



Rode Kruis  
Vlaanderen

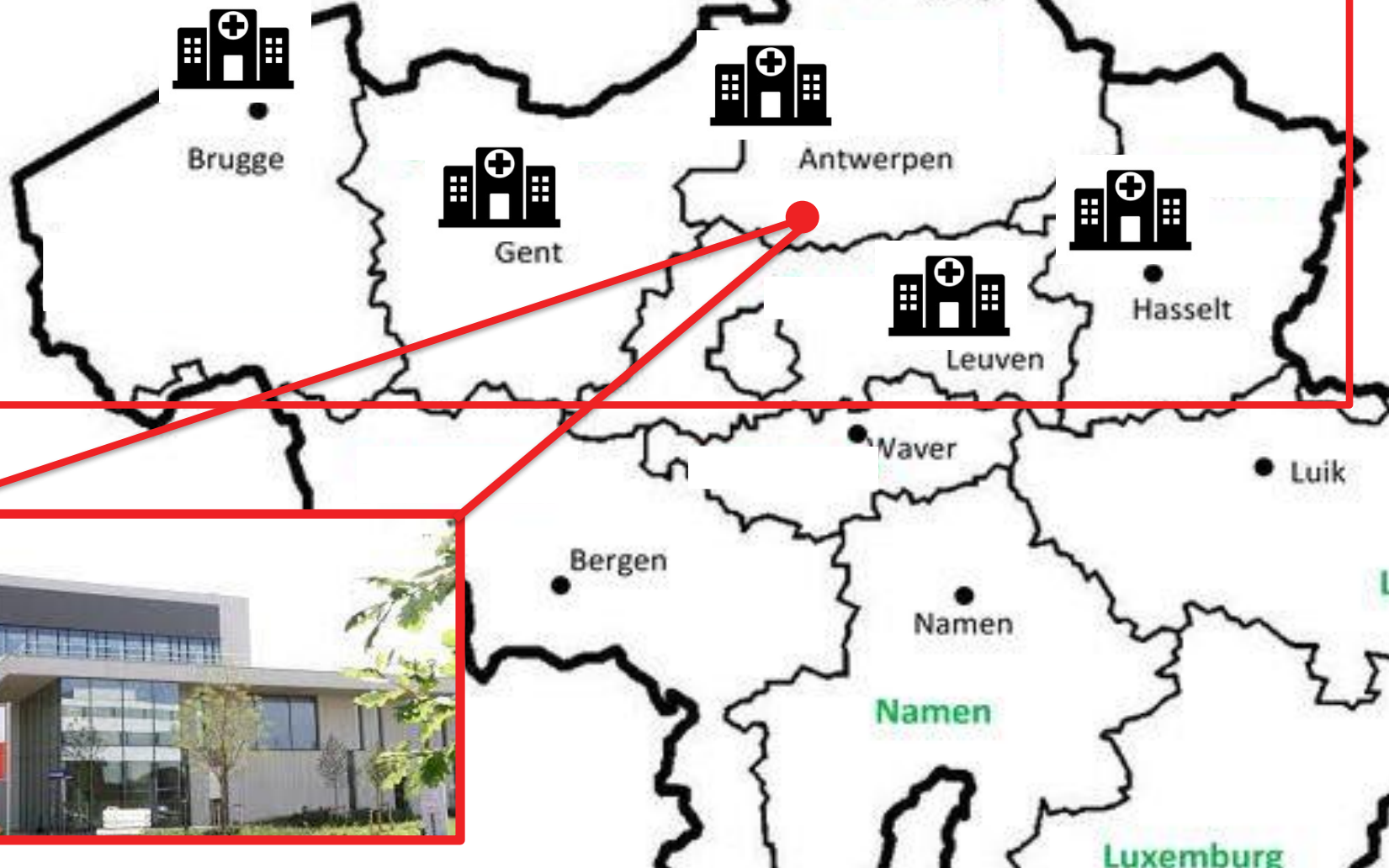
Do we need (to extend) red blood cell genotyping to improve transfusion policy in patients with hemoglobinopathies?

Vicky Van Sandt - Belgian Red Cross Flanders- HILA, Mechelen, Belgium

# Rode Kruis Vlaanderen

Service for blood supply: Mechelen

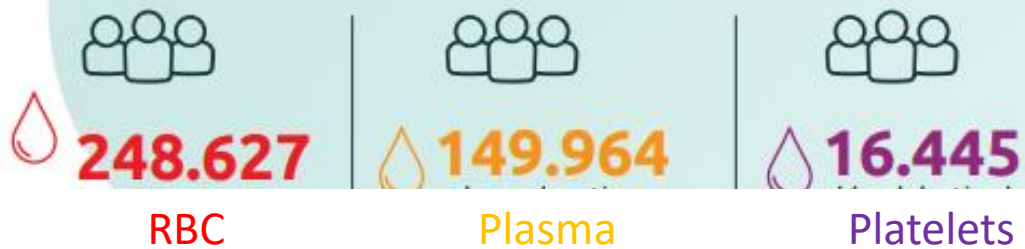
Population: 6,7 million





Rode Kruis  
Vlaanderen

**DONATIES 2021**



# HILA

Solid organ TX

Stem cell TX

Disease association

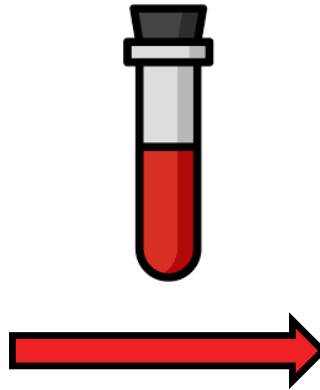
Molecular testing for RBC

Case report:

Patient with sickle cell disease and urgent transfusion need.

Limitations of our donor cohort

Adjust test methods to improve the standard of care for people of Black origin and chronic transfusion needs.



Rode Kruis  
Vlaanderen

Young female **AK**  
with homozygous sickle cell disease  
dropping hemaglobine level 6,20 → 3,40 g/dL

Irregular ABs:

BIORAD PANEL: all cells except  
C- E- K- **Fya- Fyb-** Jka- S- Lea- Leb  
are positive

Urgent need of transfusion

**Bloodbank Lab**

## Blood bank lab

Confirmation of serology:

Panreactivity: only cell 8 Fy(a-b-) negative.

Eluate Cell 8 is negative

Auto test = weak



Set ID-DiaPanel: 45161.24.x (Japan: 4516.24.xx)

Set ID-DiaPanel P: 45171.24.x (Japan: 4517.24.xx)

**LOT** 06171.24.x - 06271.24.x (Japan: 0617.24.xx - 0627.24.xx)

05361.24.x – 05461.24.x (Japan: 0536.24.xx – 0546.24.xx)

🕒 2021.11.01 (Japan: 01.11.21)

**ID-DiaPanel**  
**ID-DiaPanel-P**

Antigen-Tabell / Antigen-Table / Table d'antigènes / Tabella antigenica / Tabla de antígenos / Tabela de antígenos

Antikörper-Identifizierung / Antibody identification / Identification d'anticorps / Identificazione anticorpale / Identificación del anticuerpo / Identificação do anticorpos



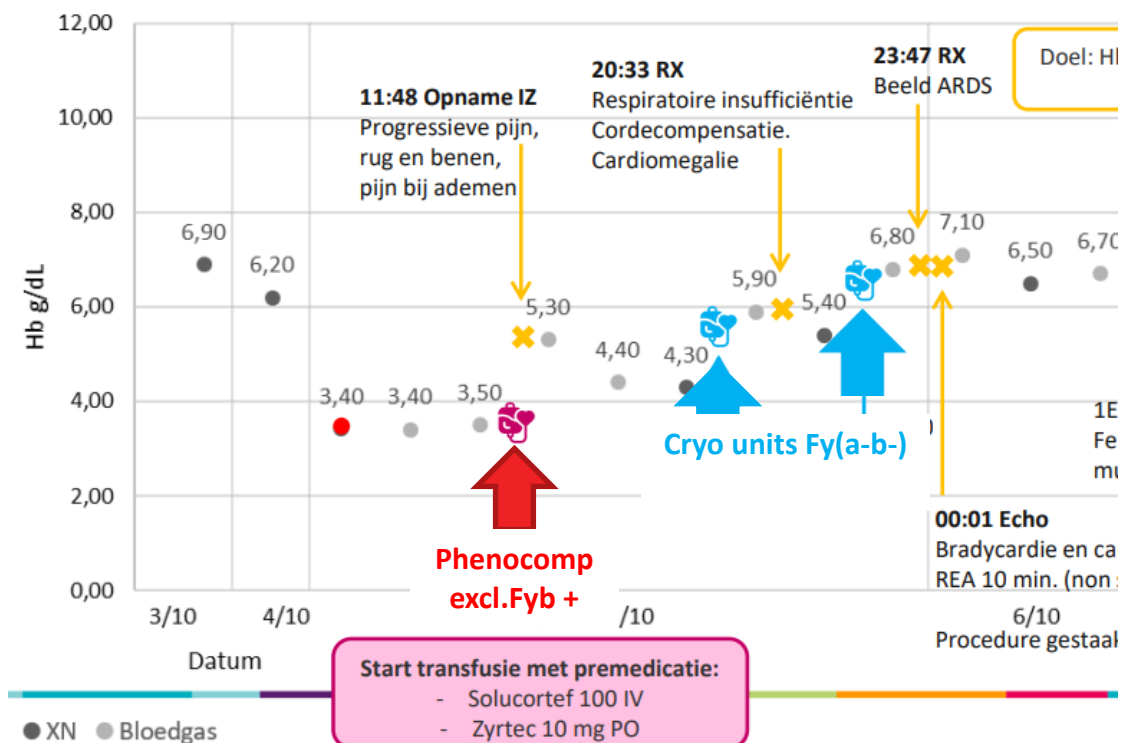
CE  
012

| Rh-hr | Mögliche Genotyp<br>Probable Genotype<br>Genotipo probable<br>Genotipo provável | Spender<br>Donor<br>Donatore<br>Donante<br>Dador | Rh-hr  |   |   |   |   | Kell |   |                |                |                 | Duffy           |                 | Kidd            |                 | Lewis           |                 | P               | MNS            |   |   | Luth. |                 | Xg              |                 | Spez. Antigene<br>Special types<br>Antígenos part.<br>Antígenos part.<br>Tipos especiais | Resultat/Result/<br>Resultado/Resultado |                  |        | Bemerkungen<br>Remarks<br>Remarques<br>Nota<br>Observações/Reservações |              |    |                                                                                      |    |
|-------|---------------------------------------------------------------------------------|--------------------------------------------------|--------|---|---|---|---|------|---|----------------|----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|----------------|---|---|-------|-----------------|-----------------|-----------------|------------------------------------------------------------------------------------------|-----------------------------------------|------------------|--------|------------------------------------------------------------------------|--------------|----|--------------------------------------------------------------------------------------|----|
|       |                                                                                 |                                                  | D      | C | E | c | e | C*   | K | K <sup>a</sup> | K <sup>b</sup> | Js <sup>a</sup> | Js <sup>b</sup> | Fy <sup>a</sup> | Fy <sup>b</sup> | Jk <sup>a</sup> | Jk <sup>b</sup> | Le <sup>a</sup> | Le <sup>b</sup> | P <sup>1</sup> | M | N | S     | Lu <sup>a</sup> | Lu <sup>b</sup> | Xg <sup>a</sup> |                                                                                          | Xg <sup>b</sup>                         | Utr/<br>Coombs   | Enzyme |                                                                        | ABO<br>elect |    |                                                                                      |    |
| 1     | CCC <sup>w</sup> D.ee                                                           | R <sub>1</sub> <sup>w</sup> R <sub>1</sub>       | 117980 | + | + | 0 | 0 | +    | + | 0              | +              | 0               | +               | nt              | nt              | +               | 0               | 0               | +               | 0              | 0 | + | 0     | +               | 0               | +               | +                                                                                        | N/A                                     |                  | 1      | 2+                                                                     | 4+           | 1+ |  |    |
| 2     | CCD.ee                                                                          | R <sub>1</sub> R <sub>1</sub>                    | 553591 | + | + | 0 | 0 | +    | 0 | +              | +              | 0               | +               | nt              | nt              | 0               | +               | +               | 0               | 0              | + | 0 | +     | +               | 0               | 0               | +                                                                                        | +                                       | N/A              |        | 2                                                                      | 2+           | 4+ |                                                                                      | 2+ |
| 3     | ccD.EE                                                                          | R <sub>2</sub> R <sub>2</sub>                    | 683067 | + | 0 | + | + | 0    | 0 | 0              | +              | 0               | +               | nt              | nt              | +               | +               | 0               | +               | 0              | + | 0 | 0     | +               | 0               | +               | +                                                                                        | N/A                                     |                  | 3      | 2+                                                                     | 4+           | 1+ |                                                                                      |    |
| 4     | Ccddee                                                                          | r <sup>+</sup> r                                 | 792268 | 0 | + | 0 | + | +    | 0 | 0              | +              | 0               | +               | nt              | nt              | 0               | +               | +               | +               | 0              | 0 | + | 0     | +               | 0               | +               | 0                                                                                        | N/A                                     |                  | 4      | 2+                                                                     | 4+           | 1+ |                                                                                      |    |
| 5     | ccddEe                                                                          | r <sup>+</sup> r                                 | 599449 | 0 | 0 | + | + | +    | 0 | 0              | +              | 0               | +               | nt              | nt              | +               | 0               | +               | 0               | 0              | + | + | 0     | +               | 0               | 0               | +                                                                                        | +                                       | N/A              |        | 5                                                                      | 2+           | 4+ |                                                                                      | 1+ |
| 6     | ccddee                                                                          | rr                                               | 729766 | 0 | 0 | 0 | + | +    | 0 | +              | +              | 0               | +               | nt              | nt              | +               | +               | 0               | +               | 0              | 0 | + | 0     | +               | 0               | +               | +                                                                                        | N/A                                     |                  | 6      | 2+                                                                     | 4+           | 2+ |                                                                                      |    |
| 7     | ccddee                                                                          | rr                                               | 420459 | 0 | 0 | 0 | + | +    | 0 | 0              | +              | 0               | +               | nt              | nt              | +               | 0               | 0               | +               | 0              | + | + | 0     | +               | +               | 0               | +                                                                                        | 0                                       | N/A              |        | 7                                                                      | 2+           | 4+ |                                                                                      | 2+ |
| 8     | ccD.ee                                                                          | R <sub>0</sub> r                                 | 289260 | + | 0 | 0 | + | +    | 0 | 0              | +              | 0               | +               | nt              | nt              | 0               | 0               | 0               | +               | 0              | 0 | + | +     | +               | 0               | +               | 0                                                                                        | 0                                       | N/A              |        | 8                                                                      | -            | -  |                                                                                      | -  |
| 9     | coddee                                                                          | rr                                               | 624656 | 0 | 0 | 0 | + | +    | 0 | 0              | +              | 0               | +               | nt              | nt              | 0               | +               | 0               | +               | +              | 0 | 0 | +     | 0               | 0               | +               | 0                                                                                        | N/A                                     | HLA <sup>a</sup> | 9      | 2+                                                                     | 2+           | 1+ |                                                                                      |    |
| 10    | coddee                                                                          | rr                                               | 514759 | 0 | 0 | 0 | + | +    | 0 | 0              | +              | +               | +               | nt              | nt              | 0               | +               | +               | 0               | 0              | + | + | 0     | +               | 0               | +               | +                                                                                        | N/A                                     |                  | 10     | 2+                                                                     | 3+           | 1+ |                                                                                      |    |
| 11    | coddee                                                                          | rr                                               | 947749 | 0 | 0 | 0 | + | +    | 0 | 0              | +              | 0               | +               | nt              | nt              | +               | 0               | +               | 0               | 0              | + | + | +     | 0               | 0               | +               | +                                                                                        | nt                                      | N/A              |        | 11                                                                     | 2+           | 3+ |                                                                                      | ±  |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        |                                                                        |              | ±  | -                                                                                    |    |
|       |                                                                                 |                                                  |        |   |   |   |   |      |   |                |                |                 |                 |                 |                 |                 |                 |                 |                 |                |   |   |       |                 |                 |                 |                                                                                          |                                         |                  |        | </                                                                     |              |    |                                                                                      |    |

Anmerkungen siehe rückseitig/Remarks see overleaf/Voir les remarques au verso/Per le note consultare il retro/Ver observaciones en el reverso/Ver observações no verso

# Transfusion timeline

## Suspicion of anti-Fy AB



## Transfusion:

- 1) Phenocompatible, excl. Fyb +
- 2) Urgent request for 2 CRYO units Fy(a-b-)

Genotyping information FYGATA was not available.

## Blood bank lab

Eluate was repeated on a different lot BIORAD PANEL

**Cel 8 Fy(a-b-) of a different donor, is positive.**

**Set ID-DiaPanel:** 45161.22.x (Japan: 4516.22.xx) **LOT** 06171.22.x – 06271.22.x (Japan: 0617.22.xx – 0627.22.xx)

**Set ID-DiaPanel P:** 45171.22.x (Japan: 4517.22.xx) 05361.22.x – 05461.22.x (Japan: 0536.22.xx – 0546.22.xx)

2021.10.04 (Japan: 04.10.21)

**ID-DiaPanel**

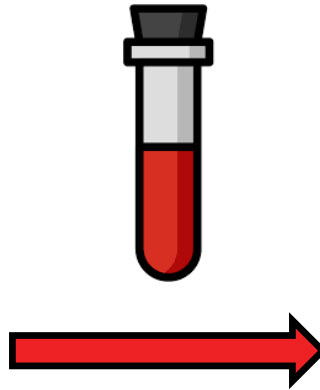
**ID-DiaPanel-P**

Antigen-Tabelle / Antigen-Table / Table d'antigènes / Tabela antigenica / Tabla de antígenos / Tabela de antígenos

**IVD**

Antikörper-Identifizierung / Antibody identification / Identification d'anticorps / Identificação anticorpal / Identificación del anticuerpo / Identificação do anticorpo

Auto-antibodies with a broad specificity , probably not Fy related.



Rode Kruis  
Vlaanderen

Teenager with sickle cell disease  
dropping hemaglobine level 6,20 → 3,40 g/dL

Irregular ABs:

BIORAD PANEL: alle cells except  
C- E- K- **Fya- Fyb-** Jka- S- Lea- Leb  
are positive

Need of transfusion

**Bloodbank Lab**

confirmation of serology

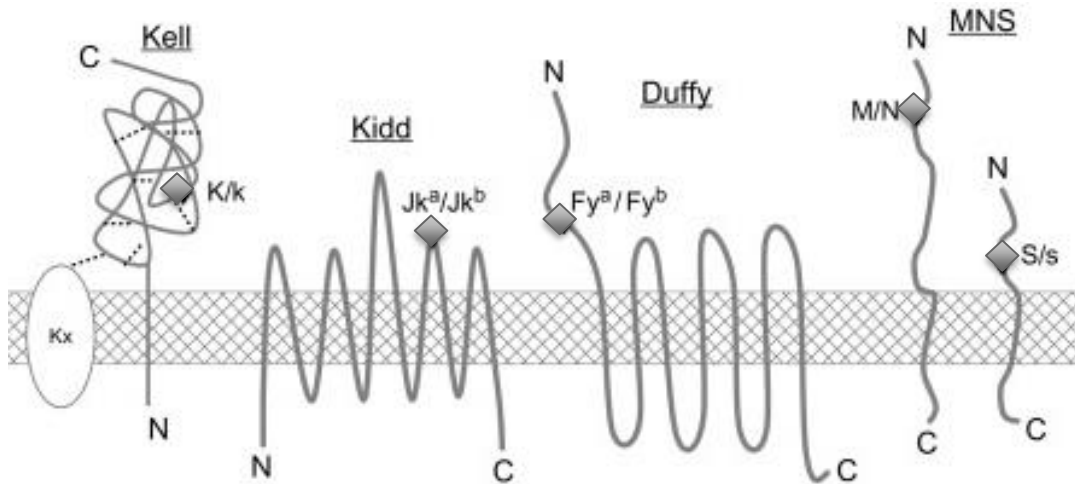


**HILA**

Molecular testing

# Red Blood Cell Transfusion

Most RBC antigens are SNPs, single nucleotide polymorphisms:



## Standard: **vERYfy**

Kell – K, k  
 Kidd – Jka, Jkb  
 Duffy – Fya, Fyb, FyX, FyGATA  
 MNS – M, N, S, s, Uvar  
 Rh – C, c, E, e  
 Dombrock – Doa, Dob

## HFA: **Rare**

Kell - Kpa, Kpb Jsa, Jsb  
 Colton – Coa, Cob  
 Lutheran – Lua, Lub  
 Diego – Dia, Dib, Wra, Wrb  
 Cartwright – Yta, Ytb  
 Knops – Kna, Knb

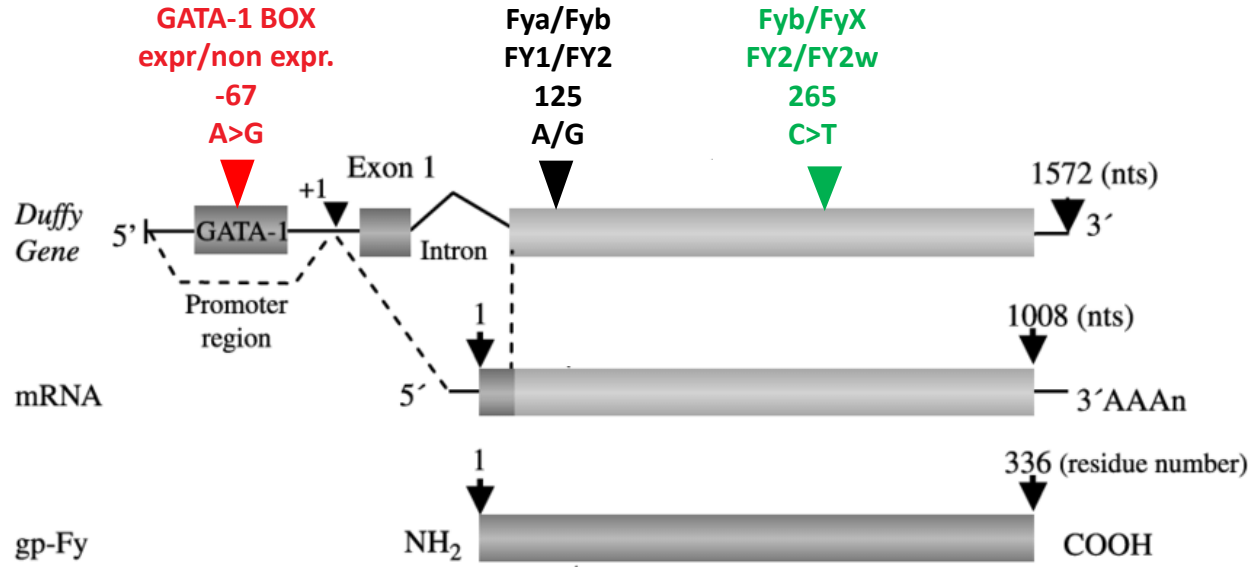
*Duffy?*



# Duffy

**Most frequent alleles can be discriminated by vERYfy:**

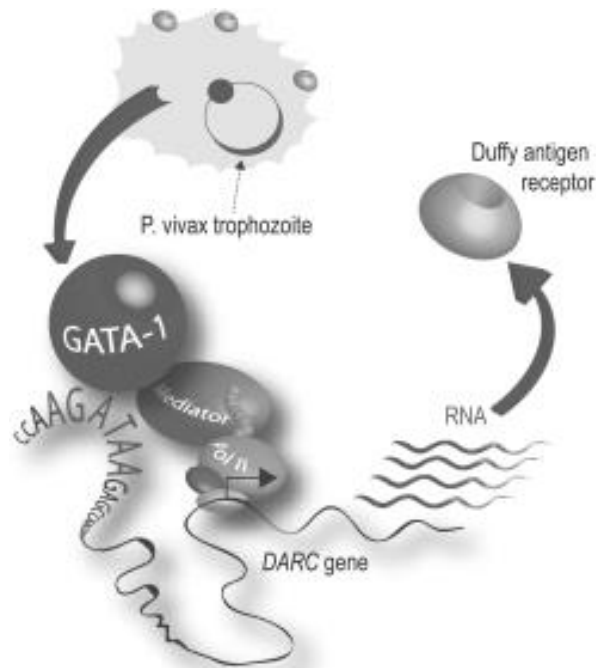
- FY\*01 : FYA
- FY\*02 : FYB
- **FY\*02W : FYX** = **Fyb weak: weak expression**
- **FY\*02N.01 : FYBNull (GATABOX)** = **FybNull, no expression on the RBC**



## FYBNull (GATA): FY\*02N.01 bij zwarten

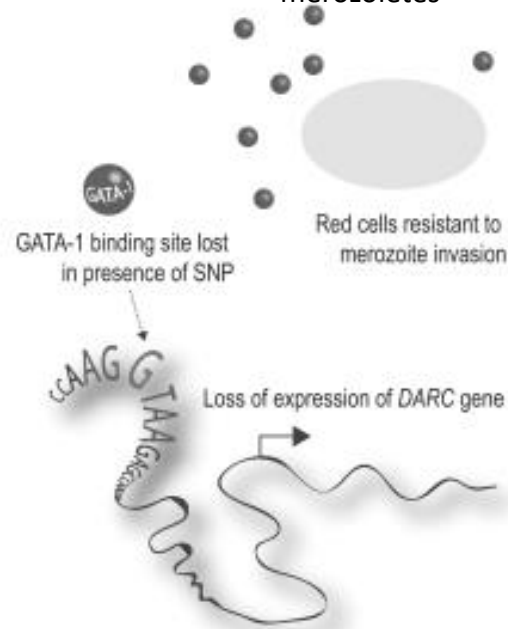
### GATA-1 box =

Binding site for the RBC transcription factor GATA-1  
→ mRNA  
→ expression of Duffy receptors on RBC  
= access gate for merozoite invasion in RBC



### Mutation G~~G~~T~~A~~

Binding site for the RBC transcription factor GATA-1  
is absent  
→ **no expression on the RBC**  
→ RBC are resistant to invasion of plasmodium merozoites



**!! Expression of Fyb on other tissues**

## RBC genotyping van Duffy

vERYfy

| SNP                          | Fya | Fyb | FyNullGATA | FyX<br>(Fybweak) |
|------------------------------|-----|-----|------------|------------------|
| 125A                         | X   |     |            |                  |
| 125G                         |     | X   | X          | X                |
| - 67C GATA-box mutatie       |     |     | X          |                  |
| - 67T WT GATA-box (non null) | X   | X   |            | X                |
| 265T                         |     |     |            | X                |



Homozygous FyGATA

No expression on the RBC, Fyb expression on other tissues.

**Negative reaction of BIORAD cel 8 (Fya-Fyb-) is not the result of anti-Fy.**

# ISBT 008: FY blood group alleles v6.1 30-NOV-2021

(ISBT 008) FY blood group alleles v6.1 30-NOV-2021

| Phenotype      | Allele name          | Nucleotide change | Exon<br>intron | Predicted amino<br>acid change | (Reference No.) PMID                            | Accession<br>number        | rs number |
|----------------|----------------------|-------------------|----------------|--------------------------------|-------------------------------------------------|----------------------------|-----------|
| FY:1 or FY(a+) | <b>FY*01 or FY*A</b> | c.125G            | 2              |                                | PMID: 8248172<br>PMID: 7705836<br>PMID: 7833467 | NG_011626.2<br>NM_002036   |           |
| FY:2 or FY(b+) | <b>FY*02 or FY*B</b> | c.125G>A          | 2              | p.Gly42Asp                     | PMID: 8248172<br>PMID: 7705836<br>PMID: 7833467 | U01839<br>X85785<br>S76830 | rs12075   |
| FY:-2,3        | <b>FY*02.01</b>      | c.126T>G          | 2              | p.Gly42Glu                     | PMID: 30848497                                  | MF1733403                  | n.a.      |

## Weak phenotypes

| Weak FY*01 phenotypes                |                  |                                              |   |                                                       |                                                 |          |                                                  |
|--------------------------------------|------------------|----------------------------------------------|---|-------------------------------------------------------|-------------------------------------------------|----------|--------------------------------------------------|
| Fy(a <sup>+</sup> )                  | <b>FY*01W.01</b> | c.265C>T                                     | 2 | p.Arg89Cys                                            | PMID: 26829175                                  | n.a.     | rs34599082                                       |
| Fy(a <sup>+</sup> )                  | <b>FY*01W.02</b> | c.265C>T<br>c.298G>A                         | 2 | p.Arg89Cys<br>p.Ala100Thr                             | PMID: 25092430                                  | KF784871 | rs34599082<br>rs13962                            |
| Fy(a <sup>+</sup> )                  | <b>FY*01W.03</b> | c.680G>A                                     | 2 | p.Gly227Glu                                           | (5), Abstract                                   | n.a.     | rs758564844                                      |
| Weak FY*02 phenotypes                |                  |                                              |   |                                                       |                                                 |          |                                                  |
| Fy(b <sup>+</sup> ), Fy <sup>c</sup> | <b>FY*02W.01</b> | c.125G>A<br>c.265C>T<br>c.298G>A             | 2 | p.Gly42Asp<br>p.Arg89Cys<br>p.Ala100Thr               | PMID: 9731074<br>PMID: 9746760<br>PMID: 9886340 | AF055992 | rs12075<br>rs34599082<br>rs13962                 |
| Fy(b <sup>+</sup> ), Fy <sup>c</sup> | <b>FY*02W.02</b> | c.125G>A<br>c.145G>T<br>c.265C>T<br>c.298G>A | 2 | p.Gly42Asp<br>p.Ala49Ser<br>p.Arg89Cys<br>p.Ala100Thr | PMID: 15569072                                  | n.a.     | rs12075<br>rs1307925062<br>rs34599082<br>rs13962 |
| Fy(b <sup>+</sup> )                  | <b>FY*02W.03</b> | c.125G>A<br>c.266G>A                         | 2 | p.Gly42Asp<br>p.Arg89His                              | (2), Abstract                                   | KY354073 | rs12075<br>rs371909350                           |
| Fy(b <sup>+</sup> )                  | <b>FY*02W.04</b> | c.125G>A<br>c.901C>T                         | 2 | p.Gly42Asp<br>p.Pro301Ser                             | (2), Abstract                                   | KY354074 | rs12075<br>rs753831902                           |
| Fy(b <sup>+</sup> )                  | <b>FY*02W.05</b> | c.125G>A<br>c.976C>T                         | 2 | p.Gly42Asp<br>p.Ser326Phe                             | GenBank Accession<br>number only                | HE572751 | rs12075<br>n.a.                                  |

## VERYfy

= SNP testing with test limitations

= covers most frequent Fy alleles.

Other null alleles do not share -67T mutation.

→ No true null phenotype with no expression.

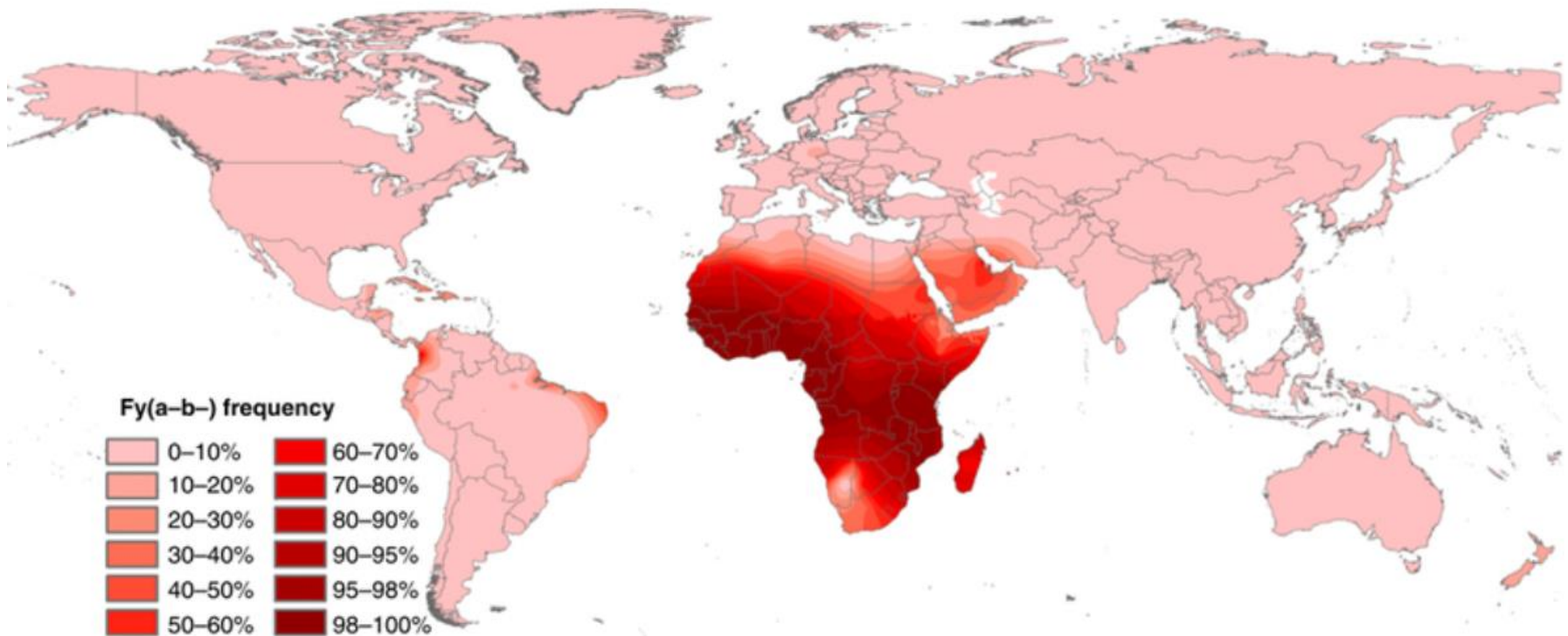
## Null phenotypes

| Phenotype                        | Allele name      | Nucleotide change            | Exon<br>intron | Predicted amino<br>acid change       | (Reference No.) PMID             | Accession<br>number  | rs number               |
|----------------------------------|------------------|------------------------------|----------------|--------------------------------------|----------------------------------|----------------------|-------------------------|
| Null phenotypes, FY*01 alleles   |                  |                              |                |                                      |                                  |                      |                         |
| Fy(a-b-)<br>erythroid cells only | <b>FY*01N.01</b> | c.-67T>C                     | Promoter       | p.0                                  | PMID: 10570183                   | AF100634             | rs2814778               |
| Fy(a-b-)                         | <b>FY*01N.02</b> | c.286_299del                 | 2              | p.Trp96_Thrfs*22                     | PMID: 7669660                    | KC924824             | rs587776507             |
| Fy(a-b-)                         | <b>FY*01N.03</b> | c.408G>A                     | 2              | p.Trp136Ter                          | PMID: 10691880                   | n.a.                 | n.a.                    |
| Fy(a-b-)                         | <b>FY*01N.04</b> | c.287G>A                     | 2              | p.Trp96Ter                           | PMID: 10691880<br>PMID: 25900316 | KC924825             | rs750052723             |
| Fy(a-b-)                         | <b>FY*01N.05</b> | c.327delC                    | 2              | p.Phe109Leufs*12                     | (1), Abstract                    | n.a.                 | n.a.                    |
| Fy(a-b-)                         | <b>FY*01N.06</b> | c.395G>A                     | 2              | p.Gly132Asp                          | PMID: 34570912                   | MZ448627             | rs530992295             |
| Fy(a-b-)                         | <b>FY*01N.07</b> | c.719delG                    | 2              | p.Gly240Alafs*4                      | PMID: 25900316                   | KC924823             | rs769160977             |
| Fy(a-b-)<br>erythroid cells only | <b>FY*01N.08</b> | c.-69T>C                     | Promoter       | p.0                                  | PMID: 26173389                   | KP967558<br>LN715170 | n.a.                    |
| Fy(a-b-)                         | <b>FY*01N.09</b> | c.296_496delinsAG<br>GCCACTG | 2              | p.Leu99_Leu165<br>delinsGlnAlaThrAla | (4), Abstract                    | n.a.                 | n.a.                    |
| Fy(a-b-)                         | <b>FY*01N.10</b> | c.762G>A                     | 2              | p.Trp254Ter                          | (6), Abstract                    | n.a.                 | rs766558424             |
| Fy(a-b-)                         | <b>FY*01N.11</b> | c.854delT                    | 2              | p.Leu285Argfs*2                      | PMID: 34570912                   | MZ448628             | rs763701958             |
| Null phenotypes, FY*02 alleles   |                  |                              |                |                                      |                                  |                      |                         |
| Fy(a-b-)<br>erythroid cells only | <b>FY*02N.01</b> | c.-57T>C<br>c.125G>A         | Promoter<br>2  | p.0<br>p.Gly42Asp                    | PMID: 7663520                    | X85785<br>MK813902   | rs2814778<br>rs12075    |
| Fy(a-b-)                         | <b>FY*02N.02</b> | c.125G>A<br>c.407G>A         | 2              | p.Gly42Asp<br>p.Trp136Ter            | PMID: 10691880                   | n.a.                 | rs12075<br>rs76819093   |
| Fy(a-b-)                         | <b>FY*02N.03</b> | c.125G>A<br>c.781G>A         | 2              | p.Gly42Asp<br>p.Gly261Arg            | PMID: 24845979                   | HG512885             | rs12075<br>n.a.         |
| Fy(a-b-)                         | <b>FY*02N.04</b> | c.125G>A<br>c.179_180delCT   | 2              | p.Gly42Asp<br>p.Ser60Cysfs*16        | PMID: 34570912                   | MZ448629             | rs12075<br>n.a.         |
| Fy(a-b-)                         | <b>FY*02N.05</b> | c.125G>A<br>c.895G>A         | 2              | p.Gly42Asp<br>p.Ala299Thr            | PMID: 34570912                   | MZ448631             | rs12075<br>rs752428245  |
| Fy(a-b-)                         | <b>FY*02N.06</b> | c.125G>A<br>c.151delT        | 2              | p.Gly42Asp<br>p.Cys51Alafs*24        | (3), Abstract                    | LN875782             | rs12075<br>n.a.         |
| Fy(a-b-)                         | <b>FY*02N.07</b> | c.124delG<br>c.125G>A        | 2              | p.Asp42Metfs*33<br>p.fs              | GenBank Accession<br>number only | KX018789             | n.a.<br>rs12075         |
| Fy(a-b-)                         | <b>FY*02N.08</b> | c.125G>A<br>c.400delT        | 2              | p.Gly42Asp<br>p.Cys134Valfs*14       | (7), Abstract<br>(6), Abstract   | MH211118             | rs12075<br>n.a.         |
| Fy(a-b-)                         | <b>FY*02N.09</b> | c.125G>A<br>c.214G>C         | 2              | p.Gly42Asp<br>p.Gly72Arg             | PMID: 34570912                   | MZ448630             | rs12075<br>rs1054826033 |

*Why is the BIORAD PANEL cell 8 (Fya-, Fyb-) negative?*



## Fya-Fyb-(GATA) population

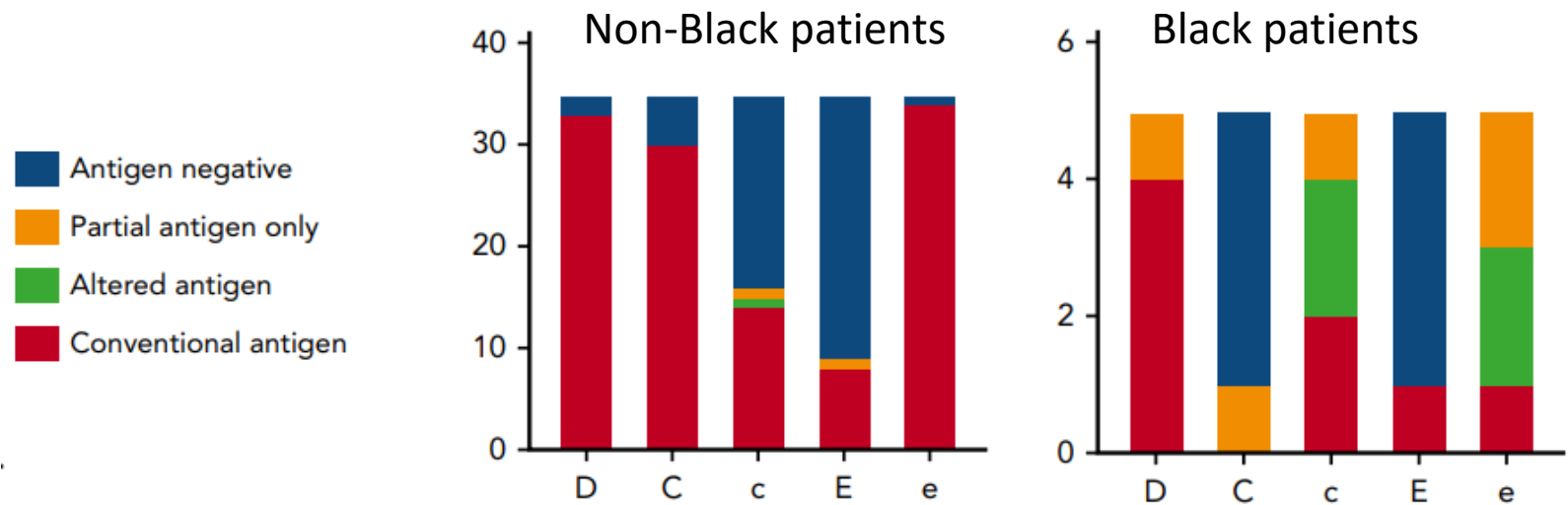


Regio: Sub Sahara Afrika

## RHD en RHCE varianten

*Waldis et al, 2020*

Population thalassemia patients, n=40



**Black patients:**

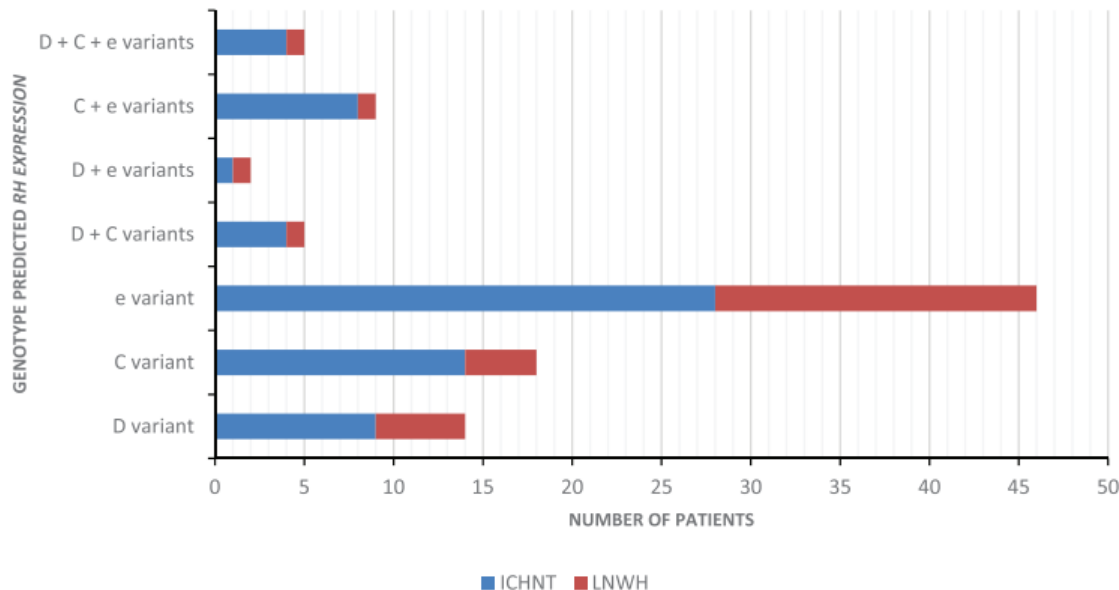
**High % partial and altered antigens in the RH-system.**

## RHD en RHCE varianten

### NHS study Hui *et al.* , 2021

Review the use of RBC genotyping in SCD patients at two London trusts (ICHNT, LNWH) with a focus on RH variants.

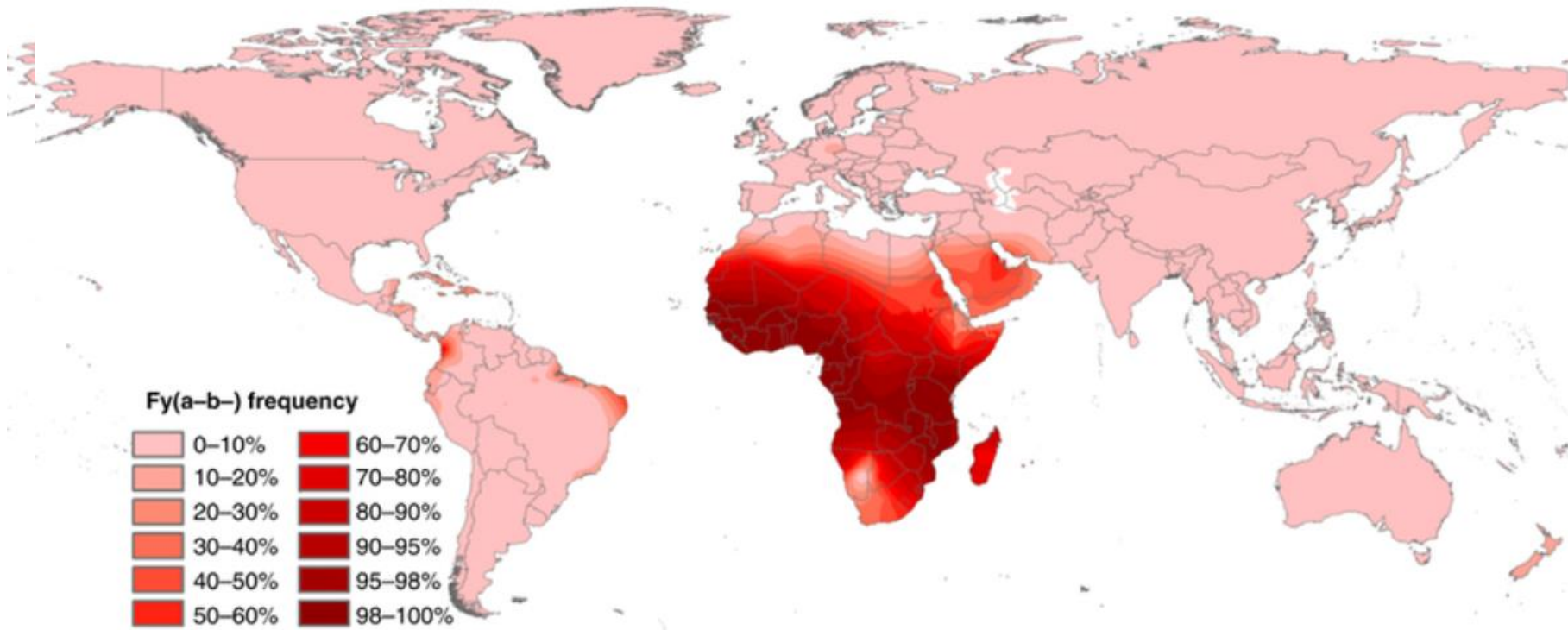
n= 828 SCD patients: adults and peds



59% of pts had genotyping

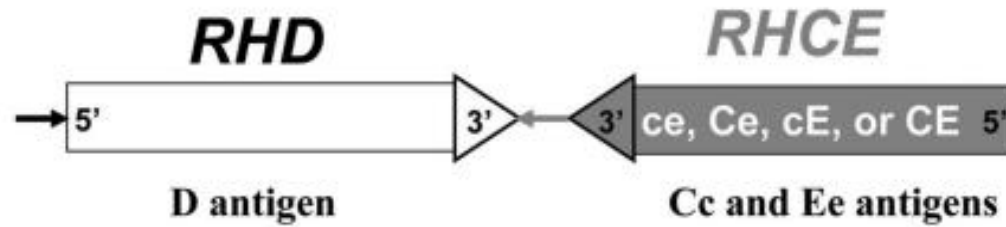
→ 20% had a RH variant or a combination of RH variants

## Fya-Fyb-(GATA) population



Black origin , Fya-, Fyb-: likely to have of RH variants

## RHD and RHCE



1p34-p36

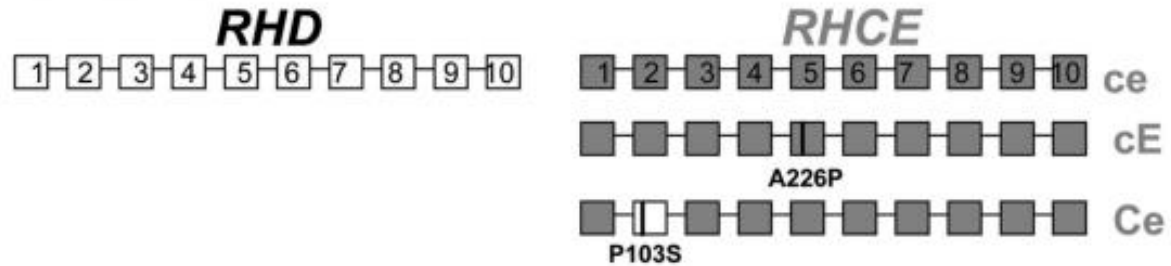
97% identical

differ by only 32–35 / 417 amino acids

56 antigens

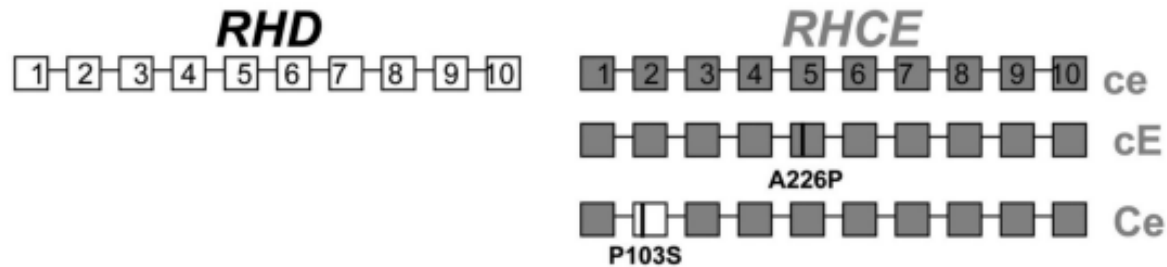
# RHD en RHCE genen

## A. Conventional Genes

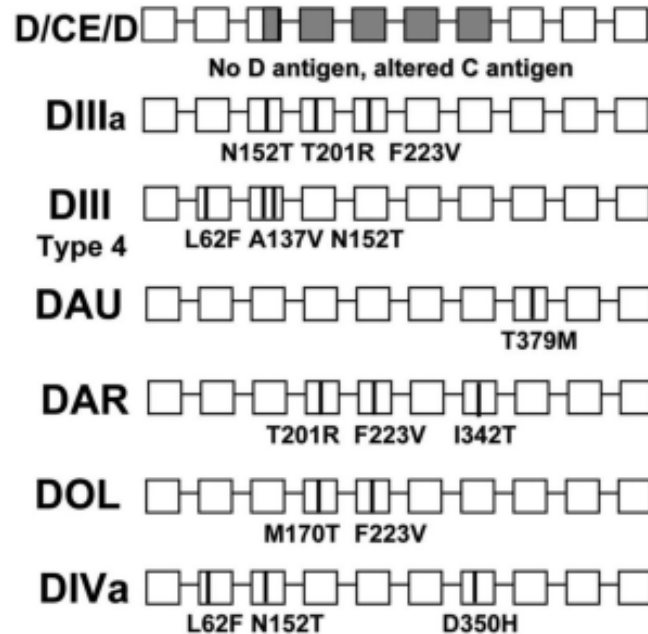


# RHD en RHCE genen

## A. Conventional Genes

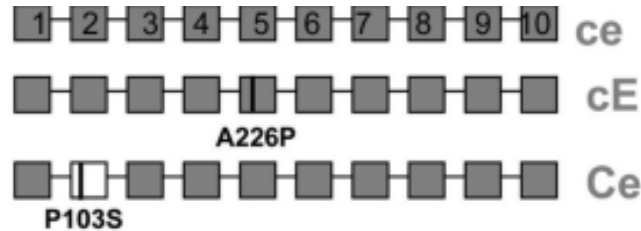


## B. Altered RHD Genes



*RHCE*:

- CcEe:



|           | Allel          | Fenotype: antigenen           |
|-----------|----------------|-------------------------------|
| <b>ce</b> | <i>RHCE*01</i> | RH:4 = c, RH:5 = e, RH:6 = ce |
| <b>cE</b> | <i>RHCE*03</i> | RH:4 = c, RH:3 = E, RH:27= cE |
| <b>Ce</b> | <i>RHCE*02</i> | RH:2 = C, RH:5 =e, RH:7 = Ce  |

- many other antigens:

High prevalence antigens present in most

Low prevalence antigens absent in most

SNPs cause:

- Weak expression CcEe
- Partial presentation CcEe
- **Absense of High Prevalence antigens**
- **Presence of Low Prevalence antigens**

## High prevalence antigens

High Prevalence antigens are antigens present in most of the population.  
SNPs in *RHCE*: high prevalence (HP) absent

### *High prevalence antigens*

*RH17 Hr0*  
*RH18 Hr (HrS ; Shabalala)*  
*RH19 hrS (Shabalala; e-like)*  
*RH26 (Deal; c-like)*  
*RH29 (Total Rh) – Resus null – D-C-c-E-e-*  
*RH31 hrB (Bastiaan; e-like)*  
*RH34 HrB (Bastiaan; Bas)*  
*RH39 (C-like)*  
*RH44 Nou*  
*RH46 Sec*  
*RH47 Dav*  
*RH51 MAR*  
*RH57 CEST*  
*RH58 CELO*  
*RH59 CEAG*  
*RH61 CEVF*  
*RH62 CEWA*

Example:

hrB (RH31) en HrB (RH34)

Prevalence

= ww: very high

= Sub Sahara Africa,

SCD populatie: up to 15% = negative

## High prevalence antigens

High Prevalence antigens are antigens present in most of the population.  
SNPs in *RHCE*: high prevalence (HP) absent

### *High prevalence antigens*

*RH17 Hr0*  
*RH18 Hr (HrS ; Shabalala)*  
*RH19 hrS (Shabalala; e-like)*  
*RH26 (Deal; c-like)*  
*RH29 (Total Rh) – Resus null – D-C-c-E-e-*  
*RH31 hrB (Bastiaan; e-like)*  
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*RH39 (C-like)*  
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*RH46 Sec*  
*RH47 Dav*  
*RH51 MAR*  
*RH57 CEST*  
*RH58 CELO*  
*RH59 CEAG*  
*RH61 CEVF*  
*RH62 CEWA*

Example:

hrB (RH31) en HrB (RH34)

Prevalence

= ww: very high

= Sub Sahara Africa,

SCD populatie: up to 15% = negative



Missing HP antigens in patients can result in allo immunisation when using HP positive blood units.

## Low prevalence antigens

SNPs in *RHCE*: presence of low prevalence (LP) antigens, which are absent in most of the population.

Within a specific population these LP antigens can be more frequent.

Table 3 Low prevalence antigens produced by *RH* alleles

| Low prevalence Antigens | Alleles reported to express the antigen                                                                                                                                                                                                         | References of antibodies to the Ag |
|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|
| RH8 (C <sup>W</sup> )   | <i>RHCE</i> *02.08.01 ( <i>RHCE</i> *CeCW) (150); <i>RHCE</i> *02.08.02 ( <i>RHCE</i> *CeNR) (151)                                                                                                                                              | (152-154)                          |
| RH9 (C <sup>h</sup> )   | <i>RHCE</i> *02.09 ( <i>RHCE</i> *CeCX) (150)                                                                                                                                                                                                   | (155)                              |
| → RH10 (V)              | See Table 4 (194,195)                                                                                                                                                                                                                           | (196)                              |
| RH11 (E <sup>W</sup> )  | <i>RHCE</i> *cEEW ( <i>RHCE</i> *03.01) (190)                                                                                                                                                                                                   | (197,198)                          |
| → RH20 (VS)             | See Table 4 (194,195)                                                                                                                                                                                                                           | (199)                              |
| RH23 (D <sup>W</sup> )  | <i>RHD</i> *05 (.01, .02, .04, .06, and .08) ( <i>RHD</i> *DV type 1, 2, 4, 6 and 8) (136); <i>RHD</i> *10.05 ( <i>RHD</i> *DAU5) (57); <i>RHD</i> *D-cE(5,6)-D (200)                                                                           | (201,202)                          |
| RH30 (Go <sup>a</sup> ) | <i>RHD</i> *04.01 ( <i>RHD</i> *DIVa) (21); <i>RHD</i> *1048C (123); <i>RHD</i> *712A,1048C (203)                                                                                                                                               | (204,205)                          |
| RH32                    | <i>RHCE</i> *CeRN ( <i>RHCE</i> *02.10.01) (206); <i>RHD</i> *14.01 and .02 ( <i>RHD</i> *DBT-1 and 2) (207)                                                                                                                                    | (208,209)                          |
| RH36 (Be <sup>a</sup> ) | <i>RHCE</i> *01.14 ( <i>RHCE</i> *ceBE) (210)                                                                                                                                                                                                   | (210-212)                          |
| RH40 (Tar)              | <i>RHD</i> *07.01 ( <i>RHD</i> *DVII) (213); <i>RHD</i> *07.02 ( <i>RHD</i> *DVII type 2) (214)                                                                                                                                                 | (215)                              |
| RH45 (Riv)              | Haplotype associating <i>RHD</i> *04.01 ( <i>RHD</i> *DIVa) and <i>RHCE</i> *DIVa(C)- (216)                                                                                                                                                     | (217)                              |
| RH48 (JAL)              | <i>RHCE</i> *01.20.07 ( <i>RHCE</i> *ceJAL) (173); <i>RHCE</i> *01.21 (.01 and .02) (218); <i>RHCE</i> *02.01 ( <i>RHCE</i> *CeMA or <i>RHCE</i> *CeJAL) (173,218)                                                                              | (173,219,220)                      |
| RH49 (STEM)             | <i>RHCE</i> *01.08 ( <i>RHCE</i> *ceBI), <i>RHCE</i> *01.09 ( <i>RHCE</i> *ceSM) (175)                                                                                                                                                          | (221)                              |
| RH54 (DAK)              | <i>RHCE</i> *CeRN ( <i>RHCE</i> *02.10.01) (67,222); <i>RHD</i> *12.02 ( <i>RHD</i> *DOL2) (175); <i>RHD</i> *03.01 ( <i>RHD</i> *DIIIa) (including with c.150C), <i>RHD</i> *03.07 ( <i>RHD</i> *DIII type 7), and <i>RHD</i> *186T (30,39,67) | (223)                              |
| RH55 (LOCR)             | <i>RHCE</i> *01.15 ( <i>RHCE</i> *ceLOCr) (224)                                                                                                                                                                                                 | (225)                              |

As all alleles have not been tested for all low prevalence antigens, the allele list for each antigen may not be comprehensive.

Example:

RH10 (V) en RH20 (VS):

Prevalence

WW = low

Sub Sahara Afrika:

SCD population: high up to tot 20%.

## Low prevalence antigens

SNPs in *RHCE*: presence of low prevalence (LP) antigens, which are absent in most of the population.

Within a specific population these LP antigens can be more frequent.

Table 3 Low prevalence antigens produced by *RH* alleles

| Low prevalence Antigens | Alleles reported to express the antigen                                                                                                                                                                                                         | References of antibodies to the Ag |
|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|
| RH8 (C <sup>W</sup> )   | <i>RHCE</i> *02.08.01 ( <i>RHCE</i> *CeCW) (150); <i>RHCE</i> *02.08.02 ( <i>RHCE</i> *CeNR) (151)                                                                                                                                              | (152-154)                          |
| RH9 (C <sup>Y</sup> )   | <i>RHCE</i> *02.09 ( <i>RHCE</i> *CeCX) (150)                                                                                                                                                                                                   | (155)                              |
| RH10 (V)                | See Table 4 (194,195)                                                                                                                                                                                                                           | (196)                              |
| RH11 (E <sup>W</sup> )  | <i>RHCE</i> *cEEW ( <i>RHCE</i> *03.01) (190)                                                                                                                                                                                                   | (197,198)                          |
| RH20 (VS)               | See Table 4 (194,195)                                                                                                                                                                                                                           | (199)                              |
| RH23 (D <sup>W</sup> )  | <i>RHD</i> *05 (.01, .02, .04, .06, and .08) ( <i>RHD</i> *DV type 1, 2, 4, 6 and 8) (136); <i>RHD</i> *10.05 ( <i>RHD</i> *DAU5) (57); <i>RHD</i> *D-cE(5,6)-D (200)                                                                           | (201,202)                          |
| RH30 (Go <sup>a</sup> ) | <i>RHD</i> *04.01 ( <i>RHD</i> *DIVa) (21); <i>RHD</i> *1048C (123); <i>RHD</i> *712A,1048C (203)                                                                                                                                               | (204,205)                          |
| RH32                    | <i>RHCE</i> *CeRN ( <i>RHCE</i> *02.10.01) (206); <i>RHD</i> *14.01 and .02 ( <i>RHD</i> *DBT-1 and 2) (207)                                                                                                                                    | (208,209)                          |
| RH36 (Be <sup>a</sup> ) | <i>RHCE</i> *01.14 ( <i>RHCE</i> *ceBE) (210)                                                                                                                                                                                                   | (210-212)                          |
| RH40 (Tar)              | <i>RHD</i> *07.01 ( <i>RHD</i> *DVII) (213); <i>RHD</i> *07.02 ( <i>RHD</i> *DVII type 2) (214)                                                                                                                                                 | (215)                              |
| RH45 (Riv)              | Haplotype associating <i>RHD</i> *04.01 ( <i>RHD</i> *DIVa) and <i>RHCE</i> *DIVa(C)- (216)                                                                                                                                                     | (217)                              |
| RH48 (JAL)              | <i>RHCE</i> *01.20.07 ( <i>RHCE</i> *ceJAL) (173); <i>RHCE</i> *01.21 (.01 and .02) (218); <i>RHCE</i> *02.01 ( <i>RHCE</i> *CeMA or <i>RHCE</i> *CeJAL) (173,218)                                                                              | (173,219,220)                      |
| RH49 (STEM)             | <i>RHCE</i> *01.08 ( <i>RHCE</i> *ceBI), <i>RHCE</i> *01.09 ( <i>RHCE</i> *ceSM) (175)                                                                                                                                                          | (221)                              |
| RH54 (DAK)              | <i>RHCE</i> *CeRN ( <i>RHCE</i> *02.10.01) (67,222); <i>RHD</i> *12.02 ( <i>RHD</i> *DOL2) (175); <i>RHD</i> *03.01 ( <i>RHD</i> *DIIIa) (including with c.150C), <i>RHD</i> *03.07 ( <i>RHD</i> *DIII type 7), and <i>RHD</i> *186T (30,39,67) | (223)                              |
| RH55 (LOCR)             | <i>RHCE</i> *01.15 ( <i>RHCE</i> *ceLOCR) (224)                                                                                                                                                                                                 | (225)                              |

As all alleles have not been tested for all low prevalence antigens, the allele list for each antigen may not be comprehensive.

Example:

RH10 (V) en RH20 (VS):

Prevalence

WW = low

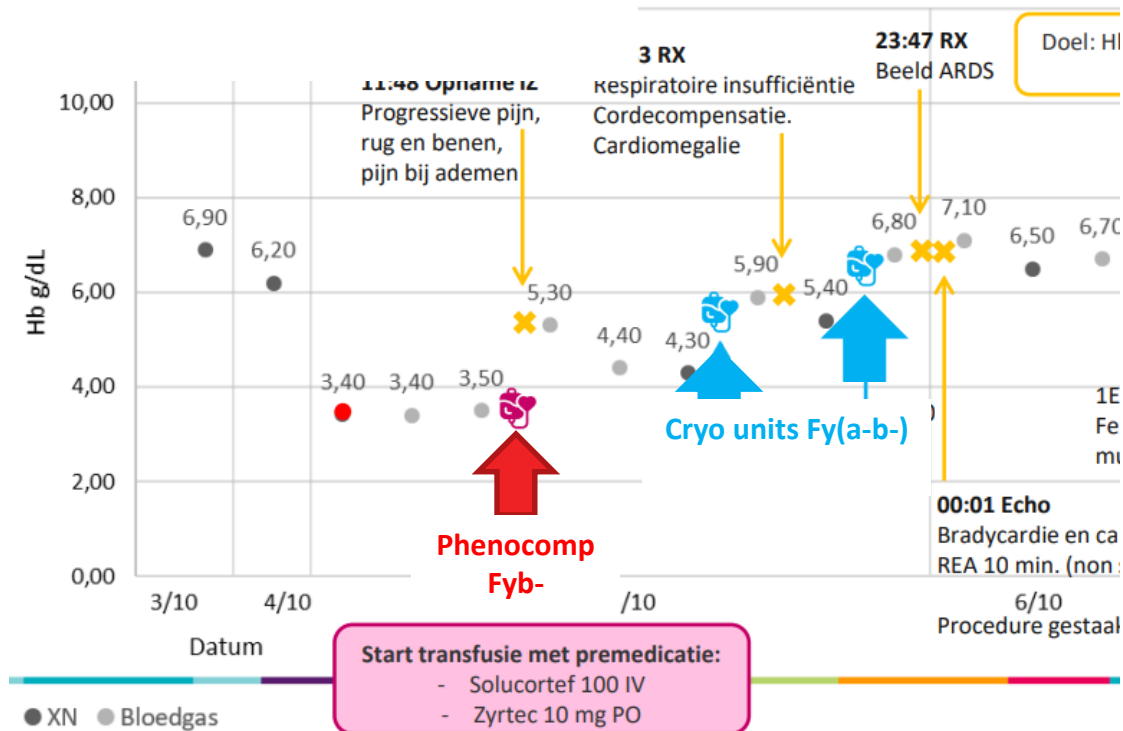
Sub Sahara Afrika:

SCD population: high up to tot 20%.



Using LP antigen positive donors can result in allo immunisation in patients that are LP antigen negative.

# Transfusion and hemoglobin concentration



**1st unit Caucasian:**  
RHCE with HP antigens

**2 cryo units Black:**  
RHCE variants:  
HP can be missing /  
LP can be present

What units is best depends  
on the patient RHCE  
genotype

*The presence of RHCE variants is a possible explanation for cel 8 being negative.*

## RHCE variant?

*Does BIORAD PANEL donor cell 8 have a RHCE variant with partial c or partial e expression and/or missing High Prevalence antigen?*

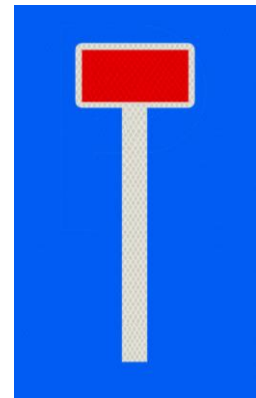
**BIORAD**

RHD/RHCE variant?

BIORAD has no genotyping information available and is not willing/able to send samples for genotyping.

**CAN BE IMPROVED !!**

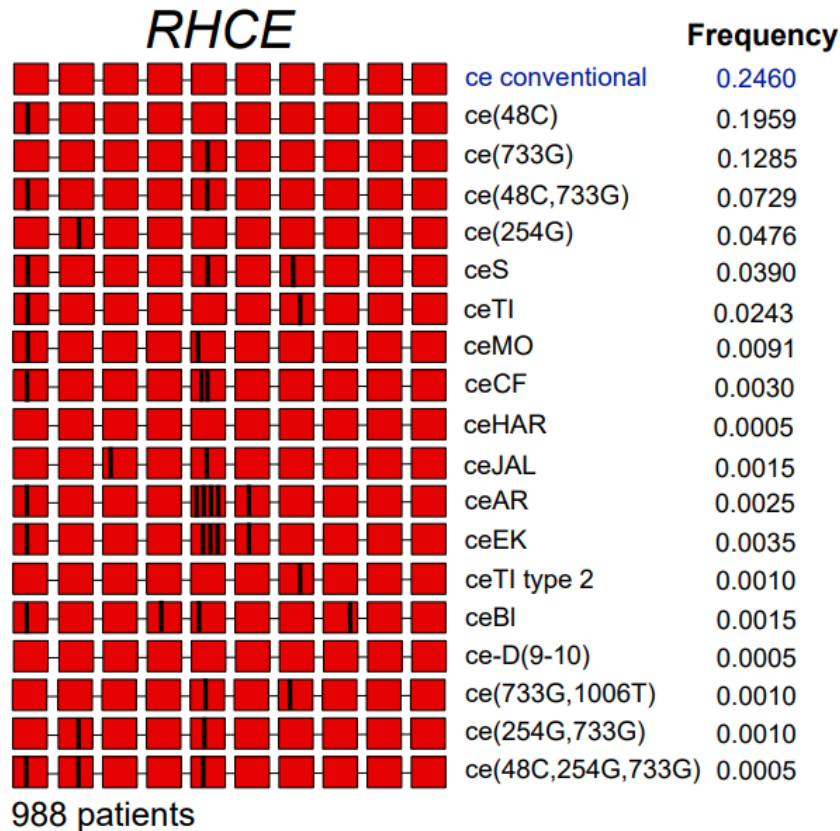
This information can be very helpfull.



## RHCE variant?

### 2) Does AK have a RHCE variant?

## RH heterogeneity in patients with SCD



- > 50% *RHCE* altered
  - some lack high prevalence  $hr^B$  and  $hr^S$
- > 30% *RHD* altered
- Patients with partial D, C, and e at risk for alloimmunization despite typing antigen+
- **RBC pheno-matched are not truly matched!**  
**Need of genotyping information!**

*Chou et al. , 2018*

## Extending RHCE genotyping, what do we need?

**1) What are the most important RHCE alleles with the highest risk of allo immunisation?**

Literature: often incomplete datasets, conflicting data.

**2) What are the most frequent RHCE variants?**

African American (AA) SCD populatie, Chou *et al.* 2018 & Chang *et al.* 2020

Antigen presentation and immunisation reports of the most frequent RHCE variants

Tabel will be published at our website: [Dienst voor het Bloed | Expertise \(rodekruis.be\)](#)  
begin 2023.

Which test meets our needs?

Sequencing

Extensive SNP testing: check all relevant SNPs of most common RHCE variants.

Minimal need = intermediate resolution, *Keller 2022*.

(AA populatie SCD, Chou *et al.* 2018 en Chang *et al.* 2020)

|                                        | Genotype         | Prevalence<br>CHOU 2018<br>SCP AA | Prevalence<br>CHIANG 2020<br>= 848 SCP AA | RH:4             | RH:5             | 48G | c.48G>C | 105T | 106 G>A | 122 A>G | 254C>G | 307C | 340C>T | 577A | 602 G>C | 667G | 667G>T | 676G | 676 G>C | 697C>G | 733C | 733C>G | 748 G>A | 916A>G | 941 T>C | 1006G | 1006 G>T | 1025C>T | 1132C>G | 109bp<br>ins |   |
|----------------------------------------|------------------|-----------------------------------|-------------------------------------------|------------------|------------------|-----|---------|------|---------|---------|--------|------|--------|------|---------|------|--------|------|---------|--------|------|--------|---------|--------|---------|-------|----------|---------|---------|--------------|---|
| ce                                     | RHCE*01          | 0.0499                            | 0.04                                      |                  |                  | E   |         |      |         |         |        | X    |        |      |         |      |        | X    |         |        |      |        |         |        |         |       |          |         |         |              |   |
| ce(48C) =<br>e+ weak                   | RHCE*01.01       | 0.1959                            | 0.23                                      |                  | w                |     | X       |      |         |         |        | X    |        |      |         |      |        | X    |         |        |      |        |         |        |         |       |          |         |         |              |   |
| ce<br>V501(733G)                       | RHCE*01.20.01    | 0.1285                            | 0.14                                      | p                | p                |     |         |      |         |         |        | X    |        |      |         |      |        | X    |         |        |      | X      |         |        |         |       |          |         |         |              |   |
| ce                                     | RHCE*02          | 0.0119                            | 0.018                                     |                  |                  |     | K       |      |         |         |        |      |        |      |         |      |        | X    |         |        |      |        |         |        |         |       |          |         |         |              | X |
| ce                                     | RHCE*03          | 0.0028                            | 0.01                                      |                  |                  | E   |         |      |         |         |        | X    |        |      |         |      |        | X    | X       |        |      |        |         |        |         |       |          |         |         |              |   |
| ce<br>V502(48C,733G)                   | RHCE*01.20.02    | 0.0729                            | 0.031                                     | p                | p                |     | X       |      |         |         |        | X    |        |      |         |      |        | X    |         |        |      | X      |         |        |         |       |          |         |         |              |   |
| ce(254G)<br>ceAG                       | RHCE*01.06.01    | 0.0476                            | 0.041                                     |                  | wp               |     |         |      |         |         | X      | X    |        |      |         |      |        | X    |         |        |      |        |         |        |         |       |          |         |         |              |   |
| ceV503, ceS                            | RHCE*01.20.03    | 0.039                             | 0.045                                     | p                | p                |     | X       |      |         |         |        | X    |        |      |         |      |        | X    |         |        |      | X      |         |        |         |       | X        |         |         |              |   |
| ceTI                                   | RHCE*01.02.01    | 0.0243                            | 0.012                                     | p                | p                |     | X       |      |         |         |        | X    |        |      |         |      |        | X    |         |        |      |        |         |        |         |       |          |         | X       |              |   |
| ceMO                                   | RHCE*01.07.01    | 0.0091                            | 0.011                                     | p                | wp               |     | X       |      |         |         |        | X    |        |      |         |      | X      | X    |         |        |      |        |         |        |         |       |          |         |         |              |   |
| ceEK                                   | RHCE*01.05.01    | 0.0035                            | 0.0017                                    | p                | wp               |     | X       |      |         |         |        | X    |        |      |         |      |        | X    |         |        |      |        |         |        |         |       |          |         |         |              |   |
| ce V506<br>ceCF                        | RHCE*01.20.06    | 0.003                             | 0.0023                                    | p                | p                |     | X       |      |         |         |        | X    |        |      |         |      |        | X    |         | X      |      | X      |         |        |         |       |          |         |         |              |   |
| ceAR                                   | RH*CE01.04.01    | 0.0025                            | 0.0006                                    | p                | p                |     | X       |      |         |         |        | X    |        |      |         |      |        | X    |         |        |      | X      |         | X      |         |       |          |         |         |              |   |
| ceBI                                   | RHCE*01.08       | 0.0015                            | 0.0023                                    |                  |                  |     | X       |      |         |         |        | X    |        |      |         |      |        | X    |         |        |      | X      |         |        | X       |       |          |         |         | X            |   |
| ceV507<br>ceJAL                        | RH*CE01.20.07    | 0.0015                            | 0.0006                                    | p weak<br>to neg | p weak<br>to neg |     |         |      |         |         |        | X    | X      |      |         |      |        | X    |         |        |      | X      |         |        |         |       |          |         |         | X            |   |
| ceV504,<br>ceTI type 2                 | RHCE*01.20.04.01 | 0.001                             | 0.0006                                    |                  | p                |     | X       |      |         |         |        | X    |        |      |         |      |        | X    |         |        |      | X      |         |        |         |       |          |         | X       |              |   |
| ceRN<br>Ce.10.01                       | RHCE*Ce.10.01    |                                   |                                           |                  |                  |     |         |      |         |         |        |      |        | X    | X       |      |        |      |         |        |      | X      |         |        |         |       |          |         |         |              |   |
| ce                                     | RHCE*04          | 0.0011                            |                                           |                  |                  |     | K       |      |         |         |        |      |        |      |         |      |        |      | X       |        |      |        |         |        |         |       |          |         |         |              | X |
| NO ISBT,<br>proposed:<br>RHCE*ce.01_02 | RHCE*01.01.02    |                                   | 0.03                                      |                  |                  |     | X       | X    |         |         |        |      |        |      |         |      |        | X    |         |        |      |        |         |        |         |       |          |         |         |              |   |
| ce(254G,733G)                          | RHCE*01.06.02    |                                   |                                           |                  | p                |     |         |      |         |         | X      | X    |        |      |         |      |        | X    |         |        |      | X      |         |        |         |       |          |         |         |              |   |
| ceVS.05<br>ce(733G,1006T)              | RHCE*01.20.05    |                                   | 0.0017                                    |                  | p                |     |         |      |         |         |        | X    |        |      |         |      |        | X    |         |        |      | X      |         |        |         |       | X        |         |         |              |   |
| ceV509                                 | RHCE*01.20.09    |                                   | 0.027                                     |                  |                  |     | X       |      |         |         |        |      |        |      |         |      |        |      |         |        |      | X      |         |        |         | X     |          |         |         |              |   |
| ceHAR                                  | RHCE*01.22.01    |                                   |                                           |                  | weak             |     |         |      |         |         |        | X    |        |      |         |      | X      | X    |         | X      |      | X      |         |        |         |       |          |         |         |              |   |
| ceSM                                   |                  |                                   |                                           |                  |                  |     |         |      |         |         |        | X    |        |      |         |      |        | X    |         |        |      | X      |         |        |         |       |          |         |         |              |   |

# RHCE variant?

## LinkSeq RBC genotyping RUO

**SureTyper™ Blood** Test Result Details

Rare Alleles: ☒ Shown Negative Assays: ☒ Shown

**TEST RESULT FOR RhCE**

Genotype — **RHCE\*01 RHCE\*01.20.01**  
 Phenotype — **C-,E-,cp,ep,Cw-,Cx-,V+,hrS+,VS+,hrBw,Crawford-**

*This is a clean test result.*

Genotype — RHCE\*01 RHCE\*01.20.01 | Phenotype — C-,E-,cp,ep,Cw-,Cx-,V+,hrS+,VS+,hrBw,Crawford- CC ⓘ

| GROUP                         | ALLELES               | C | E | c | e | Cw | Cx | V | hrS | VS | hrB | CF |
|-------------------------------|-----------------------|---|---|---|---|----|----|---|-----|----|-----|----|
| RHCE*01<br>1 common<br>4 rare | <b>RHCE* 01.20.01</b> | - | - | p | p | -  | -  | + | +   | +  | w   | -  |
|                               | RHCE* 01.22d, 01.25d  | - | - | + | w | -  | -  | - | +   | -  | +   | -  |
|                               | RHCE* 01.29d          | - | - | + | - | -  | -  | - | +   | -  | +   | -  |
|                               | RHCE* 01.34e          | - | - | p | - | -  | -  | - | +   | -  | +   | -  |
| RHCE*01<br>1 common           | <b>RHCE* 01.20.01</b> | - | - | p | p | -  | -  | + | +   | +  | w   | -  |

*This genotype consists of alleles from a single group.*

Cannot exclude the following RARE alleles from another locus:  
 RHD\*01N.42e, RHD\*01N.43e, RHD\*03.02e, RHD\*17.02d, RHD\*17.05e, RHD\*45e, RHD\*58e

AK

**Homozygous: RHCE\*01.20.01**

Antigen presentation and immunisation reports of the most frequent RHCE variants

Tabel will be published at our website: [Dienst voor het Bloed | Expertise \(rodekruis.be\)](#)  
begin 2023.

# RHCE variant?

## LinkSeq RBC genotyping RUO

**SureTyper™ Blood** Test Result Details

Rare Alleles: ☒ Shown Negative Assays: ☒ Shown

**TEST RESULT FOR RhCE**

Genotype — **RHCE\*01 RHCE\*01.20.01**  
 Phenotype — **C-,E-,cp,ep,Cw-,Cx-,V+,hrS+,VS+,hrBw,Crawford-**

*This is a clean test result.*

Genotype — RHCE\*01 RHCE\*01.20.01 | Phenotype — C-,E-,cp,ep,Cw-,Cx-,V+,hrS+,VS+,hrBw,Crawford- CC ⓘ

| GROUP                         | ALLELES              | C | E | c | e | Cw | Cx | V | hrS | VS | hrB | CF |
|-------------------------------|----------------------|---|---|---|---|----|----|---|-----|----|-----|----|
| RHCE*01<br>1 common<br>4 rare | RHCE* 01.20.01       | - | - | p | p | -  | -  | + | +   | +  | w   | -  |
|                               | RHCE* 01.22d, 01.25d | - | - | + | w | -  | -  | - | +   | -  | +   | -  |
|                               | RHCE* 01.29d         | - | - | + | - | -  | -  | - | +   | -  | +   | -  |
|                               | RHCE* 01.34e         | - | - | p | - | -  | -  | - | +   | -  | +   | -  |
| RHCE*01<br>1 common           | RHCE* 01.20.01       | - | - | p | p | -  | -  | + | +   | +  | w   | -  |

*This genotype consists of alleles from a single group.*

Cannot exclude the following RARE alleles from another locus:  
 RHD\*01N.42e, RHD\*01N.43e, RHD\*03.02e, RHD\*17.02d, RHD\*17.05e, RHD\*45e, RHD\*58e

**AK**

**Homozygous: RHCE\*01.20.01**

- Presence of LP antigenen V (RH10) and VS (RH20)
- Low expression of HP antigen hrB (RH31): anti hrB?
- partial c (RH4): anti-c ?
- partial e (RH5): anti-e ?



## Transfusion policy

**IH, serology:**

**auto-antibodies with a broad specificity**, possible anti-e

**HILA, genotyping:**

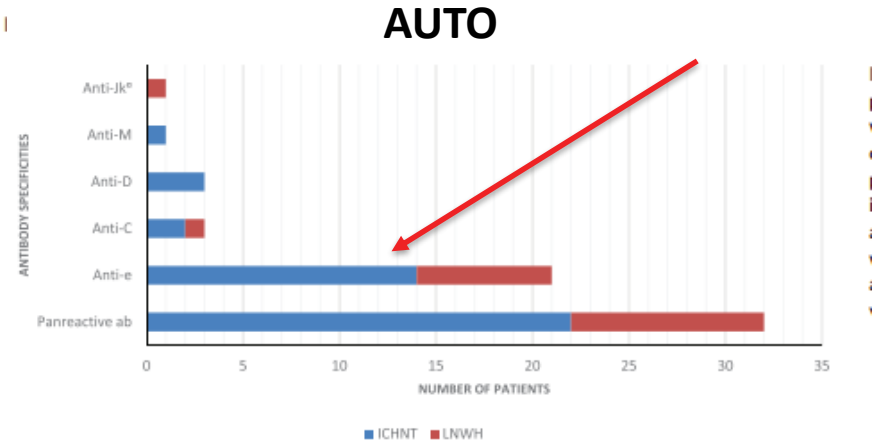
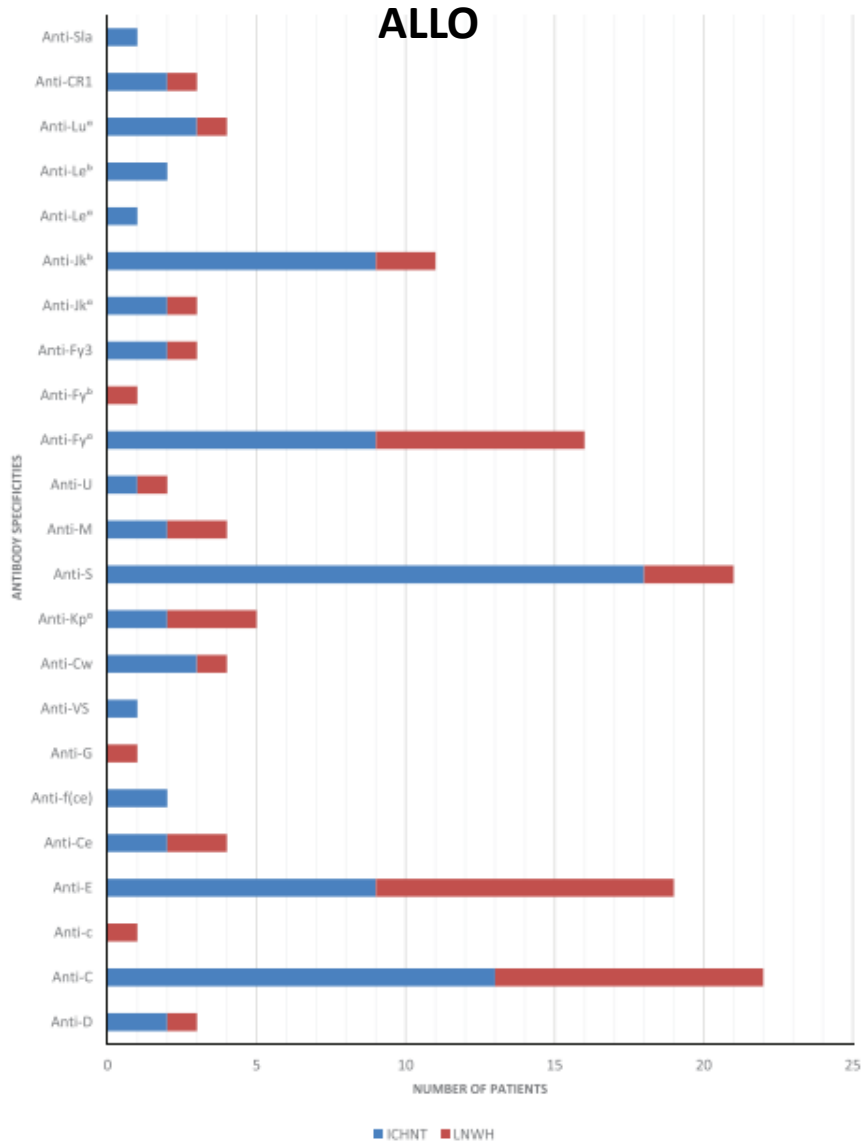
Possible rhesus antibodies

**anti-e?**

# Hui *et al.* 2021

SCD population n= 828,

59% genotyped



## Transfusion policy

### IH, serology:

**auto-antibodies with a broad specificity**, possible anti-e

### HILA, genotyping:

Possible rhesus antibodies

anti-e: Floch *et al.* 2018; Hiu *et al* 2020: auto

### Anti-hrB ?

Molecular basis of the hrB phenotype is complex/unclear.

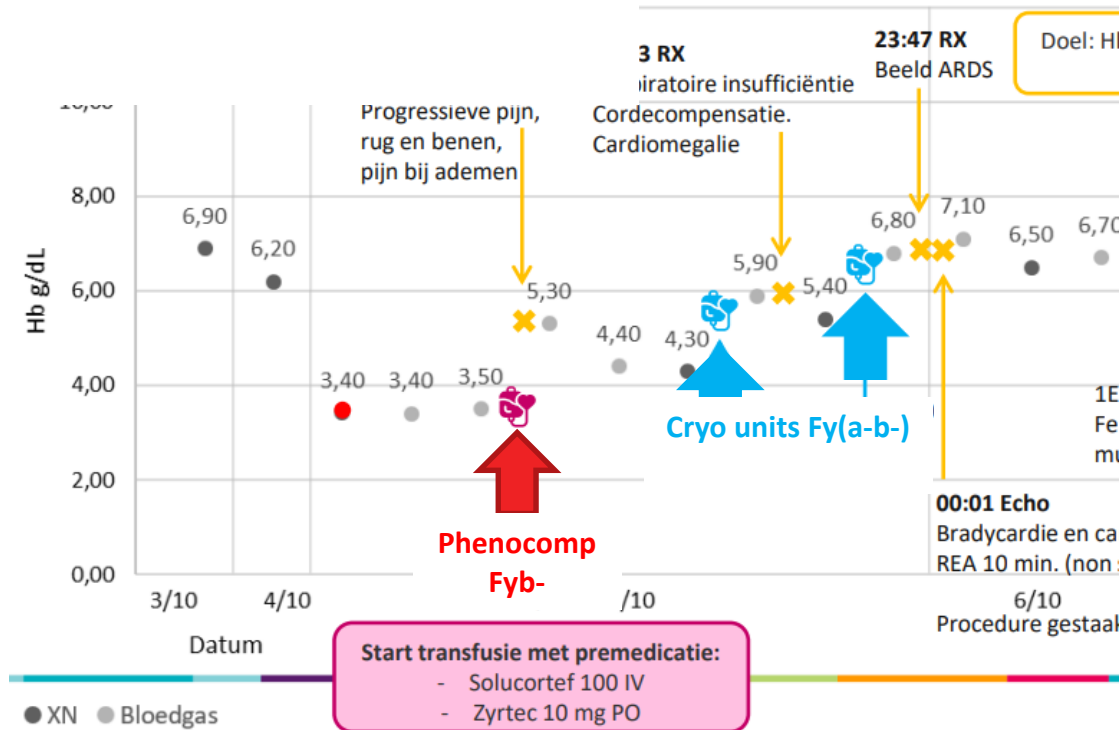
733G:

Not all alleles with this 733G are hrB-

Some alleles are hrB- and do not carry this mutation.

Weak expression of hrB- can result in a risk of alloimmunisation (*Keller 2019*)

# Transfusion and hemoglobin concentration



**1st unit Caucasian:**  
RHCE with HP antigens, including hrB

X

**2 cryo units Black:**  
RHCE variants with missing HP or extra LP

?

Genotyping results of donors unknown...

After the cryo units the Hb level stayed more stable.

Patient had to stay a long time at the hospital due to other complications.

## 2 important lessons learned

1) Improve matching of red blood cell transfusion in patients with chronic transfusion need, originating from Sub-Saharan Africa

2) Genotyping our Black African donor population for RHD and RHCE.

Can we better match for RHCE?

**“FINDING A NEEDLE  
IN A HAYSTACK”**



## Red Cross Flanders donors

= Mainly Caucasian

Origin of donors is not systematically registered

# International Rare Donor Program



## International Rare Donor Panel

The International Rare Donor Panel (IRDP) was conceived under a joint World Health Organisation (WHO) and ISBT initiative in 1965 to facilitate the rapid location and exchange of rare blood between countries.

The panel currently contains details of rare donors from 27 contributing countries and also frozen unit inventories from frozen blood banks around the world. The compilation and maintenance of the IRDP is carried out by the Red Cell Reference department of the IBGRL in Bristol, UK.



## International Rare Donor Panel

The IRDP database can only be accessed by authorised users.

Access the  
database

Access to this database is restricted to medical professionals who may be required to source rare blood for clinical use only. To request an account or for additional assistance please complete our [online contact form](#).

## International Rare Donor Program

Main request @ IDRP for RHCE = missing high prevalence antigens: hrB and hrS

Genotyping patients at intermediate resolution is required.

Minimal requirements for hrB –

RHCE c.48G>C, c.340C>T, c.697C>G, c.712A>G, c.733C>G, c.1006G>T and c.1025C>T

Minimal requirements for hrS -

RHCE c.48G>C, c.667G>T, c.712A>G, 818C>T and 916A>G

→ Identify donors with the same or similar RH variant alleles.

## Future strategy

2) Pro Acive improve genotyping resolution of patients with hemoglobinopathies for RHD and RHCE at intermediate resolution.

LinkSeq RBC genotyping: product is stopped.

## Future strategy

1) Improve genotyping resolution of patients with hemoglobinopathies for RHD and RHCE at intermediate resolution.



CDE eXtend:

addition of relevant SNPs

|                                            |        | Prevalence<br>CHANG<br>2020<br>n= 848 SCD<br>AA | LINKSEQ    | 48G | c48G>C | 105T | 106 G>A | 122 A>G | 254C>G | 307C | 340C>T | 577A | 602 G>C | 667G | 676G | 676 G>C | 697C>G | 712A>G | 712A | 733C>G | 733C | 748 G>A | 787A>G | 800T>A | 818C>T | 916A>G | 939G>A/C | 941 T>C | 1006 G>T | 1025C>T | 109bp ins | 335+3039ins10<br>9 |
|--------------------------------------------|--------|-------------------------------------------------|------------|-----|--------|------|---------|---------|--------|------|--------|------|---------|------|------|---------|--------|--------|------|--------|------|---------|--------|--------|--------|--------|----------|---------|----------|---------|-----------|--------------------|
|                                            |        |                                                 | CDE EXTEND | 48G | 48G>C  |      | 106G>A  | 122A>G  | 254C>G | 307C | 340C>T | 577A | 577G    | 667G | 676G | 676G>C  | 697C>G | 712A>G | 712A | 733C>G | 733C |         | 787A>G | 800T>A | 818C>T | 916A>G | 939G>A/C |         | 1006G>T  | 1025C>T | 1025C     |                    |
| ce(48C) =<br>e+ weak                       | 0,23   |                                                 |            |     | x      |      |         |         |        | x    |        |      |         |      | x    |         |        |        |      |        |      |         |        |        |        |        |          |         |          |         |           |                    |
| ce                                         | 0,2    |                                                 |            |     |        |      |         |         |        |      |        |      |         |      |      |         |        |        |      |        |      |         |        |        |        |        |          |         |          |         |           |                    |
| ce                                         | 0,18   |                                                 |            |     |        |      |         |         |        |      |        |      |         |      |      |         |        |        |      |        |      |         |        |        |        |        |          |         |          |         |           |                    |
| ce<br>VS01(733G<br>)                       | 0,14   |                                                 |            |     |        |      |         |         |        | x    |        |      |         |      | x    |         |        |        |      | x      |      |         |        |        |        |        |          |         |          |         |           |                    |
| ce                                         | 0,1    |                                                 |            |     |        |      |         |         |        | x    |        |      |         |      |      |         |        |        |      |        |      |         |        |        |        |        |          |         |          |         |           |                    |
| ceVS03, ceS                                | 0,045  |                                                 |            |     | x      |      |         |         |        | x    |        |      |         |      | x    |         |        |        |      | x      |      |         |        |        |        |        |          |         | x        |         |           |                    |
| ce(254G)<br>ceAG                           | 0,041  |                                                 |            |     |        |      |         |         | x      | x    |        |      |         |      | x    |         |        |        |      |        |      |         |        |        |        |        |          |         |          |         |           |                    |
| ce<br>VS02(48C,7<br>33G)                   | 0,031  |                                                 |            |     | x      | x    |         |         |        | x    |        |      |         |      | x    |         |        |        |      | x      |      |         |        |        |        |        |          |         |          |         |           |                    |
| NO ISBT,<br>proposed:<br>RHCE*ce.01<br>.02 | 0,03   |                                                 |            |     | x      |      |         |         |        |      |        |      |         |      |      |         |        |        |      |        |      |         |        |        |        |        |          |         |          |         |           |                    |
| ceVS09                                     | 0,027  |                                                 |            |     | x      |      |         |         |        |      |        |      |         |      |      |         |        |        |      |        |      |         |        |        |        |        |          | x       |          |         |           |                    |
| ce.04                                      | 0,017  |                                                 |            |     |        |      |         |         |        |      |        |      |         |      |      |         |        |        |      |        |      |         |        |        |        |        |          |         |          |         |           |                    |
| ceTI                                       | 0,012  |                                                 |            |     | x      |      |         |         |        | x    |        |      |         |      | x    |         |        |        |      |        |      |         |        |        |        |        |          |         |          |         | x         |                    |
| ceMO                                       | 0,011  |                                                 |            |     | x      |      |         |         |        | x    |        |      |         |      | x    | x       |        |        |      |        |      |         |        |        |        |        |          |         |          |         |           |                    |
| ce VS06<br>ceCF                            | 0,0023 |                                                 |            |     | x      |      |         |         |        | x    |        |      |         |      | x    |         | x      |        |      |        |      |         |        |        |        |        |          |         |          |         |           |                    |
| ceBI                                       | 0,0023 |                                                 |            |     | x      |      |         |         |        | x    |        |      |         |      | x    |         |        |        |      |        |      |         |        |        | x      |        |          |         |          |         |           | x                  |
| ceEK                                       | 0,0017 |                                                 |            |     | x      |      |         |         |        | x    |        |      |         |      | x    |         |        |        |      |        |      |         |        |        |        |        |          |         |          |         |           |                    |
| ceVS.05<br>ce(733G,10<br>06T)              | 0,0017 |                                                 |            |     |        |      |         |         |        | x    |        |      |         |      | x    |         |        |        |      | x      |      |         |        |        |        |        |          |         | x        |         |           |                    |
| CE                                         | 0,0011 |                                                 |            |     | x      |      |         |         |        |      |        |      |         |      |      | x       |        |        |      |        |      |         |        |        |        |        |          |         |          |         |           |                    |
| ceAR                                       | 0,0006 |                                                 |            |     | x      |      |         |         |        | x    |        |      |         |      | x    |         |        |        |      | x      |      |         |        |        |        | x      |          |         |          |         |           |                    |
| ceVS04,<br>ceTI type 2                     | 0,0006 |                                                 |            |     | x      |      |         |         |        | x    |        |      |         |      | x    |         |        |        |      | x      |      |         |        |        |        |        |          |         |          |         | x         |                    |
| ceVS07<br>ceJAL                            | 0,0006 |                                                 |            |     |        |      |         |         |        | x    | x      |      |         |      | x    |         |        |        |      | x      |      |         |        |        |        |        |          |         |          |         |           |                    |
| ce(254G,73<br>3G)                          |        |                                                 |            |     |        |      |         |         | x      | x    |        |      |         |      | x    |         |        |        |      | x      |      |         |        |        |        |        |          |         |          |         |           |                    |
| ce(48C,254<br>G,733G)                      |        |                                                 |            |     |        |      |         |         |        | x    |        |      |         |      | x    |         |        |        |      |        |      |         |        |        |        |        |          |         |          |         |           |                    |
| Ce.10.02                                   |        |                                                 |            |     |        |      |         |         |        |      |        | x    | x       |      |      |         |        |        |      |        |      |         |        |        |        |        |          |         |          |         |           |                    |
| ce-D(9-10)                                 |        |                                                 |            |     |        |      |         |         |        | x    |        |      |         |      | x    |         |        |        |      |        |      |         |        |        |        |        |          |         |          |         |           |                    |
| ceHAR                                      |        |                                                 |            |     |        |      |         |         |        | x    |        |      |         |      | x    | x       |        |        |      | x      |      |         |        |        |        |        |          |         |          |         |           |                    |
| CeRN<br>Ce.10.01                           |        |                                                 |            |     |        |      |         |         |        |      |        | x    | x       |      |      |         |        |        |      |        |      |         |        |        |        |        |          |         |          |         |           |                    |
| ceSM                                       |        |                                                 |            |     |        |      |         |         |        | x    |        |      |         |      | x    |         |        |        |      |        |      |         |        |        |        | x      |          |         |          |         |           |                    |

The New CDE Extend will allow to discriminate  
the most frequent/important RHCE alleles

## Future strategy

1) Improve genotyping resolution of patients with hemoglobinopathies for RHD and RHCE at intermediate resolution.



CDE eXtend: addition of relevant SNPs

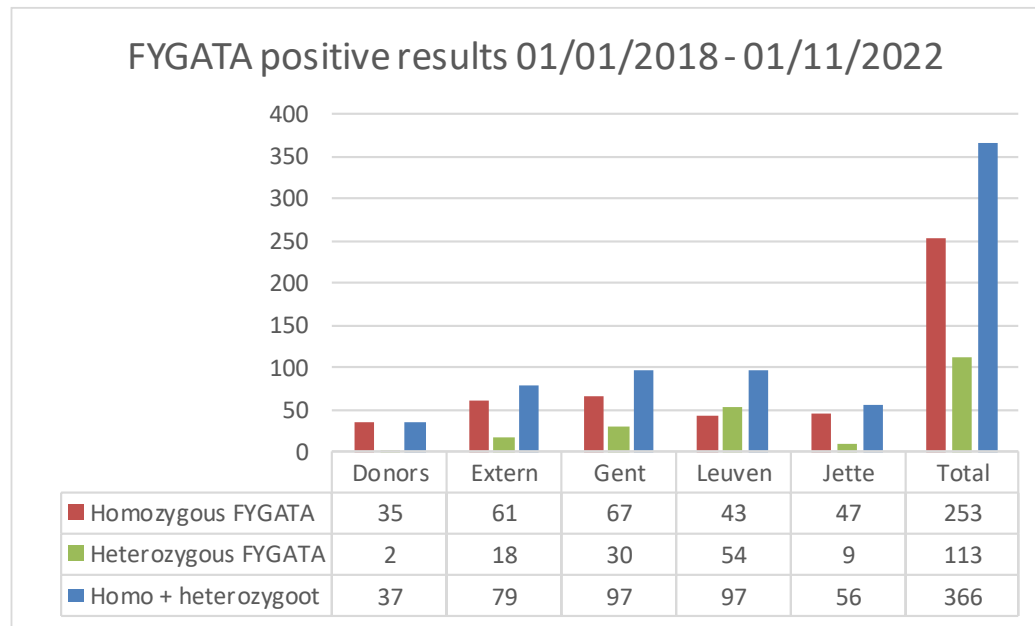
Meet the minimal requirements for hrB-, hrS-

**Allowing to set up a personalized transfusion protocol with compatible donor requirements.**

| RHCE SNPs      | hrB- | hrS- | CDE eXtend |
|----------------|------|------|------------|
| 48G            |      |      | in kit     |
| 48G>C          | X    | X    | in kit     |
| 106G>A         |      |      | developed  |
| 122A>G         |      |      | in kit     |
| 254C>G         |      |      | in kit     |
| 307C           |      |      | in kit     |
| 335+3039ins109 |      |      | in kit     |
| 340C>T         | X    |      | in R&D     |
| 340C           |      |      | in R&D     |
| 577G           |      |      | developed  |
| 577A           |      |      | developed  |
| 667G>T         |      | X    | in R&D     |
| 667G           |      |      | developed  |
| 676G>C         |      |      | in kit     |
| 697C>G         | X    |      | in R&D     |
| 697C           |      |      | developed  |
| 712A>G         | X    | X    | developed  |
| 712A           |      |      | developed  |
| 733C>G         | X    |      | in kit     |
| 733 C          |      |      | developed  |
| 787A>G         |      |      | developed  |
| 800T>A         |      |      | developed  |
| 818C>T         |      | X    | in R&D     |
| 916A>G         |      | X    | developed  |
| 939G>A/C       |      |      |            |
| 1006G>T        | X    |      | in kit     |
| 1006G          |      |      | developed  |
| 1025C>T        | X    |      | developed  |
| 1025C          |      |      | developed  |

## Future strategy

2) Genotype our Black African donors  
proxy FYGATA



Future: systematically register origin donors.

3) Genotype 10 000 random donors to find more rare bloodgroups not only for RHCE.

## What we learned

### 1) For patients with black origin

- Caucasian donors can be unfeasable
- Not all Black donors are suitable
- Need intermediate genotyping results of RHCE of patients to setup a personalized transfusion protocol.

### 2) Register the ethnicity of our donors

Genotype donors from African origin for RHCE at intermediate resolution: Set up Rare donor panel for RHCE.

### 3) Future sequencing?



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Dorien Leenaerts  
Sarah Mahieu  
Tom Eyckmans



Marie-Paule Emonds  
Johan Beert  
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