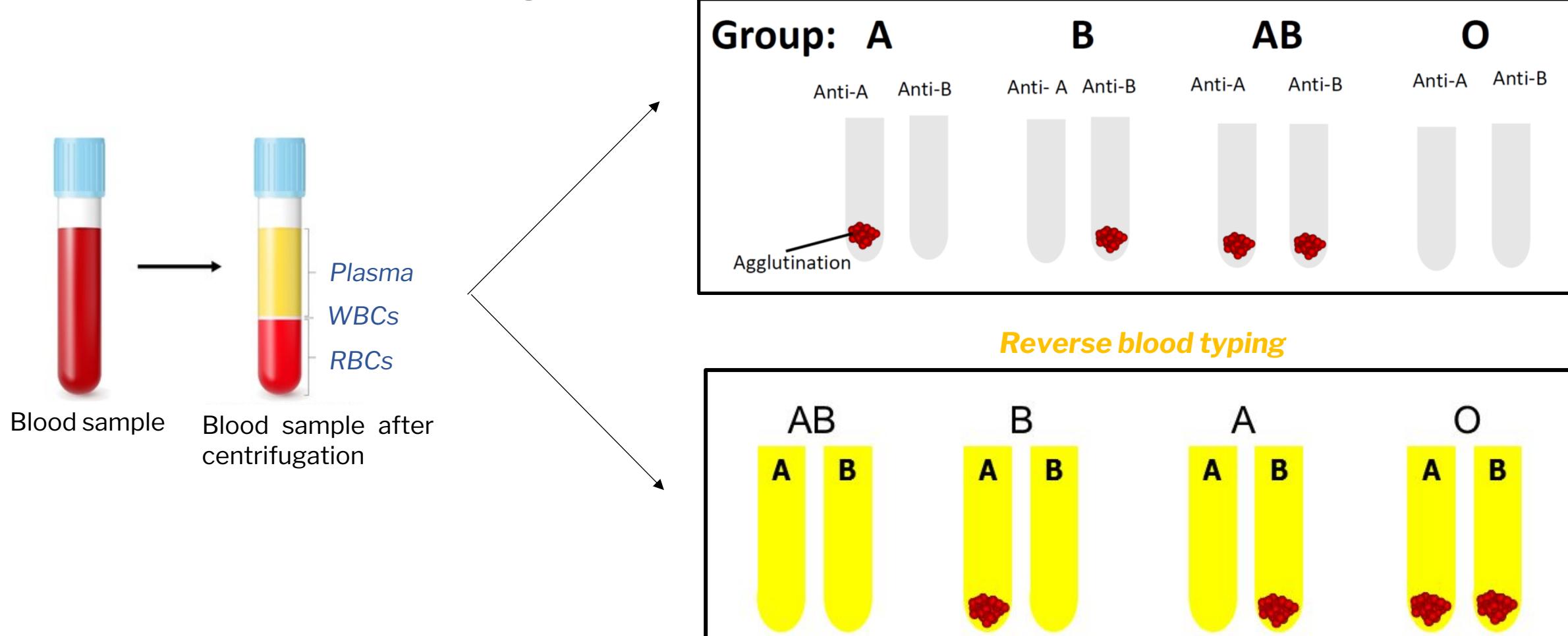
- *Type of antigen expressed on the RBC surface*
- *Type of antibodies present in the plasma*

	Group A	Group B	Group AB	Group O
Red blood cell type				
Antibodies in plasma			None	
Antigens in red blood cell	A antigen	B antigen	A and B antigens	None

Serological blood testing

The gold standard approach

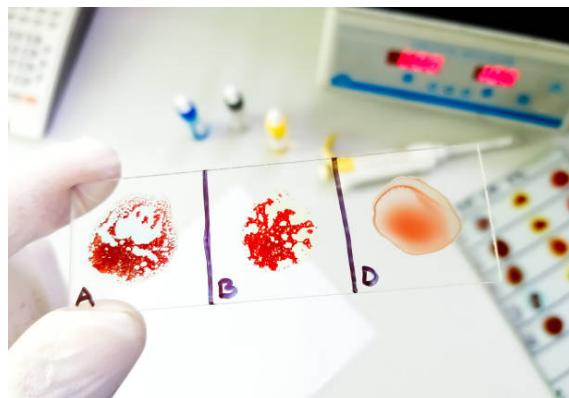
Forward and reverse blood typing



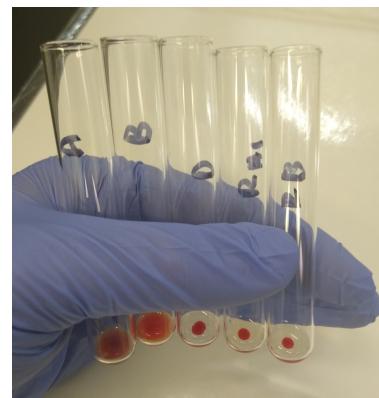
Serological blood testing

The gold standard approach

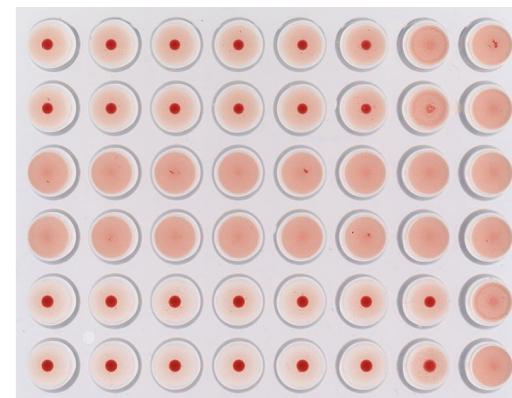
Well known and commonly used



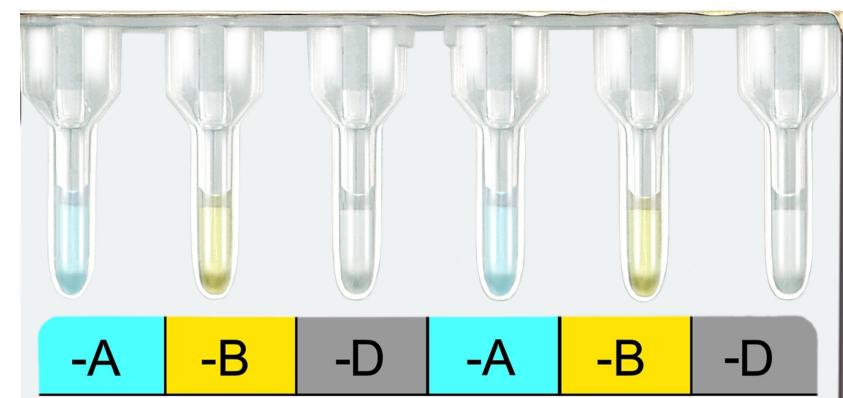
Slide test



Tube test



Microplate agglutination



Microcolumn gel

Other methods

Novel paper based diagnostics

Dye – assisted paper based detection

Microfluidic testing

Waveguide Mode sensor testing

Erythrocyte magnetized technology

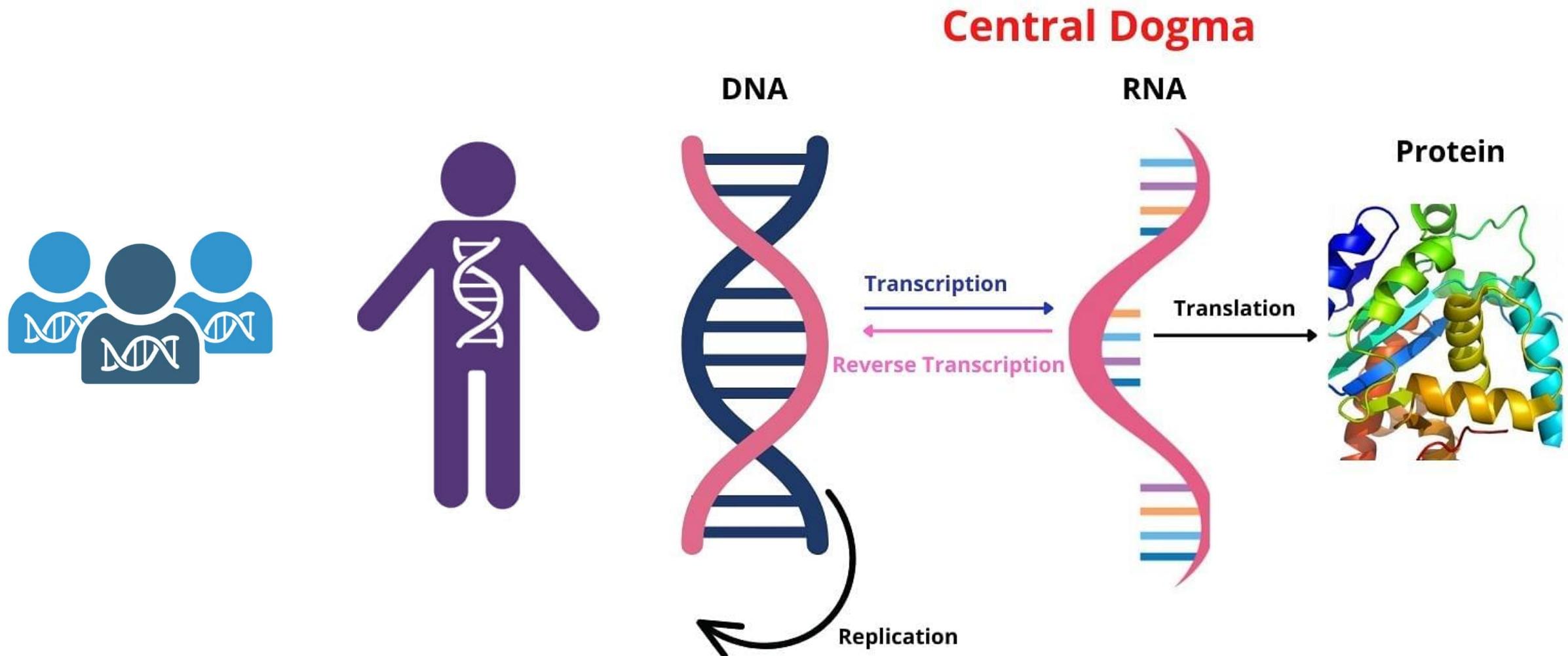
Protein chip testing

Surface plasmon resonance testing

Flow cytometry testing

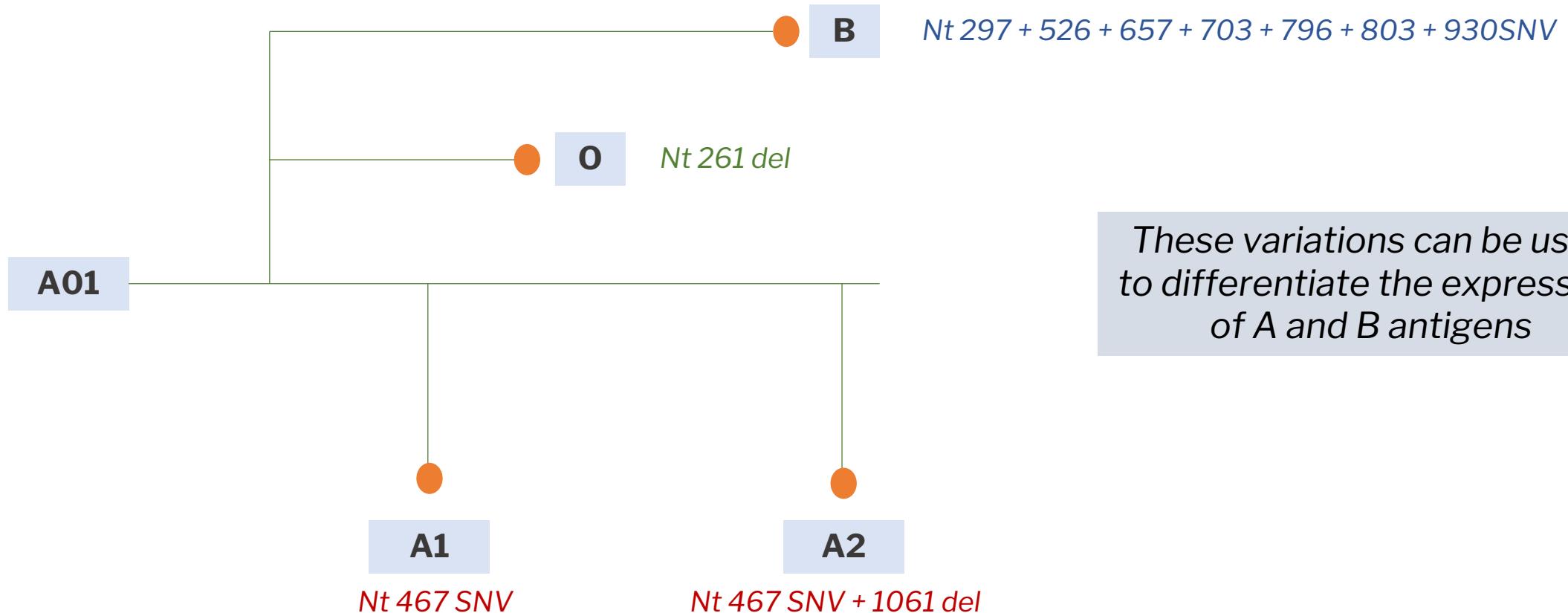
Molecular blood testing

Allelic variations in diagnostics



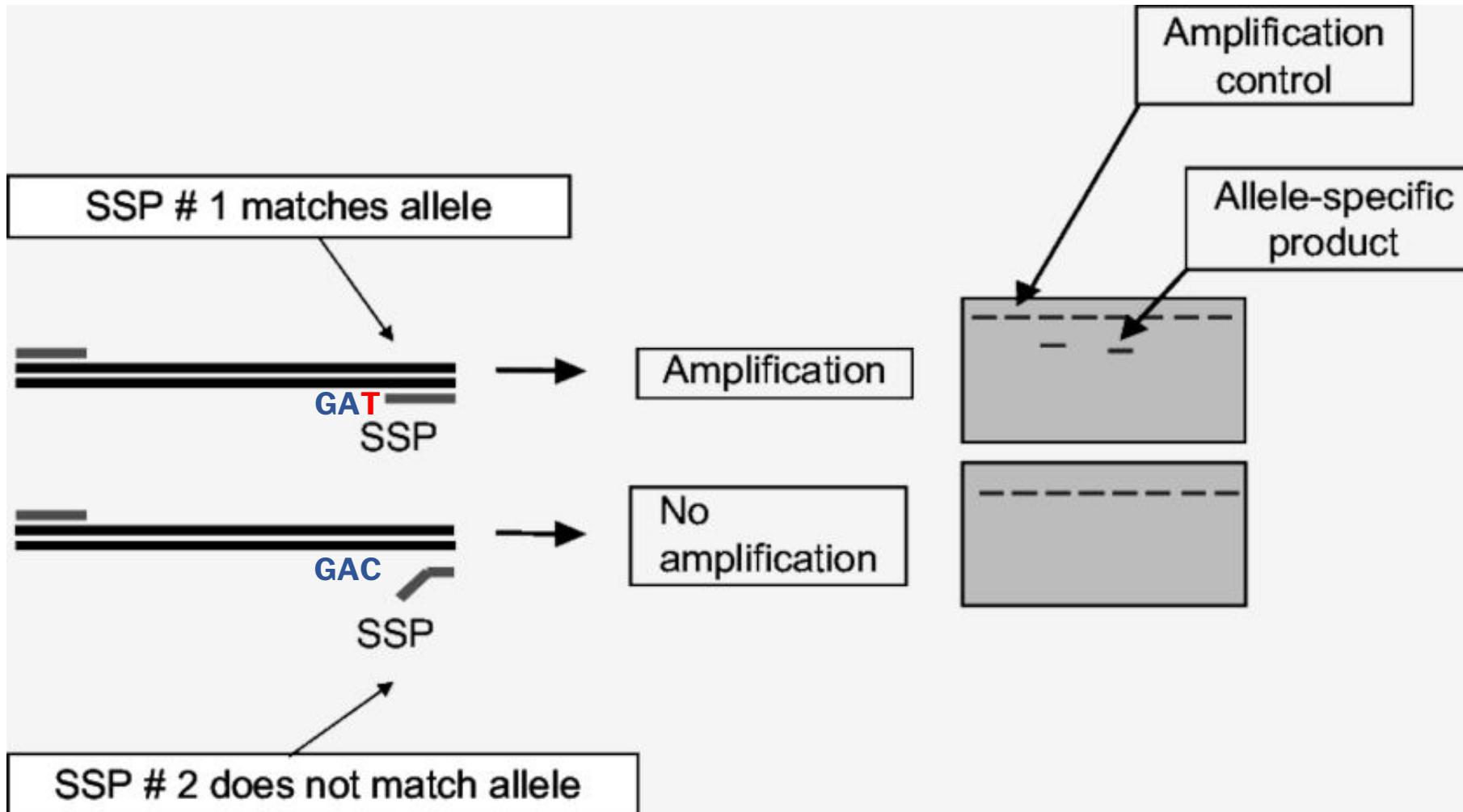
Molecular blood testing

Allelic variations in diagnostics



Molecular blood testing

Allelic variations in diagnostics



Molecular blood testing

Types & techniques



Low throughput

- *PCR – Allele Specific Primers*
- *Denaturing Gradient Gel Electrophoresis (DGGE)*
- *Single Strand Confirmation Polymorphism*

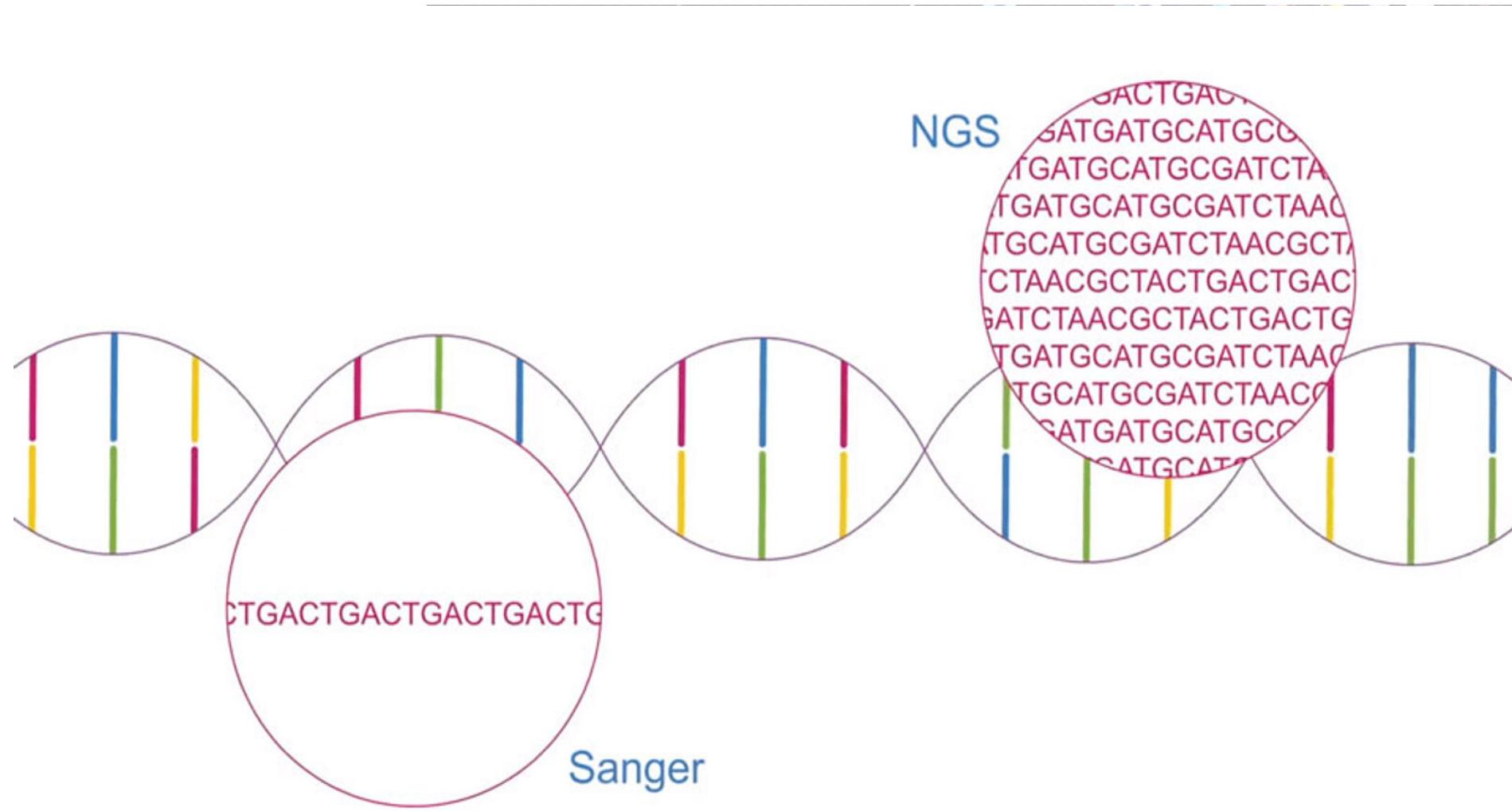
Medium throughput

- *Real Time PCR*
- *Sanger DNA Sequencing*
- *Pyrosequencing*

High throughput

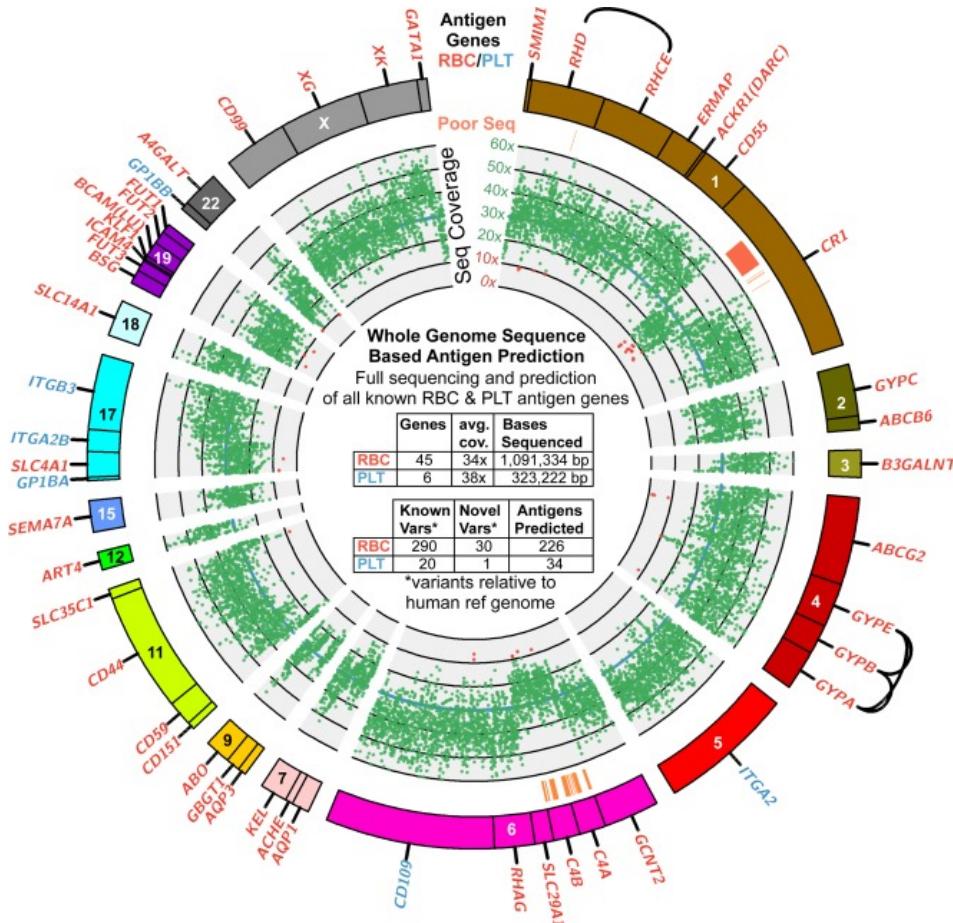
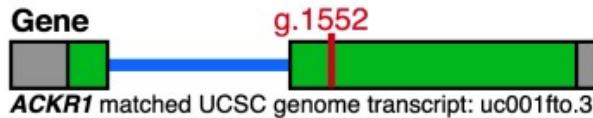
- *Microarray techniques*
- *Next Generation Sequencing*

Next Generation Sequencing in Immunohematology



Next Generation Sequencing in Immunohematology

The first proof of principle study - 2016



► 47 year old European woman

► RBC and Platelet Ags 98.4% in concordance with serological results

Upcoming courses ...

- Genomics in advancing the future of blood group profiling
- From genomes to populations – Population specific blood group registries

Thank

You

