

# Blood Group Microarray, Nine Blood Groups

*FOR GENOTYPING THE ABO, RHD/RHCE, DUFFY, KELL, KIDD, DIEGO, DOMBROCK, COLTON, AND MNS BLOOD GROUPS*

## Disease Overview

- Safe blood transfusion requires appropriate matching of blood group antigens between donor and recipient. A mismatch between the antigens of donor and recipient may lead to alloimmunization, which is followed by an antibody-mediated immune response that can result in lysis of red blood cells (RBCs).
- RBC antigens in the above nine blood groups systems are most relevant to transfusion safety.
- Current serotyping tests to determine RBC antigen profiles rely on the use of antigen-specific antibodies. Although serotyping is a simple and robust method, it has logistic and functional limitations.
- Genotyping on a blood group microarray is able to overcome most of the limitations of serotyping, including the prediction of RBC antigen profiles in recently transfused patients and in patients whose RBCs are coated with immunoglobulins (DAT+).
- Other advantages of genotyping include avoidance of phenotype call errors due to batch-to-batch variation in the specificity of serotyping antibodies and increased certainty in RhD-negative, RhD-weak, and RhD-partial individuals.

## Genetics

Ten different genes code for the blood groups assayed.

## Indications for Ordering

- DAT+ individuals (i.e., individuals with conditions such as chronic lymphocytic leukemia, autoimmune hemolytic anemia, and Hodgkin lymphoma) who produce autoantibodies that bind to RBCs and interfere with serotyping.
- Recently transfused individuals who have circulating RBCs of donor origin that interfere with the typing of self RBCs.
- Individuals with conditions requiring frequent transfusions (e.g., sickle cell disease, beta thalassemia) who develop antibodies to low-immunogenicity antigens present on donor RBCs. Although these antigens are usually not typed by standard serology because of their low immunogenicity, they can lead to hemolytic reactions after multiple transfusions.
- Individuals with RhD variants with low antigen expression or with reduced numbers of antigenic epitopes (e.g., weak D, D elute, partial D) where serotyping may yield inconclusive calls.
- Resolution of serotyping discrepancies.

## Additional Potential Applications

- RBCs used as reagents for reverse typing need to comply with regulations for test sensitivity. Genotyping constitutes an appropriate method for performing quality assurance on reagent RBCs.
- Extensive serotyping of donor blood is not standard practice due to lack of staffing, costs, or limited antibody availability. Genotyping may allow for extensive donor typing at a lower cost.

## Interpretation

- The genotype and predicted phenotype are reported for each of the nine blood group systems analyzed.
- In heterozygotes with only one allele encoding an antigen, the predicted phenotype will be positive for that antigen.
- In compound heterozygotes with both alleles encoding antigens, the predicted phenotype will be positive for both antigens.
- A “no call” will be reported for an allele when a new or rare genetic variant or a variant combination not present in the reference database is detected.
- Results of this test should be interpreted within the context of clinical data, as well as serology data where available.

## Methodology

- Multiplex PCR followed by microarray analysis to detect over 100 genetic variants in nine blood group systems (ABO, RhD/RhCE, Duffy, Kell, Kidd, Diego, Dombrock, Colton, and MNS). Variants are analyzed singly and in combination to determine the genotype and predict the phenotype of RBC antigens.
- Clinical sensitivity is 99.8 percent, compared to 95.8 percent for serotyping.
- Analytical sensitivity and specificity are 99 percent.
- The test is performed by Progenika Inc.

## Limitations

- New or rare genetic variants or variant combinations that are not part of the reference database will not be detected.
- Rare diagnostic errors may occur due to mutations at binding sites for PCR primers or detection probes.

### Related Tests

- RhCc Antigen (*RHCE*) Genotyping ([0050421](#))
- RhD Antigen (RhD) Genotyping ([0051368](#))
- RhEe Antigen (*RHCE*) Genotyping ([0050423](#))
- Antigen Testing, Rh Phenotype ([0013019](#))
- ABO Group & Rh Type ([0010003](#))

### References

1. Rouger P, et al. Immunologic risks of blood transfusion and public health. *Transfus Clin Biol* 1994;1(2):141–53.
2. Hillyer CD, et al. Integrating molecular technologies for red blood cell typing and compatibility testing into blood centers and transfusion services. *Transfus Med Rev* 2008;22(2):117–32.
3. Storry JR, et al. Application of DNA analysis to the quality assurance of reagent red blood cells. *Transfusion* 2007;47(1 Suppl):73S–8S.
4. Hult A, et al. Blood group genotype analysis for the quality improvement of reagent test red blood cells. *Vox Sang.* 2005;88(4):265–70.
5. Avent ND, et al. The BloodGen project: toward mass-scale comprehensive genotyping of blood donors in the European Union and beyond. *Transfusion* 2007;47(1 Suppl):40S–6S.

### Test Information

**2002389**

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For specific collection, transport, and testing information, refer to the ARUP Web site at [www.aruplab.com](http://www.aruplab.com).

For information on test selection, ordering, and interpretation, refer to ARUP Consult® at [www.arupconsult.com](http://www.arupconsult.com).