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# Ethnische Diversivität und deren Folgen für die erythrozytäre Versorgung von Patienten

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AKH, Kliniken am Südgarten, 26.11.2012

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# Content

1 Introduction

2 Antibody specificities to high frequency antigens: incidence in Europe

3 Impact of migration

4 DNA based donor screening programs

5 Necessity, to screen for HFA-neg in ethnic minorities

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# Patients with red cell antibodies

## Prevalence of the compatible blood type

Two situations may challenge an adequate blood supply:

- Multiple antibody specificities

  e.g., anti-e, -$Fy^a$, -$Jk^a$ (compatible blood: 1:670)

- Specificity to a high frequency antigen (HFA)

  e.g., anti-k (compatible blood: 1:500)

  e.g., anti-$Kp^b$ (compatible blood: 1:10.000)

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# Patients with red cell antibodies

## Prevalence of the compatible blood type

Two situations may challenge an adequate blood supply:

- Multiple antibody specificities

  e.g., anti-e, -$Fy^a$, -$Jk^a$ (compatible blood: 1:670)

- Specificity to a high frequency antigen (HFA)

  e.g., **anti-U** Blacks → 1: 50

  Caucasians → 1: >10.000

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# Patients with red cell antibodies

## Prevalence of the compatible blood type

Some (rare) blood types have an unequal prevalence

in different ethnic populations

While blood establishments have some preparedness for the “local” specificities to HFA,

.... reagents and compatible donors for the supply of “exotic” rare blood types are missing

# ISBT BLOOD GROUP SYSTEMS

modified from: http://www.isbtweb.org/fileadmin/user_upload/WP_on_Red_Cell_Immunogenetics_and/Table_of_blood_group_antigens_within_systems_v2.0_110914.pdf

| No. | System name | ISBT symbol | Number of antigens 287 | Gene | Chromos. location | CD code |
|---|---|---|---|---|---|---|
| 1 | ABO | ABO | 4 | ABO | 9q34.2 | |
| 2 | MNS | MNS | 46 | GYPA, GYPB, GYPE | 4q31.21 | CD235 |
| 3 | P1PK | P1PK | 2 | A4GALT | 22q13.2 | |
| 4 | Rh | RH | 52 | RHD, RHCE | 1p36.11 | CD240 |
| 5 | Lutheran | LU | 20 | LU | 19q13.32 | CD239 |
| 6 | Kell | KEL | 32 | KEL | 7q34 | CD238 |
| 7 | Lewis | LE | 6 | FUT3 | 19p13.3 | |
| 8 | Duffy | FY | 5 | DARC | 1q23.2 | CD234 |
| 9 | Kidd | JK | 3 | SLC14A1 | 18q12.3 | |
| 10 | Diego | DI | 22 | SLC4A1 | 17q21.31 | CD233 |
| 11 | Yt | YT | 2 | ACHE | 7q22.1 | |
| 12 | Xg | XG | 2 | XG, MIC2 | Xp22.33 | CD99 |
| 13 | Scianna | SC | 7 | ERMAP | 1p34.2 | |
| 14 | Dombrock | DO | 7 | ART4 | 12p12.3 | CD297 |
| 15 | Colton | CO | 4 | AQP1 | 7p14.3 | |
| 16 | Landsteiner-Wiener | LW | 3 | ICAM4 | 19p13.2 | CD242 |
| 17 | Chido/Rodgers | CH/RG | 9 | C4A, C4B | 6p21.3 | |
| 18 | H | H | 1 | FUT1 | 19q13.33 | CD173 |
| 19 | Kx | XK | 1 | XK | Xp21.1 | |
| 20 | Gerbich | GE | 11 | GYPC, GYPD | 2q14.3 | CD236 |
| 21 | Cromer | CROM | 16 | CD55 | 1q32.2 | CD55 |
| 22 | Knops | KN | 9 | CR1 | 1q32.2 | CD35 |
| 23 | Indian | IN | 4 | CD44 | 11p13 | CD44 |
| 24 | Ok | OK | 3 | BSG | 19p13.3 | CD147 |
| 25 | Raph | RAPH | 1 | CD151 | 11p15.5 | CD151 |
| 26 | John Milton Hagen | JMH | 6 | SEMA7A | 15q24.1 | CD108 |
| 27 | I | I | 1 | GCNT2 | 6p24.2 | |
| 28 | Globoside | GLOB | 1 | B3GALT3 | 3q26.1 | |
| 29 | Gill | GIL | 1 | AQP3 | 9p13.3 | |
| 30 | Rh-associated gp | RHAG | 4 | RHAG | 6p21-qter | CD241 |
| 31 | Forssman | FORS | 1 | GBGT1 | 9q34.2 | |
| 32 | Junior | JR | 1 | ABCG2 | 4q22 | CD338 |
| 33 | Langereis | LAN | 1 | ABCB6 | 2q36 | |

| ISBT BLOOD GROUP SYSTEMS | | | modified from: http://www.isbtweb.org/fileadmin/user_upload/WP_on_Red_Cell_Immunogenetics_and/Table_of_blood_group_antigens_within_systems_v2.0_110914.pdf | | | |
|---|---|---|---|---|---|---|
| No. | System name | ISBT symbol | Number of hf-antigens | Gene | Chromos. location | CD code |
| 1 | ABO | ABO | 4 | ABO | 9q34.2 | |
| 2 | MNS | MNS | 6/46 | GYPA, GYPB, GYPE | 4q31.21 | CD235 |
| 3 | P1PK | P1PK | 1/2 | A4GALT | 22q13.2 | |
| 4 | Rh | RH | 11/52 | RHD, RHCE | 1p36.11 | CD240 |
| 5 | Lutheran | LU | 14/20 | LU | 19q13.32 | CD239 |
| 6 | Kell | KEL | 14/32 | KEL | 7q34 | CD238 |
| 7 | Lewis | LE | 6 | FUT3 | 19p13.3 | |
| 8 | Duffy | FY | 2/5 | DARC | 1q23.2 | CD234 |
| 9 | Kidd | JK | 1/3 | SLC14A1 | 18q12.3 | |
| 10 | Diego | DI | 2/22 | SLC4A1 | 17q21.31 | CD233 |
| 11 | Yt | YT | 1/2 | ACHE | 7q22.1 | |
| 12 | Xg | XG | 1/2 | XG, MIC2 | Xp22.33 | CD99 |
| 13 | Scianna | SC | 2/7 | ERMAP | 1p34.2 | |
| 14 | Dombrock | DO | 3/7 | ART4 | 12p12.3 | CD297 |
| 15 | Colton | CO | 2/4 | AQP1 | 7p14.3 | |
| 16 | Landsteiner-Wiener | LW | 2/3 | ICAM4 | 19p13.2 | CD242 |
| 17 | Chido/Rodgers | CH/RG | 7/9 | C4A, C4B | 6p21.3 | |
| 18 | H | H | 1/1 | FUT1 | 19q13.33 | CD173 |
| 19 | Kx | XK | 1/1 | XK | Xp21.1 | |
| 20 | Gerbich | GE | 3/11 | GYPC, GYPD | 2q14.3 | CD236 |
| 21 | Cromer | CROM | 8/16 | CD55 | 1q32.2 | CD55 |
| 22 | Knops | KN | 5/9 | CR1 | 1q32.2 | CD35 |
| 23 | Indian | IN | 1/4 | CD44 | 11p13 | CD44 |
| 24 | Ok | OK | 1/3 | BSG | 19p13.3 | CD147 |
| 25 | Raph | RAPH | 1/1 | CD151 | 11p15.5 | CD151 |
| 26 | John Milton Hagen | JMH | 1/6 | SEMA7A | 15q24.1 | CD108 |
| 27 | I | I | 1/1 | GCNT2 | 6p24.2 | |
| 28 | Globoside | GLOB | 1/1 | B3GALT3 | 3q26.1 | |
| 29 | Gill | GIL | 1/1 | AQP3 | 9p13.3 | |
| 30 | Rh-associated gp | RHAG | 2/4 | RHAG | 6p21-qter | CD241 |
| 31 | Forssman | FORS | 1 | GBGT1 | 9q34.2 | |
| 32 | Junior | JR | 1/1 | ABCG2 | 4q22 | CD338 |
| 33 | Langereis | LAN | 1/1 | ABCB6 | 2q36 | |

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## Blood Group Antigen Gene Mutation Database

Home | Systems | Resources | Administration | About

The database currently has 1284 alleles of 41 genes.

### Systems

**ABO**
**Chido/Rodgers** (CH/RG)
**Colton** (CO)
**Cromer** (CROM)
**Diego** (DI; band 3)
**Dombrock** (DO)
**Duffy** (FY)
**Gerbich** (GE)
**Gill** (GIL)
**H**
**I**
**Indian** (IN)
**John Milton Hagen** (JMH)
**Kell** (KEL)
**Kidd** (JK)
**Knops** (KN)
**Kx** (XK)
**Landsteiner-Wiener** (LW)
**Lewis** (LE)
**Lutheran** (LU)
**MNS** (glycophorin A/B/E)
**Ok** (OK)
**P1PK and Globoside**
**Raph** (RAPH)
**Rh** (RH)
**Rh-associated glycoprotein** (RhAG)
**Scianna** (SC)
**T/Tn**
**Xg** (XG)
**Y**

http://www.ncbi.nlm.nih.gov/projects/gv/mhc/xslcgi.cgi?cmd=bgmut/

# ISBT Blutgruppen-Collections

modifiziert nach: http://www.isbtweb.org/fileadmin/user_upload/WP_on_Red_Cell_Immunogenetics_and/Table_of_blood_group_antigens_within_systems_v2.0_110914.pdf

## Table of high incidence antigens (901 series)

| No. | Name | ISBT Symbol |
|---|---|---|
| 901001 | Vel | Vel |
| ~~901002~~ | ~~Langereis~~ | ~~Lan~~ |
| 901003 | August | Ata |
| ~~901004~~ | | |
| ~~901005~~ | ~~Junior~~ | ~~Jra~~ |
| ~~901006~~ | | |
| ~~901007~~ | | |
| 901008 | Emm | Emm |
| 901009 | Anton | AnWj |
| ~~901010~~ | | |
| ~~901011~~ | | |
| 901012 | Sid | Sda |
| 901013 | Duclos | |
| 901014 | Pelletier | PEL |
| 901015 | ABTI | ABTI |
| 901016 | MAM | MAM |

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# Which HFAs should be included in screening?

→ Incidence of antibody specificities to HFAs in Europe

→ Clinical significance of the ab specificities

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# Antibodies to high frequency antigens

## Which specificities are relevant in Europe?

Germany, Swizzerland, Austria (20 month), n=52



Kpb *(19,6%),* Vel *(17,9%),* Lub *(14,3%),* Yta *(14,3%),* Coa *(5,4%),*
HOh *(5,4%),* AnWj *(3,6%),* Kx *(3,6%),* MAM *(3,6%),* Fy3 *(1,8%),*
Ku *(1,8%),* Lan *(1,8%),* Lu6 *(1,8%),* Rh17 *(1,8%)* and Tja *(PP1Pk; 1,8%).*

Seltsam A, Wagner FF, Salama A, Flegel WA. Antibodies to high-frequency antigens may decrease the quality of transfusion support: an observational study. Transfusion 2003;43:1563-6

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# Antibodies to high frequency antigens

## Which specificities are relevant in Europe?

Germany, Swizzerland, Austria (20 month), n=52



*"[...] 66% of the rare blood supply involved the four specificities anti-Kpb, -Vel, -Lub or -Yta."*

Seltsam A, Wagner FF, Salama A, Flegel WA. Antibodies to high-frequency antigens may decrease the quality of transfusion support: an observational study. Transfusion 2003;43:1563-6

# Antibodies to high frequency antigens

## Incidence at the RCR, Swiss RC, Bern

| Specificity anti- | Incidence count | Incidence % |
|---|---|---|
| Yta | 92 | *26.4* |
| Vel | 51 | *14.7* |
| Lub | 48 | *13.8* |
| k | 39 | *11.2* |
| Kpb | 24 | *6.9* |
| P | 14 | *4.0* |
| Jra | 14 | *4.0* |
| Gerbich | 13 | *3.7* |
| Lan | 12 | *3.4* |
| Coa | 12 | *3.4* |
| Ku | 6 | *1.7* |
| Rh17 | 5 | *1.4* |
| K11 | 4 | *1.1* |
| U | 4 | *1.1* |
| Jk3 | 3 | *0.9* |
| Lu8 | 2 | *0.6* |
| Wrb | 2 | *0.6* |
| Jsb | 1 | *0.3* |
| AnWj | 1 | *0.3* |
| Co3 | 1 | *0.3* |
| | 348 | *100.0* |



Courtesy of Hein Hustinx 2005

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# Antibodies to high frequency antigens

## Which specificities are relevant in Europe?

France, 1994 to 2008 (n=2082)

Fy(a-b-) *(26,1%),* k- *(19,4%),* Yt(a-) *(12,7%),* r'r' *(CCddee, 9,1%),* U- *(7,0%),* Vel- *(5,6%),* r"r" *(ccddEE, 3,5%),* Lu(b-) *(3,2%),* D-- *(1,1%),* Lu:-13 *(0,9%),* Js(b-) *(0,9%),* Kp(b-) *(0,9%),* RzRz *(CCD.EE, 0,7%),* I- *(0,5%),* $O_h$ *(0,4%) and* Ge:-2,3 *(0,3%)*



Peyrard T, Pham BN, Rouger P & Le Pennec PY in:
Reesink HW, et al. Donors with rare pheno (geno) type. Vox Sang 2008;95:236-53

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# Antibodies to high frequency antigens

## Antibodies to FY-antigens made by $FY0^{ES}$ people

~ 4.000.000 African inhabitants in France and its overseas territories

105 Anti-Fya
83 Anti-Fy3
24 Anti-Fy5



Peyrard T, INTS, France

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# Antibodies to high frequency antigens

## Which specificities are relevant in Europe?

*"[...] Shortages in supply for the African-Caribbean population (U- D-, hrS-, HrB-, Js(b-) and RN/RN)."*



Peyrard T, Pham BN, Rouger P & Le Pennec PY in:
Reesink HW, et al. Donors with rare pheno (geno) type. Vox Sang 2008;95:236-53

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# Antibodies to high frequency antigens

## Which specificities are relevant in Europe?

*“[...] K0, McLeod, p, U-, Lan-, Vel- and Ge:-2,-3 are probably the most difficult phenotypes to find”*



Reesink HW, et al. Donors with rare pheno (geno) type. Vox Sang 2008;95:236-53

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# Antibodies to high frequency antigens

## Calculated frequency of HFA-negatives in Austria

Austria: ~ 8.5 Mio inhabitants

| | | |
|---|---|---|
| k-, Yta-, Lub-, Coa- | 4 x | 17.000 |
| r'r', Vel-, Kpb- | 3 x | 3.500 |
| r''r'' | | 1.750 |
| | | 80.000 |

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# Antibodies to high frequency antigens

## Calculated frequency of HFA-negatives in Austria

Austria: ~ 8.5 Mio inhabitants

| | | |
|---|---|---|
| k-, Yta-, Lub-, Coa- | 4 x | 17.000 |
| r'r', Vel-, Kpb- | 3 x | 3.500 |
| r''r'' | | 1.750 |
| | | 80.000 |

~40.000 people of African origin

| | |
|---|---|
| FY0 | 26.000 |
| U- | 800 |
| Jsb- | 400 |
| | 27.200 |

| HFAs with unequal prevalence in different populations | | Caucasians | East. Europ. | Blacks | Asians | Taiwanese | Japanese | Arabs | Indians | Melanesians | Mexicans | S.Am Indians | Jews |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| System | Antigen | | | | | | | | | | | | |
| MNS | U | | | 0,99 | | | | | | | | | |
| RH | D | | | | | | | | | | | | |
| | G | | | | | | | | | | | | |
| | Hr | | | 0,99 | | | | | | | | | |
| | hrS | | | 0,99* | | | | | | | | | |
| LU | LU6 | | | | | | | | | | | | * |
| KEL | Jsb | | | 0,99 | | | | | | | | | |
| FY | Fya | | | | | | | | | | | | |
| | FY3 | | | 0,32 | | | | 0,75 | | | | | 0,96 |
| | FY5 | | | 0,32 | | | | | | | | | |
| JK | JK3 | | | | | | | | | | | | |
| DI | Dib | | | | | | | | | | | 0,96 | |
| YT | Yta | | | | | | | 0,97 | | | | | .98 |
| XG | CD99 | | | | | | * | | | | | | |
| DO | Gya | | 0,99 | | | | 0,99 | | | | | | |
| | Hy | | | 0,99 | | | | | | | | | |
| | Joa | | | 0,99 | | | | | | | | | |
| H | Oh; Para-Bombay | | | | | 0,998 | | | 0,999 | | | | |
| GE | GE3 | | | | | | | | | 0,5 | | | |
| CROM | Cra | | | 0,99 | | | | | | | | | |
| | Tca | | | 0,99 | | | | | | | | | |
| | Dra | | | | | | | | | | | | * |
| | Esa | | | * | | | | | | | * | * | |
| | UMC | | | | | | * | | | | | | |
| IN | Inb | | | | | | | | 0,96 | | | | |
| OK | Oka | | | | | | * | | | | | | |
| RAPH | MER2 | | | | | | | | | | | | * |

modifiziert nach: Reid ME. The Blood Group Antigen Facts Book. 2nd Ed 2004

| HFAs with unequal prevalence in different populations | | Caucasians | East. Europ. | Blacks | Asians | Taiwanese | Japanese | Arabs | Indians | Melanesians | Mexicans | S.Am Indians | Jews |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| System | Antigen | | | | | | | | | | | | |
| MNS | U | | | 0,99 | | | | | | | | | |
| RH | D | | | | 0,99 | 0,99 | | | | | | 0,99 | |
| | G | | | | 0,999 | 0,999 | | | | | | | |
| | Hr | | | 0,99 | | | | | | | | | |
| | hrS | | | 0,99* | | | | | | | | | |
| LU | LU6 | | | | | | | | | | | | * |
| KEL | Jsb | | | 0,99 | | | | | | | | | |
| FY | Fya | | | | 0,99 | 0,99 | | | | | | | |
| | FY3 | | | 0,32 | | | | 0,75 | | | | | 0,96 |
| | FY5 | | | 0,32 | | | | | | | | | |
| JK | JK3 | | | | | | | | | | | | |
| DI | Dib | | | | | | | | | | | 0,96 | |
| YT | Yta | | | | | | | 0,97 | | | | | .98 |
| XG | CD99 | | | | | | * | | | | | | |
| DO | Gya | | 0,99 | | | | 0,99 | | | | | | |
| | Hy | | | 0,99 | | | | | | | | | |
| | Joa | | | 0,99 | | | | | | | | | |
| H | Oh; Para-Bombay | | | | | 0,998 | | | 0,999 | | | | |
| GE | GE3 | | | | | | | | | 0,5 | | | |
| CROM | Cra | | | 0,99 | | | | | | | | | |
| | Tca | | | 0,99 | | | | | | | | | |
| | Dra | | | | | | | | | | | | * |
| | Esa | | | * | | | | | | | * | * | |
| | UMC | | | | | | * | | | | | | |
| IN | Inb | | | | | | | | 0,96 | | | | |
| OK | Oka | | | | | | * | | | | | | |
| RAPH | MER2 | | | | | | | | | | | | * |

modifiziert nach: Reid ME. The Blood Group Antigen Facts Book. 2nd Ed 2004

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# RHD genotyping

## Variant D types in South East Asia

Shanghai population:

~ 0,4 % apparently RhD-negative

among them: ~ 17 % DEL - 1227 G>A

- 3 G>A

~ 4,35 % weak / partial D

Li Q. Vox Sang. 2009 Aug;97(2):139-46.

Fukumori Y. Transfus Med 1997;7:227-231
Mak KH. Transfusion 1993; 33:348-351
Shao CP. Vox Sang 2002;83:156-161

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# Antibodies specificities to high frequency antigens

## clinical significance

1

| clinically significant | sometimes clinically significant | not significant if not reactive at 37°C | generally not significant |
|---|---|---|---|
| H bei $O_h$ | Ata | AnWj | CH/RG |
| Diego | Colton | Lutheran | Cost |
| Duffy | Cromer | $Sd^a$ | JMH |
| Kell | Dombrock | | HLA/Bg |
| Kidd | Gerbich | | Knops |
| P | Indian | | |
| P1PK2 | Junior | | |
| Rh | Lan | | |
| S,s,U | LW | | |
| Vel | Scianna | | |
| | Yta | | |

Modifiziert nach: Reid ME. The Blood Group Antigen Facts Book. 2nd Ed 2004.

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# Selection of publications

## high-throughput RBC genotyping including HFAs

**Table 1.** Selection of recent publication on high-throughput RBC genotyping including HFAs

| Number of RBC genotype/allels included | HFA included | Technique | Study size, n[$] | Concordance rate, % | Reference |
|---|---|---|---|---|---|
| 18 | LU2, KEL2, KEL4, DI2 | microarray | 372* | 98–100 | Denomme GA, Transfusion 2005 |
| 16 | KEL2, KEL4 | microarray | 618 | 97–100 | Montpetit A, Transfusion 2006 |
| 35 | LU2, KEL2, FY0, LW5, DI2, CO1, DO4, DO5, SC1 | microarray | 188 | 100 | Hashmi G, Transfusion 2005 |
| # | MNS5, KEL2, KEL4, DO5 | microarray | 94 | # | Beiboer SH, Transfusion 2005 |
| 33, 87, 9, 31[§] | # | microarray | 1,000[¤] | 99.8[¤] | Avent ND, Transfusion 2007 |
| 16 | LU2, KEL2, KEL4, KEL7, DI2, CO1 | microarray | 92 | 100 | Karpasitou K, Transfusion 2008 |
| 17 | LU2, KEL2, CO1 | real-time PCR | 200 | 100 | Polin H, Vox Sang 2008 |

[$]Evaluation of defined samples.
*For most of the SNPs tested.
[§]ABO, RHD, RHCE, minor antigens
[#]Not specified for the tests on RBC polymorphisms.
[¤]Data from the Conformité Européenne (CE) submission *www.progenika.com/eu/*.

Jungbauer C. Transfus Med Hemother 2009;36:213-218

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# Donor typing:

## In-house DNA typing programmes: antigens tested

### *Springe*

M, N, S, s
$Lu^a$, $Lu^b$
$Kp^a$, $Kp^b$

$Fy^a$, $Fy^b$
$Jk^a$, $Jk^b$

$Yt^a$, $Yt^b$,
$Co^a$, $Co^b$

### *Bern*

M, N, S, s
$Lu^a$, $Lu^b$
K, k, $Kp^a$, $Kp^b$, $Js^a$, $Js^b$

$Fy^a$, $Fy^b$, Fy0
$Jk^a$, $Jk^b$
$Di^a$, $Di^b$
$Yt^a$, $Yt^b$
$Co^a$, $Co^b$
$Do^a$, $Do^b$, Hy+
Sc1, Sc2
$LW^a$, $LW^b$

### *Vienna*

M, N, S, s
$Lu^a$, $Lu^b$, Lu8, Lu14
K, k, $Kp^a$, $Kp^b$, $Js^a$, $Js^b$,
K11, KEL17, $Kp^c$
$Fy^a$, $Fy^b$, $Fy^{BWK}$, Fy0
$Jk^a$, $Jk^b$
$Di^a$, $Di^b$, $Wr^a$, $Wr^b$
$Yt^a$, $Yt^b$
$Co^a$, $Co^b$
$In^a$, $In^b$
$Do^a$, $Do^b$

Courtesy of Christoph Niederhauser, Swiss Red Cross, Bern

# Multiplex PCR screening for 35 RBC antigens

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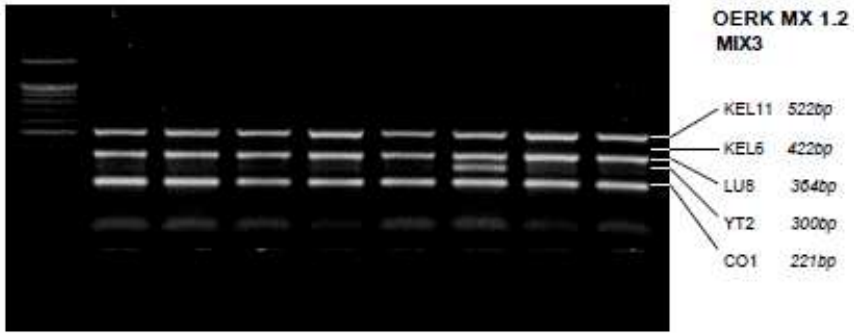
Multiplex PCR genotyping for 36 red blood cell surface antigens (MX version 1.0 -1.2)


OERK MX 1.2
MIX1

| | |
|---|---|
| KEL21 | 623bp |
| DI4 | 538bp |
| DI1 | 460bp |
| LU2 | 351bp |
| FYX | 276bp |
| IN2 | 209bp |

OERK MX 1.2
MIX2

| | |
|---|---|
| FY0 | 713bp |
| DI3 | 539bp |
| DI2 | 457bp |
| LU1 | 351bp |
| FY5 | 276bp |
| IN1 | 211bp |

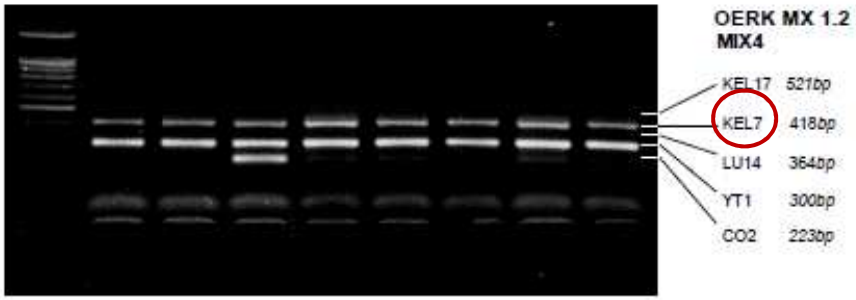


OERK MX 1.2
MIX3

| | |
|---|---|
| KEL11 | 522bp |
| KEL6 | 422bp |
| LU3 | 364bp |
| YT2 | 300bp |
| CO1 | 221bp |

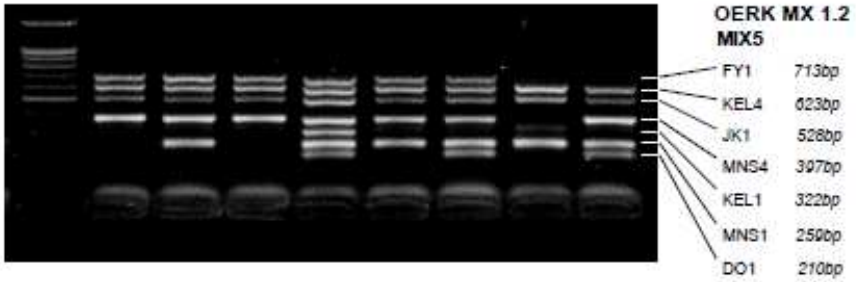
Austrian Red Cross, Vienna Blood Centre page 1/2 JNB, 2009.12.02

Multiplex PCR genotyping for 36 red blood cell surface antigens (MX version 1.0 -1.2)



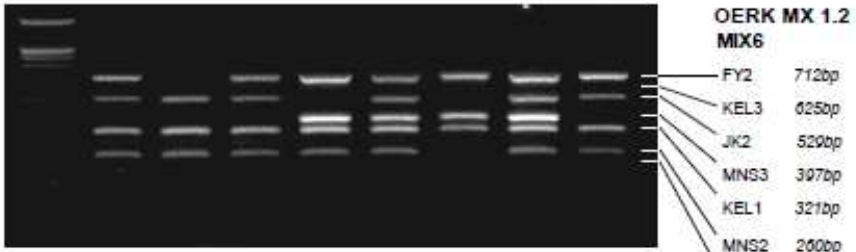
OERK MX 1.2
MIX4

| | |
|---|---|
| KEL17 | 521bp |
| KEL7 | 418bp |
| LU14 | 364bp |
| YT1 | 300bp |
| CO2 | 223bp |



OERK MX 1.2
MIX5

| | |
|---|---|
| FY1 | 713bp |
| KEL4 | 623bp |
| JK1 | 526bp |
| MNS4 | 397bp |
| KEL1 | 322bp |
| MNS1 | 259bp |
| DO1 | 210bp |

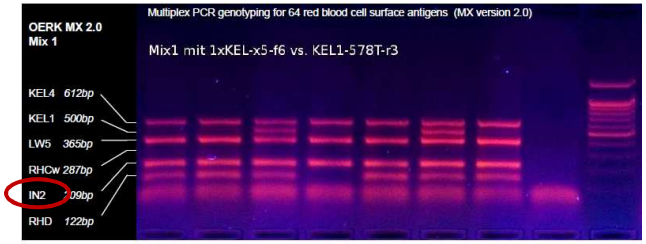


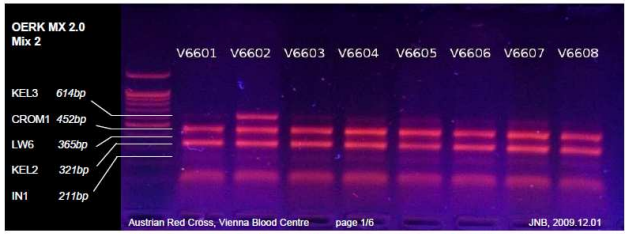
OERK MX 1.2
MIX6

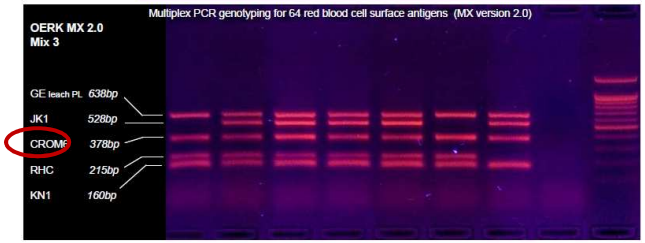
| | |
|---|---|
| FY2 | 712bp |
| KEL3 | 625bp |
| JK2 | 529bp |
| MNS3 | 397bp |
| KEL1 | 321bp |
| MNS2 | 260bp |
| DO2 | 209bp |

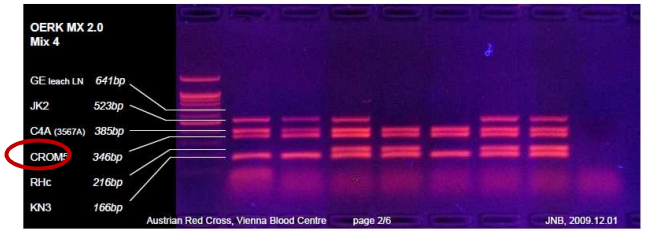
Austrian Red Cross, Vienna Blood Centre page 2/2 JNB, 2009.12.02

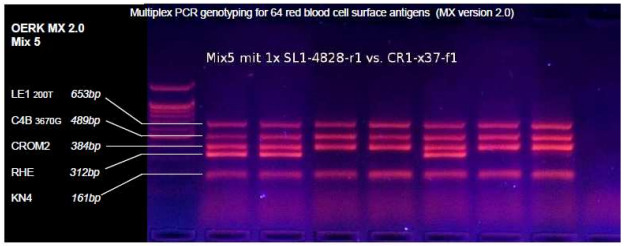
Jungbauer et al. High-Throughput Multiplex PCR Genotyping for 35 Red Blood Cell Antigens in Blood Donors. Vox Sang. 2012 Apr;102(3):234-42.

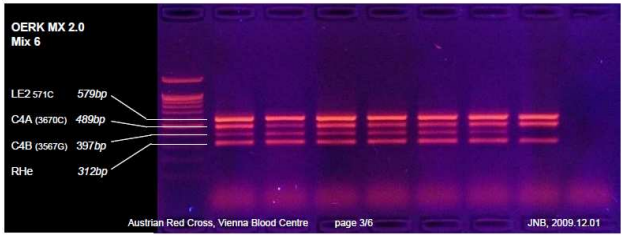


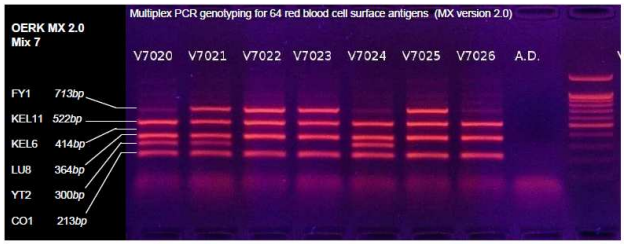



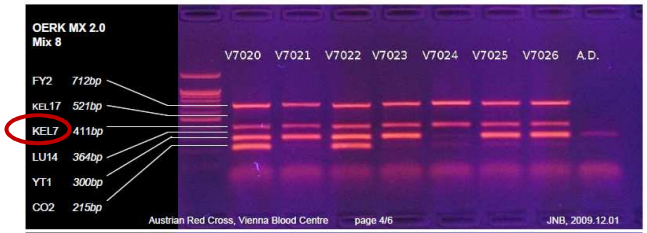



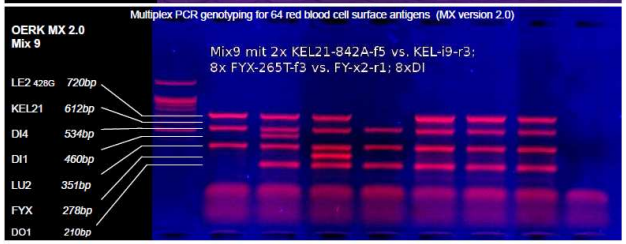



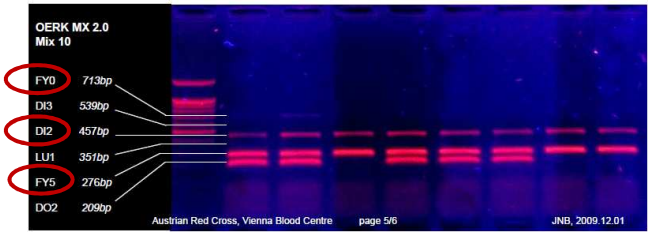



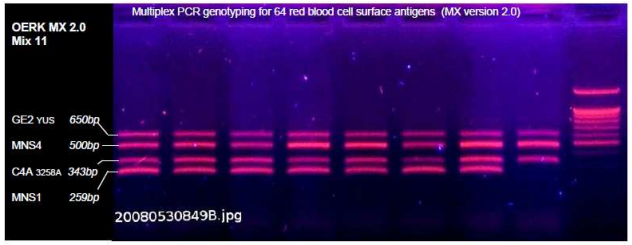



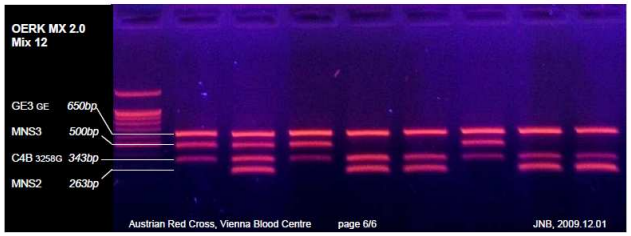

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# OERK MX 2.0 Multiplex PCR Screening for 64 RBC antigens

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Observed genotype frequency of 6000 Eastern Austrian blood donors

| | MNS1 | MNS2 | MNS3 | MNS4 | MNS5 | LU1 | LU2 | LU8 | LU14 | KEL1 | KEL2 | KEL3 | KEL4 | KEL6 | KEL7 | KEL11 | KEL17 | KEL21 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| total tested | 6000 | 6000 | 6000 | 6000 | 6000 | 6000 | 6000 | 6000 | 6000 | 6000 | 6000 | 6000 | 6000 | 6000 | 6000 | 6000 | 6000 | 6000 |
| homozygous positive | 1794 | 1228 | 623 | 2752 | 6000 | 9 | 5578 | 5727 | 5 | 5 | 5470 | 1 | 5922 | 0 | 5999 | 5981 | 0 | 0 |
| heterozygous | 2978 | 2978 | 2625 | 2625 | 0 | 413 | 413 | 268 | 268 | 525 | 525 | 77 | 77 | 1 | 1 | 19 | 19 | 0 |
| **negative** | 1228 | 1794 | 2752 | 623 | 0 | 5578 | 9 | 5 | 5727 | 5470 | 5 | 5922 | 1 | 5999 | 0 | 0 | 5981 | 6000 |
| obs. negative preval. | 0,205 | 0,299 | 0,459 | 0,104 | 0,000 | 0,930 | 0,002 | 0,001 | 0,955 | 0,912 | 0,001 | 0,987 | 0,000 | 1,000 | 0,000 | 0,000 | 0,997 | 1,000 |

| | FY1 | FY2 | FY | FYX | JK1 | JK2 | DI1 | DI2 | DI3 | DI4 | YT1 | YT2 | DO1 | DO2 | CO1 | CO2 | IN1 | IN2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| total tested | 6000 | 6000 | 6000 | 6000 | 6000 | 6000 | 6000 | 6000 | 6000 | 6000 | 6000 | 6000 | 6000 | 6000 | 6000 | 6000 | 6000 | 6000 |
| homozygous positive | 1041 | 1831 | 5969 | 0 | 1591 | 1498 | 0 | 5978 | 0 | 6000 | 5308 | 24 | 878 | 2214 | 5526 | 11 | 0 | 6000 |
| heterozygous | 3127 | 3127 | 31 | 153 | 2911 | 2911 | 22 | 22 | 0 | 0 | 668 | 668 | 2908 | 2908 | 463 | 463 | 0 | 0 |
| **negative** | 1832 | 1042 | 0 | 5837 | 1498 | 1591 | 5978 | 0 | 6000 | 0 | 24 | 5308 | 2214 | 878 | 11 | 5526 | 6000 | 0 |
| obs. negative preval. | 0,305 | 0,174 | 0,000 | 0,973 | 0,250 | 0,265 | 0,996 | 0,000 | 1,000 | 0,000 | 0,004 | 0,885 | 0,369 | 0,146 | 0,002 | 0,921 | 1,000 | 0,000 |

Jungbauer et al. High-Throughput Multiplex PCR Genotyping for 35 Red Blood Cell Antigens in Blood Donors. Vox Sang. 2012 Apr;102(3):234-42.

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# Conclusion I

Due to migration we have to expect more “exotic” HFA-specificities in future

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# Conclusion II

DNA based typing methods provide independence from the availability of serological typing reagents

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# Conclusion II

To find certain rarities, it will be necessary to screen potential donors from populations, which regularly would be deferred from donation (Malaria endemic areas)

St. Anna kinderSpital

MEDICAL UNIVERSITY OF VIENNA

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