Nomenclature for the KIR of non-human species

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Abstract
The increasing number of Killer Immunoglobulin-like Receptor (KIR) sequences available for non-human primate species and cattle has prompted development of a centralized database, guidelines for a standardized nomenclature, and minimum requirements for database submission. The guidelines and nomenclature are based on those used for human KIR and incorporate modifications made for inclusion of non-human species in the companion IPD-NHKIR database. Included in this first release are the rhesus macaque (Macaca mulatta), chimpanzee (Pan troglodytes), orangutan (Pongo abelii and Pongo pygmaeus), and cattle (Bos taurus).

Keywords KIR • Nomenclature • Variant • Allele • Gene • Database • Sequence

Introduction
The KIR locus has been studied in a number of non-human species primates and is characterized by high levels of allelic polymorphism, haplotypic polymorphism in the number of genes, and extensive duplication and recombination (Hammond et al. 2016; Parham 2004). These factors have made it difficult to assign orthologues and have led to a number of different nomenclature systems being used to name genes and alleles. This report describes a common framework and guidelines for KIR nomenclature in non-human species. These have been developed by taking advantage of lessons learned in the development of a nomenclature system for the human KIR (Marsh et al. 2003).

General naming guidelines
To provide consistency with the IPD-MHC Database (Maccari et al. 2017), the non-human KIR nomenclature adopts the same four-character prefix used for species designation in the naming of MHC alleles (de Groot et al. 2012; Ellis et al. 2006; Klein et al. 1990). Also, genes and alleles will be named based on the conventions that have been adopted for the human KIR system (Marsh et al. 2003) that are based on the structures of the molecules they encode. The first digit following the KIR acronym corresponds to the number of Ig-like domains in the polypeptide and the “D” denotes “Domain.” The D is followed by either an “L” indicating a “Long” cytoplasmic tail, an “S” indicating a “Short” cytoplasmic tail or a “P” for pseudogenes. In addition, the inclusion of a “W” indicates “Workshop” following the “L,” “S,” or “P” to indicate any sequence that by phylogenetic analysis is sufficiently divergent to be considered a “new” gene, but lack either genomic sequencing or family studies to demonstrate
that it does define a new gene and not a divergent lineage a
known gene. Tables 1, 2, and 3 list the current gene designations
and their previous names. Symbols for genes are itali-
cized (e.g., *Mamu-KIR3DL01*), whereas symbols for proteins
are not italicized (e.g., *Mamu-KIR3DL01*). Alleles follow the
same conventions as gene names.

Reflecting species-specific differences, there have been
further additions/modifications to the general nomenclature
for rhesus macaque and cattle. As with the human KIR no-
mencature, alleles in each series have been named in order of
their deposition into a generalist sequence databank, GenBank/EMBL-ENA/DDBJ (Benson et al. 2017; Chojnacki et al. 2017; Mashima et al. 2017). Where the
identity is known of the animal providing the sequenced
DNA, that information is included in the database, as well as
information regarding the origin of the animal. Tables 4, 5, 6,
and 7 provide a complete list of genes and alleles currently in
the nomenclature, as well as the original name(s), accession
number, and reference to the original report of the sequence.

Each KIR allele name includes a unique number corre-
sponding to up to three sets of digits separated by colons.
All alleles are given a three-digit name, which corresponds
to the first set of digits; longer names are assigned only
when necessary.
The digits placed before the first colon describe the alleles
that differ at non-synonymous substitutions (also called coding

| Species   | KIR gene designation(s)                                                                 | Previous KIR gene designation(s)                                                                 |
|-----------|----------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| Rhesus macaque (Mamu) | **Mamu-KIR1D** 2DL501NK, 2DL503NK, KIR2DL4, KIR2DL4.1, MmKIR2DL4 2DL426NK, 3DL34, KIR3DL1, KIR3DL1-like_1, KIR3DL1, KIR3DL1-like1, KIR3DL12, KIR3DL13, KIR3DL14, KIR3DL15, KIR3DL19, KIR3DL1_2 variant_2, KIR3DL2, KIR3DL2-old, KIR3DL3, KIR3DL4, KIR3DL5 | KIR3D-like_3, KIR3D2, KIR3DL21, KIR3DL21-like1  |
|           | **Mamu-KIR2DL04** 2DL501NK, 2DL503NK, KIR2DL4, KIR2DL4.1, MmKIR2DL4 2DL426NK, 3DL34, KIR3DL1, KIR3DL1-like_1, KIR3DL1, KIR3DL1-like1, KIR3DL12, KIR3DL13, KIR3DL14, KIR3DL15, KIR3DL19, KIR3DL1_2 variant_2, KIR3DL2, KIR3DL2-old, KIR3DL3, KIR3DL4, KIR3DL5 | KIR3D11  |
|           | **Mamu-KIR3DL01** 2DL501NK, 2DL503NK, KIR2DL4, KIR2DL4.1, MmKIR2DL4 2DL426NK, 3DL34, KIR3DL1, KIR3DL1-like_1, KIR3DL1, KIR3DL1-like1, KIR3DL12, KIR3DL13, KIR3DL14, KIR3DL15, KIR3DL19, KIR3DL1_2 variant_2, KIR3DL2, KIR3DL2-old, KIR3DL3, KIR3DL4, KIR3DL5 | KIR3D11  |
|           | **Mamu-KIR3DL02** 2DL501NK, 2DL503NK, KIR2DL4, KIR2DL4.1, MmKIR2DL4 2DL426NK, 3DL34, KIR3DL1, KIR3DL1-like_1, KIR3DL1, KIR3DL1-like1, KIR3DL12, KIR3DL13, KIR3DL14, KIR3DL15, KIR3DL19, KIR3DL1_2 variant_2, KIR3DL2, KIR3DL2-old, KIR3DL3, KIR3DL4, KIR3DL5 | KIR3D11  |
|           | **Mamu-KIR3DL03** 2DL501NK, 2DL503NK, KIR2DL4, KIR2DL4.1, MmKIR2DL4 2DL426NK, 3DL34, KIR3DL1, KIR3DL1-like_1, KIR3DL1, KIR3DL1-like1, KIR3DL12, KIR3DL13, KIR3DL14, KIR3DL15, KIR3DL19, KIR3DL1_2 variant_2, KIR3DL2, KIR3DL2-old, KIR3DL3, KIR3DL4, KIR3DL5 | KIR3D11  |
|           | **Mamu-KIR3DL04** 2DL501NK, 2DL503NK, KIR2DL4, KIR2DL4.1, MmKIR2DL4 2DL426NK, 3DL34, KIR3DL1, KIR3DL1-like_1, KIR3DL1, KIR3DL1-like1, KIR3DL12, KIR3DL13, KIR3DL14, KIR3DL15, KIR3DL19, KIR3DL1_2 variant_2, KIR3DL2, KIR3DL2-old, KIR3DL3, KIR3DL4, KIR3DL5 | KIR3D11  |
|           | **Mamu-KIR3DL05** 2DL501NK, 2DL503NK, KIR2DL4, KIR2DL4.1, MmKIR2DL4 2DL426NK, 3DL34, KIR3DL1, KIR3DL1-like_1, KIR3DL1, KIR3DL1-like1, KIR3DL12, KIR3DL13, KIR3DL14, KIR3DL15, KIR3DL19, KIR3DL1_2 variant_2, KIR3DL2, KIR3DL2-old, KIR3DL3, KIR3DL4, KIR3DL5 | KIR3D11  |
|           | **Mamu-KIR3DL06** 2DL501NK, 2DL503NK, KIR2DL4, KIR2DL4.1, MmKIR2DL4 2DL426NK, 3DL34, KIR3DL1, KIR3DL1-like_1, KIR3DL1, KIR3DL1-like1, KIR3DL12, KIR3DL13, KIR3DL14, KIR3DL15, KIR3DL19, KIR3DL1_2 variant_2, KIR3DL2, KIR3DL2-old, KIR3DL3, KIR3DL4, KIR3DL5 | KIR3D11  |
|           | **Mamu-KIR3DL07** 2DL501NK, 2DL503NK, KIR2DL4, KIR2DL4.1, MmKIR2DL4 2DL426NK, 3DL34, KIR3DL1, KIR3DL1-like_1, KIR3DL1, KIR3DL1-like1, KIR3DL12, KIR3DL13, KIR3DL14, KIR3DL15, KIR3DL19, KIR3DL1_2 variant_2, KIR3DL2, KIR3DL2-old, KIR3DL3, KIR3DL4, KIR3DL5 | KIR3D11  |
|           | **Mamu-KIR3DL08** 2DL501NK, 2DL503NK, KIR2DL4, KIR2DL4.1, MmKIR2DL4 2DL426NK, 3DL34, KIR3DL1, KIR3DL1-like_1, KIR3DL1, KIR3DL1-like1, KIR3DL12, KIR3DL13, KIR3DL14, KIR3DL15, KIR3DL19, KIR3DL1_2 variant_2, KIR3DL2, KIR3DL2-old, KIR3DL3, KIR3DL4, KIR3DL5 | KIR3D11  |
|           | **Mamu-KIR3DL09** 2DL501NK, 2DL503NK, KIR2DL4, KIR2DL4.1, MmKIR2DL4 2DL426NK, 3DL34, KIR3DL1, KIR3DL1-like_1, KIR3DL1, KIR3DL1-like1, KIR3DL12, KIR3DL13, KIR3DL14, KIR3DL15, KIR3DL19, KIR3DL1_2 variant_2, KIR3DL2, KIR3DL2-old, KIR3DL3, KIR3DL4, KIR3DL5 | KIR3D11  |
substitutions). Alleles that differ only by synonymous nucleotide substitutions (also called silent or non-coding substitutions) but are within the coding sequence are distinguished by their third sets of digits.

In addition to the unique allele number, optional suffixes can be added to an allele name to indicate the expression status of the gene and/or its encoded protein. Alleles known not to be expressed—so called “Null” alleles—have been given the suffix “N.” Alleles that have been shown to be alternatively expressed may have the suffix “L,” “S,” “C,” “A,” or “Q.”

The suffix “L” is used to indicate an allele that has been shown to have “Low” cell surface expression when compared to normal levels. The “S” suffix is used to denote an allele specifying a protein which is expressed as a soluble, “Secreted” molecule and is not present on the cell surface. The “C” suffix is assigned to alleles producing proteins that are present in the “Cytoplasm” and not on the cell surface. An “A” suffix indicates an “Aberrant” expression, where there is doubt as to whether a protein is actually expressed. A “Q” suffix is used when the expression of an allele is “Questionable,” given that the mutation seen in the allele has been shown to affect normal expression levels in other alleles and other KIR genes.

As of May 2018, no alleles have been named with the “C,” “A,” “Q,” or “S” suffixes.

A schematic representation of the syntax for the non-human KIR allele designation is shown in Fig. 1.

### Species-specific guidelines

#### Naming rhesus macaque KIR genes

The *Mamu-KIR* sequences fall into a number of distinct lineages based on phylogenetic analysis. Most sequences correspond to lineage II KIR and are further divided into those encoding KIR that have long cytoplasmic tails or short cytoplasmic tails. The genes have been numbered sequentially and where possible the gene name has the same the same number as the first reported allele for that gene. For example, the *Mamu-KIR3DL1* gene (Hershberger et al. 2001) was renamed *Mamu-KIR3DL01*001.

The nomenclature uses a two-digit numbering of individual genes for the macaque sequences as seen with the naming of *Mamu-KIR3DL01*001. This renaming aims to avoid confusion with previous sequence names. Subsequent analysis has shown that some of the proposed sequences of different genes are actually allelic variants of the same gene. Rather than skipping numbers to avoid confusion, it was thought better to introduce the two-digit numbering system.

Recombinant alleles are named according to the locus, which provide the majority of the sequence. For example,
## Table 4  Allele designations and their previous names

| Gene      | Allele designation | Previous designations | Accession number                                      | Reference                          |
|-----------|--------------------|-----------------------|-------------------------------------------------------|-----------------------------------|
| Mamu-KIR1D | Mamu-KIR1D*001     | KIR1D                 | AF334634                                              | (Hershberger et al. 2001)         |
| Mamu-KIR1D | Mamu-KIR1D*002     | KIR1D,Mamu-KIR1D*00202-JHB-HA | AU728181, GU112257, GU112266, GU112232 | (Sambrook et al. 2005)            |
| Mast2DL04 | Mast2DL04*001:01   | KIR2DL4, KIR2DL4.1, MmKIR2DL4*0010101-JHB | EU702886, AF361088, AF334644, FJ824091, GU112331, GU112318, GU112263, GU112303, GU112287 | (Blokhuis et al. 2009a; Blokhuis et al. 2009b; Blokhuis et al. 2010; Grendell et al. 2001; Hershberger et al. 2001) |
| Mast2DL04 | Mast2DL04*001:02   | 2DL501NK              | GU299490                                              | (Colantoni et al. 2011)           |
| Mast2DL04 | Mast2DL04*002      | MmKIR2DL4*0020101-JHB | FJ824092, GU112279                                    | (Blokhuis et al. 2009b; Blokhuis et al. 2010) |
| Mast2DL04 | Mast2DL04*003      | KIR2DL4, MmKIR2DL4*0040101-JHB | AYS05486, FJ824093, GU112322, GU112284 | (Andersen et al. 2004; Blokhuis et al. 2009b; Blokhuis et al. 2010) |
| Mast2DL04 | Mast2DL04*004      | KIR2DL4                | AY728182                                              | (Sambrook et al. 2005)            |
| Mast2DL04 | Mast2DL04*005      | MmKIR2DL4*0050101-JHB | FJ824094                                              | (Blokhuis et al. 2009b)           |
| Mast2DL04 | Mast2DL04*006:01   | MmKIR2DL4*0060101-JHB | FJ824095                                              | (Blokhuis et al. 2009b)           |
| Mast2DL04 | Mast2DL04*006:02   | 2DL503NK               | GU014298                                              | (Colantoni et al. 2011)           |
| Mast2DL04 | Mast2DL04*007      | MmKIR2DL4*0070101-JHB | FJ824096                                              | (Blokhuis et al. 2009b)           |
| Mast2DL04 | Mast2DL04*008:01   | MmKIR2DL4*0080101-JHB | FJ824097                                              | (Blokhuis et al. 2009b)           |
| Mast2DL04 | Mast2DL04*008:02   | MmKIR2DL4*0080201-JHB | FJ824098, GU112326                                    | (Blokhuis et al. 2009b; Blokhuis et al. 2010) |
| Mast2DL04 | Mast2DL04*010      | MmKIR2DL4*0100101-JHB | FJ824100                                              | (Blokhuis et al. 2009b)           |
| Mast2DL04 | Mast2DL04*011      | MmKIR2DL4*0110101-JHB | FJ824101                                              | (Blokhuis et al. 2009b)           |
| Mast2DL04 | Mast2DL04*012      | MmKIR2DL4*0120101-JHB | FJ824102                                              | (Blokhuis et al. 2009b)           |
| Mast2DL04 | Mast2DL04*013      | MmKIR2DL4*0130101-JHB | FJ824103                                              | (Blokhuis et al. 2009b)           |
| Mast2DL04 | Mast2DL04*014:01   | MmKIR2DL4*0140101-JHB | FJ824104, GU112316                                    | (Blokhuis et al. 2009b; Blokhuis et al. 2010) |
| Mast2DL04 | Mast2DL04*014:02   | MmKIR2DL4*0140201-JHB | FJ824105                                              | (Blokhuis et al. 2009b)           |
| Mast2DL04 | Mast2DL04*015:01   | MmKIR2DL4*0150101-JHB | FJ824106, GU112313                                    | (Blokhuis et al. 2009b; Blokhuis et al. 2010) |
| Mast2DL04 | Mast2DL04*015:02   | MmKIR2DL4*0150201-JHB | FJ824107, GU112280                                    | (Blokhuis et al. 2009b; Blokhuis et al. 2010) |
| Mast2DL04 | Mast2DL04*016      | MmKIR2DL4*0160101-JHB | FJ824108                                              | (Blokhuis et al. 2009b)           |
| Mast2DL04 | Mast2DL04*017      | MmKIR2DL4*0170101-JHB | FJ824109                                              | (Blokhuis et al. 2009b)           |
| Mast2DL04 | Mast2DL04*018      | MmKIR2DL4*0180101-JHB | FJ824110                                              | (Blokhuis et al. 2009b)           |
| Mast2DL04 | Mast2DL04*019      | MmKIR2DL4*0190101-JHB | FJ824111                                              | (Blokhuis et al. 2009b)           |
| Mast2DL04 | Mast2DL04*020      | MmKIR2DL4*0200101-JHB | FJ824112, GU112274                                    | (Blokhuis et al. 2009b; Blokhuis et al. 2010) |
| Mast3DL01 | Mast3DL01*001      | KIR3DL1, 3DL3         | AF334616, GU299488                                    | (Colantoni et al. 2011; Hershberger et al. 2001) |
| Mast3DL01 | Mast3DL01*002      | KIR3DL2-old, 2DL426NK | AF334617, GU299488                                    | (Hershberger et al. 2001); (Colantoni et al. 2011) |
| Mast3DL01 | Mast3DL01*003      | KIR3DL3               | AF361083, GU112305                                    | (Blokhuis et al. 2010; Grendell et al. 2001) |
| Mast3DL01 | Mast3DL01*004      | KIR3DL4               | AF334619                                              | (Hershberger et al. 2001)         |
| Mast3DL01 | Mast3DL01*005      | KIR3DL5               | AF334620                                              | (Hershberger et al. 2001)         |
| Mast3DL01 | Mast3DL01*006      | KIR3DL12              | AF361082                                              | (Grendell et al. 2001)            |
| Mast3DL01 | Mast3DL01*007N     | KIR3DL13              | AF408151                                              | (Grendell et al. 2001)            |
| Mast3DL01 | Mast3DL01*008N     | KIR3DL14              | AF408152                                              | (Grendell et al. 2001)            |
| Mast3DL01 | Mast3DL01*009N     | KIR3DL15              | AF408153                                              | (Grendell et al. 2001)            |
| Mast3DL01 | Mast3DL01*010      | KIR3DL19              | AF408150                                              | (Grendell et al. 2001)            |
| Gene          | Allele designation                  | Previous designations                  | Accession number                  | Reference                                      |
|---------------|-------------------------------------|----------------------------------------|-----------------------------------|-----------------------------------------------|
| Mamu-KIR3DL01 | Mamu-KIR3DL01*011                   | KIR3DL1*variant_2                      | AY728187                         | (Sambrook et al. 2005)                         |
| Mamu-KIR3DL01 | Mamu-KIR3DL01*012                   | KIR3DL1*002-BNB, KIR3DL-like_1         | EU419033, AY505476, GU112286     | (Andersen et al. 2004; Blokhuis et al. 2010; Moreland et al. 2011) |
| Mamu-KIR3DL01 | Mamu-KIR3DL01*013                   | KIR3DL1*003-BNB                        | EU419034                         | (Moreland et al. 2011)                         |
| Mamu-KIR3DL01 | Mamu-KIR3DL01*014                   | KIR3DL1*005-BNB                        | EU419035                         | (Moreland et al. 2011)                         |
| Mamu-KIR3DL01 | Mamu-KIR3DL01*015                   | KIR3DL1*006-BNB                        | EU419036                         | (Moreland et al. 2011)                         |
| Mamu-KIR3DL01 | Mamu-KIR3DL01*016                   | KIR3DL1*007-BNB                        | EU419037, GU112258               | (Blokhuis et al. 2010; Moreland et al. 2011)   |
| Mamu-KIR3DL01 | Mamu-KIR3DL01*017                   | KIR3DL12*001-BNB                       | EU419044                         | (Moreland et al. 2011)                         |
| Mamu-KIR3DL01 | Mamu-KIR3DL01*018                   | KIR3DL2*001-BNB                        | EU419046                         | (Moreland et al. 2011)                         |
| Mamu-KIR3DL01 | Mamu-KIR3DL01*019:01                | KIR3DL1*001-BNB                        | EU419032, GU112300               | (Blokhuis et al. 2010; Moreland et al. 2011)   |
| Mamu-KIR3DL01 | Mamu-KIR3DL01*019:02                | None                                   | GU112283                         | (Blokhuis et al. 2010)                         |
| Mamu-KIR3DL01 | Mamu-KIR3DL01*020                   | KIR3DL1-like1                          | EU688987                         | (Moreland et al. 2011)                         |
| Mamu-KIR3DL01 | Mamu-KIR3DL01*021                   | KIR3DL                                 | FJ562108                         | (Bostik et al. 2009)                           |
| Mamu-KIR3DL01 | Mamu-KIR3DL01*022                   | None                                   | GU112267                         | (Blokhuis et al. 2010)                         |
| Mamu-KIR3DL01 | Mamu-KIR3DL01*023                   | None                                   | GU112292                         | (Blokhuis et al. 2010)                         |
| Mamu-KIR3DL01 | Mamu-KIR3DL01*024                   | None                                   | GU112321                         | (Blokhuis et al. 2010)                         |
| Mamu-KIR3DL01 | Mamu-KIR3DL01*025                   | None                                   | GU112324                         | (Blokhuis et al. 2010)                         |
| Mamu-KIR3DL01 | Mamu-KIR3DL01*026                   | KIR3DL. allele 2                        | FJ562109                         | (Bostik et al. 2009)                           |
| Mamu-KIR3DL01 | Mamu-KIR3DL01*027                   | KIR3DL. allele 3                        | FJ562110                         | (Bostik et al. 2009)                           |
| Mamu-KIR3DL02 | Mamu-KIR3DL02*001                   | KIR3DL2                                | AY728188                         | (Sambrook et al. 2005)                         |
| Mamu-KIR3DL02 | Mamu-KIR3DL02*002                   | KIR3DL-like_3                          | AY505478                         | (Andersen et al. 2004)                         |
| Mamu-KIR3DL02 | Mamu-KIR3DL02*003                   | KIR3DL21*001-BNB                       | EU419050                         | (Moreland et al. 2011)                         |
| Mamu-KIR3DL02 | Mamu-KIR3DL02*004:01                | KIR3DL21*003-BNB                       | EU419052                         | (Moreland et al. 2011)                         |
| Mamu-KIR3DL02 | Mamu-KIR3DL02*004:02                | KIR3DL21*005-BNB                       | EU419053                         | (Moreland et al. 2011)                         |
| Mamu-KIR3DL02 | Mamu-KIR3DL02*005                   | KIR3DL21*006-BNB                       | EU419054                         | (Moreland et al. 2011)                         |
| Mamu-KIR3DL02 | Mamu-KIR3DL02*006                   | KIR3DL21-like1                         | EU688989                         | (Moreland et al. 2011)                         |
| Mamu-KIR3DL02 | Mamu-KIR3DL02*007                   | None                                   | GU112277                         | (Blokhuis et al. 2010)                         |
| Mamu-KIR3DL02 | Mamu-KIR3DL02*008                   | None                                   | GU112281                         | (Blokhuis et al. 2010)                         |
| Mamu-KIR3DL02 | Mamu-KIR3DL03*001                   | KIR3DL21*002-BNB                       | EU419051                         | (Moreland et al. 2011)                         |
| Mamu-KIR3DL02 | Mamu-KIR3DL03*002                   | KIR3DL21*007-BNB                       | EU419055                         | (Moreland et al. 2011)                         |
| Mamu-KIR3DL02 | Mamu-KIR3DL03*003                   | KIR3DL-like1-BNB                      | EU419031                         | (Moreland et al. 2011)                         |
| Mamu-KIR3DL02 | Mamu-KIR3DL03*004                   | KIR3DL4                                | FN424253                         | (Kruse et al. 2010)                            |
| Mamu-KIR3DL02 | Mamu-KIR3DL03*005                   | KIR3DL-5                               | FN424256                         | (Kruse et al. 2010)                            |
| Mamu-KIR3DL04 | Mamu-KIR3DL04*001:01                | KIR3DL11*002-BNB                      | EU419040                         | (Moreland et al. 2011)                         |
| Mamu-KIR3DL04 | Mamu-KIR3DL04*001:02                | None                                   | GU112311                         | (Blokhuis et al. 2010)                         |
| Mamu-KIR3DL04 | Mamu-KIR3DL04*001:03                | None                                   | GU112319                         | (Blokhuis et al. 2010)                         |
| Mamu-KIR3DL04 | Mamu-KIR3DL04*002                   | KIR3DL11*003-BNB                      | EU419042                         | (Moreland et al. 2011)                         |
| Mamu-KIR3DL05 | Mamu-KIR3DL05*001                   | KIR3DL16*001-BNB                      | EU419045                         | (Moreland et al. 2011)                         |
| Mamu-KIR3DL05 | Mamu-KIR3DL05*002                   | KIR3DL7*004-BNB                       | EU419061                         | (Moreland et al. 2011)                         |
| Mamu-KIR3DL05 | Mamu-KIR3DL05*003                   | KIR3DL7*005-BNB                       | EU419062                         | (Moreland et al. 2011)                         |
| Mamu-KIR3DL05 | Mamu-KIR3DL05*004                   | KIR3DL7*009-BNB                       | EU419066                         | (Moreland et al. 2011)                         |
| Mamu-KIR3DL05 | Mamu-KIR3DL05*005                   | KIR3DL7*013-BNB                       | EU419069                         | (Moreland et al. 2011)                         |
| Mamu-KIR3DL05 | Mamu-KIR3DL05*006:01                | KIR3DL7-like2                         | EU688991                         | (Moreland et al. 2011)                         |
| Mamu-KIR3DL05 | Mamu-KIR3DL05*006:02                | None                                   | GU112293                         | (Blokhuis et al. 2010)                         |
| Mamu-KIR3DL05 | Mamu-KIR3DL05*007                   | KIR3DL-3                              | FN424252                         | (Kruse et al. 2010)                            |
| Mamu-KIR3DL05 | Mamu-KIR3DL05*008                   | 3DL7b-3DL40                           | GU112291, GU014295              | (Blokhuis et al. 2010)                         |
|              |                                     |                                        |                                   | (Colantonio et al. 2011)                       |
| Gene          | Allele designation | Previous designations | Accession number | Reference                                      |
|--------------|--------------------|-----------------------|------------------|------------------------------------------------|
| Mamu-KIR3DL05| Mamu-KIR3DL05*009  | None                  | GU112310         | (Blokhuis et al. 2010)                         |
| Mamu-KIR3DL05| Mamu-KIR3DL05*010  | KIR3DL allele 13      | FJ562120         | (Bostik et al. 2009)                          |
| Mamu-KIR3DL05| Mamu-KIR3DL05*011  | KIR3DL allele 14      | FJ562121         | (Bostik et al. 2009)                          |
| Mamu-KIR3DL06| Mamu-KIR3DL06*001  | KIR3DL6               | AF334621         | (Hershberger et al. 2001)                     |
| Mamu-KIR3DL06| Mamu-KIR3DL06*002  | KIR3DL6*001-BNB       | EU419056         | (Moreland et al. 2011)                        |
| Mamu-KIR3DL07| Mamu-KIR3DL07*001  | KIR3DL7               | AF334622         | (Hershberger et al. 2001)                     |
| Mamu-KIR3DL07| Mamu-KIR3DL07*002  | KIR3DL18              | AF361086         | (Grendell et al. 2001)                        |
| Mamu-KIR3DL07| Mamu-KIR3DL07*003  | KIR3DL7*001-BNB       | EU419057         | (Moreland et al. 2011)                        |
| Mamu-KIR3DL07| Mamu-KIR3DL07*004  | KIR3DL7*003-BNB       | EU419060         | (Moreland et al. 2011)                        |
| Mamu-KIR3DL07| Mamu-KIR3DL07*005  | KIR3DL7*006-BNB       | EU419063         | (Moreland et al. 2011)                        |
| Mamu-KIR3DL07| Mamu-KIR3DL07*006  | KIR3DL7*007-BNB       | EU419064         | (Moreland et al. 2011)                        |
| Mamu-KIR3DL07| Mamu-KIR3DL07*007  | KIR3DL7*008-BNB       | EU419065         | (Moreland et al. 2011)                        |
| Mamu-KIR3DL07| Mamu-KIR3DL07*008  | KIR3DL7*012-BNB       | EU419068         | (Moreland et al. 2011)                        |
| Mamu-KIR3DL07| Mamu-KIR3DL07*009:01 | KIR3DL7-like1, 2DL420 | EU688990, GU299489 | (Colantonio et al. 2011; Moreland et al. 2011) |
| Mamu-KIR3DL07| Mamu-KIR3DL07*009:02 | None                | GU112282         | (Blokhuis et al. 2010)                        |
| Mamu-KIR3DL07| Mamu-KIR3DL07*010  | KIR3DL7-like3        | EU688992         | (Moreland et al. 2011)                        |
| Mamu-KIR3DL07| Mamu-KIR3DL07*011  | KIR3DL allele 10      | FJ562117         | (Bostik et al. 2009)                          |
| Mamu-KIR3DL07| Mamu-KIR3DL07*012  | KIR3DL allele 11      | FJ562118         | (Bostik et al. 2009)                          |
| Mamu-KIR3DL08| Mamu-KIR3DL08*001:01 | KIR3DL8              | AY728189         | (Sambrook et al. 2005)                        |
| Mamu-KIR3DL08| Mamu-KIR3DL08*001:02 | KIR3DL8*002-BNB      | EU419071         | (Moreland et al. 2011)                        |
| Mamu-KIR3DL08| Mamu-KIR3DL08*002  | KIR3DL17             | AF361084, GU112306 | (Blokhuis et al. 2010; Grendell et al. 2001) |
| Mamu-KIR3DL08| Mamu-KIR3DL08*003  | KIR3DL17             | AF361085         | (Grendell et al. 2001)                        |
| Mamu-KIR3DL08| Mamu-KIR3DL08*004  | KIR3DL-like_2        | AY505477         | (Andersen et al. 2004)                        |
| Mamu-KIR3DL08| Mamu-KIR3DL08*005  | KIRDL8               | AY728189         | (Sambrook et al. 2005)                        |
| Mamu-KIR3DL08| Mamu-KIR3DL08*006  | KIR3DL8*001-BNB      | EU419070         | (Moreland et al. 2011)                        |
| Mamu-KIR3DL08| Mamu-KIR3DL08*007  | None                 | GU112268         | (Blokhuis et al. 2010)                        |
| Mamu-KIR3DL08| Mamu-KIR3DL08*008  | None                 | GU112285         | (Blokhuis et al. 2010)                        |
| Mamu-KIR3DL08| Mamu-KIR3DL08*009  | None                 | GU112290         | (Blokhuis et al. 2010)                        |
| Mamu-KIR3DL08| Mamu-KIR3DL08*010  | None                 | GU112330         | (Blokhuis et al. 2010)                        |
| Mamu-KIR3DL08| Mamu-KIR3DL08*011  | KIR3DL allele 8      | FJ562115         | (Bostik et al. 2009)                          |
| Mamu-KIR3DL10| Mamu-KIR3DL10*001  | KIR3DL10             | AY728183         | (Sambrook et al. 2005)                        |
| Mamu-KIR3DL10| Mamu-KIR3DL10*002:01 | KIR3DL9, KIR3DL allele 5 | AF334624, GU112259, FJ562112 | (Hershberger et al. 2001; Blokhuis et al. 2010; Bostik et al. 2009) |
| Mamu-KIR3DL10| Mamu-KIR3DL10*002:02 | 3DL3NK              | GU299486         | (Colantonio et al. 2011)                      |
| Mamu-KIR3DL10| Mamu-KIR3DL10*003  | KIR3DL10*001-BNB     | EU419038         | (Moreland et al. 2011)                        |
| Mamu-KIR3DL10| Mamu-KIR3DL10*004  | KIR3DL10*002-BNB     | EU419039         | (Moreland et al. 2011)                        |
| Mamu-KIR3DL10| Mamu-KIR3DL10*005:01 | 3DL10-2DL501        | GU014294         | (Colantonio et al. 2011)                      |
| Mamu-KIR3DL10| Mamu-KIR3DL10*005:02 | None                | GU112295         | (Blokhuis et al. 2010)                        |
| Mamu-KIR3DL10| Mamu-KIR3DL10*006  | KIR3DL allele 6      | FJ562113         | (Bostik et al. 2009)                          |
| Mamu-KIR3DL11| Mamu-KIR3DL11*001  | KIR3DL11             | AF334626, GU112271 | (Blokhuis et al. 2010; Hershberger et al. 2001) |
| Mamu-KIR3DL11| Mamu-KIR3DL11*002  | KIR3DL-1             | FN424250         | (Krus et al. 2010)                            |
| Mamu-KIR3DL11| Mamu-KIR3DL11*003  | KIR3DL-6             | FN424259         | (Krus et al. 2010)                            |
| Mamu-KIR3DL11| Mamu-KIR3DL11*004  | KIR3DL-7             | FN424261         | (Krus et al. 2010)                            |
| Mamu-KIR3DL11| Mamu-KIR3DL11*005  | None                 | GU112276         | (Blokhuis et al. 2010)                        |
| Mamu-KIR3DL11| Mamu-KIR3DL11*006  | None                 | GU112296         | (Blokhuis et al. 2010)                        |
| Mamu-KIR3DL11| Mamu-KIR3DL11*007  | KIR3DL allele 9      | FJ562116         | (Bostik et al. 2009)                          |
| Gene           | Allele designation | Previous designations       | Accession number       | Reference                                      |
|---------------|--------------------|-----------------------------|------------------------|------------------------------------------------|
| Mamu-KIR3DL20 | Mamu-KIR3DL20*001  | KIR3DL20*001-BNB            | EU419047               | (Moreland et al. 2011)                        |
| Mamu-KIR3DL20 | Mamu-KIR3DL20*002  | KIR3DL20                   |                     | (Blokhuys et al. 2010; Sambrook et al. 2005) |
| Mamu-KIR3DL20 | Mamu-KIR3DL20*003  | KIR3DL20_variant_2          |                     | (Sambrook et al. 2005)                        |
| Mamu-KIR3DL20 | Mamu-KIR3DL20*004  | KIR3DL20*003-BNB            | EU419048               | (Moreland et al. 2011)                        |
| Mamu-KIR3DL20 | Mamu-KIR3DL20*005  | None                       | EU419049               | (Moreland et al. 2011)                        |
| Mamu-KIR3DL20 | Mamu-KIR3DL20*006  | None                       | GU112255               | (Blokhuys et al. 2010)                        |
| Mamu-KIR3DL20 | Mamu-KIR3DL20*007  | None                       | GU112256               | (Blokhuys et al. 2010)                        |
| Mamu-KIR3DL20 | Mamu-KIR3DL20*008  | None                       | GU112264               | (Blokhuys et al. 2010)                        |
| Mamu-KIR3DL20 | Mamu-KIR3DL20*009  | None                       | GU112270               | (Blokhuys et al. 2010)                        |
| Mamu-KIR3DL20 | Mamu-KIR3DL20*010  | None                       | GU112275               | (Blokhuys et al. 2010)                        |
| Mamu-KIR3DL20 | Mamu-KIR3DL20*011  | None                       | GU112289               | (Blokhuys et al. 2010)                        |
| Mamu-KIR3DL20 | Mamu-KIR3DL20*012  | None                       | GU112299               | (Blokhuys et al. 2010)                        |
| Mamu-KIR3DL20 | Mamu-KIR3DL20*013  | None                       | GU112304, GU112317     | (Blokhuys et al. 2010)                        |
| Mamu-KIR3DL20 | Mamu-KIR3DL20*014  | None                       | GU112308               | (Blokhuys et al. 2010)                        |
| Mamu-KIR3DL20 | Mamu-KIR3DL20*015  | None                       | GU134802               | (Blokhuys et al. 2010)                        |
| Mamu-KIR3DS01 | Mamu-KIR3DS01*001:01 | KIR3DH5                | AF361087               | (Grendell et al. 2001)                        |
| Mamu-KIR3DS01 | Mamu-KIR3DS01*001:02 | None                | GU112307               | (Blokhuys et al. 2010)                        |
| Mamu-KIR3DS01 | Mamu-KIR3DS01*002  | KIR3DH1                   |                     | (Sambrook et al. 2005)                        |
| Mamu-KIR3DS01 | Mamu-KIR3DS01*003  | KIR3DH7                   | GU564161               | (Chaichompo et al. 2010)                      |
| Mamu-KIR3DS02 | Mamu-KIR3DS02*001  | KIR3DH2                   | AF334649               | (Hersberger et al. 2001)                      |
| Mamu-KIR3DS02 | Mamu-KIR3DS02*002  | KIR3DH-like_5             | AY505483               | (Andersen et al. 2004)                        |
| Mamu-KIR3DS02 | Mamu-KIR3DS02*003  | KIR3DH-like_6             | AY505484               | (Andersen et al. 2004)                        |
| Mamu-KIR3DS02 | Mamu-KIR3DS02*004:01 | KIR3DH2*001-BNB, KIR3DH14 | EU419026, EU702460     | (Blokhuys et al. 2009a; Moreland et al. 2011) |
| Mamu-KIR3DS02 | Mamu-KIR3DS02*004:02 | KIR3DH13, 3DH42           | EU702459, GU014296    | (Blokhuys et al. 2009a)                       |
| Mamu-KIR3DS02 | Mamu-KIR3DS02*004:03 | KIR3DH12                | EU702458               | (Blokhuys et al. 2009a)                       |
| Mamu-KIR3DS02 | Mamu-KIR3DS02*005  | KIR3DH2*002-BNB           | EU419027               | (Moreland et al. 2011)                        |
| Mamu-KIR3DS02 | Mamu-KIR3DS02*006  | KIR3DH16                  | EU702462               | (Blokhuys et al. 2009a)                       |
| Mamu-KIR3DS02 | Mamu-KIR3DS02*007  | KIR3DH15                  | EU702461               | (Blokhuys et al. 2009a)                       |
| Mamu-KIR3DS02 | Mamu-KIR3DS02*008  | KIR3DH10                  | EU702456, GU112278    | (Blokhuys et al. 2009a; Blokhuis et al. 2010) |
| Mamu-KIR3DS02 | Mamu-KIR3DS02*009  | None                      | GU112261, GU112315     | (Blokhuys et al. 2010)                        |
| Mamu-KIR3DS02 | Mamu-KIR3DS02*010  | None                      | GU112297               | (Blokhuys et al. 2010)                        |
| Mamu-KIR3DS02 | Mamu-KIR3DS02*011  | None                      | GU112323               | (Blokhuys et al. 2010)                        |
| Mamu-KIR3DS02 | Mamu-KIR3DS02*012  | 3DH2*NEW1                 | JN613291               | (Hellmann et al. 2011)                        |
| Mamu-KIR3DS02 | Mamu-KIR3DS02*013  | 3DH2*NEW1                 | JN613299               | (Hellmann et al. 2011)                        |
| Mamu-KIR3DS03 | Mamu-KIR3DS03*001:01 | KIR3DH3                | AF334650, GU112312    | (Hersberger et al. 2001)                      |
| Mamu-KIR3DS03 | Mamu-KIR3DS03*001:02 | None                | GU112294               | (Blokhuys et al. 2010)                        |
| Mamu-KIR3DS03 | Mamu-KIR3DS03*002  | KIR3DH9                   | EU702455, GU112269    | (Blokhuys et al. 2009a; Blokhuis et al. 2010) |
| Mamu-KIR3DS03 | Mamu-KIR3DS03*003  | KIR3DH8                   | EU702454               | (Blokhuys et al. 2009a)                       |
| Mamu-KIR3DS04 | Mamu-KIR3DS04*001  | KIR3DH4                   | AY505483               | (Hersberger et al. 2001)                      |
| Mamu-KIR3DS04 | Mamu-KIR3DS04*002  | KIR3DH4*001-BNB           | EU419028               | (Moreland et al. 2011)                        |
| Mamu-KIR3DS04 | Mamu-KIR3DS04*003  | KIR3DH4*002-BNB, KIR3DH4  | EU419029, JN613296    | (Hellmann et al. 2011; Moreland et al. 2011) |
| Mamu-KIR3DS04 | Mamu-KIR3DS04*004  | KIR3DH6                   | EU702452               | (Blokhuys et al. 2009a)                       |
| Mamu-KIR3DS04 | Mamu-KIR3DS04*005  | KIR3DH4                   | JN613300               | (Hellmann et al. 2011)                        |
the sequence originally named *Mamu-KIR3DL5* (Hershberger et al. 2001) is a recombinant of *Mamu-KIR3DL01* and *Mamu-KIR3DL07*. As such, it has been renamed as an allele of *Mamu-KIR3DL01, Mamu-KIR3DL01* *005*. This principal has also been applied to recombinant alleles in other species.

Along with the lineage II KIR genes, rhesus macaques have KIR genes for lineage I, III, and V KIR. The lineage I KIR gene in rhesus macaques is orthologous to other primate lineage I KIR, referred to as 2DL4 and has been named *Mamu-KIR2DL04*. A single lineage III KIR is also present on some *Mamu-KIR* haplotypes and in all cases appears to be expressed as a one Ig domain KIR. It has been named *Mamu-KIR1D*. Finally, there is a lineage V KIR gene that is expressed as either a two Ig or three Ig domain KIR. The published genomic sequence shows the gene to contain three Ig domain encoding exons; however, due to splicing

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**Table 4** (continued)

| Gene        | Allele designation | Previous designations | Accession number          | Reference                             |
|-------------|--------------------|-----------------------|---------------------------|---------------------------------------|
| Mamu-KIR3DS04 | Mamu-KIR3DS04*006 | KIR3DH-1              | GU564157                  | (Chaichompoo et al. 2010)             |
| Mamu-KIR3DS05 | Mamu-KIR3DS05*001 | KIR3DH1*001-BNB       | EU419024, EU419025, EU702468, AY505487, GU112262 | (Moreland et al. 2011)               |
| Mamu-KIR3DS05 | Mamu-KIR3DS05*002:01 | KIR3DH1*002-BN, KIR3DM1, KIR_Partial_Sequence_1 | EU419025, EU702468, AY505487, GU112262 | (Andersen et al. 2004; Blokhuis et al. 2009a; Blokhuis et al. 2010; Moreland et al. 2011) |
| Mamu-KIR3DS06 | Mamu-KIR3DS06*002:02 | KIR3DM6               | EU702473                  | (Blokhuis et al. 2009a)               |
| Mamu-KIR3DS06 | Mamu-KIR3DS06*003 | KIR3DM-1              | FN424260                  | (Kruse et al. 2010)                   |
| Mamu-KIR3DS06 | Mamu-KIR3DS06*001 | KIR3DH-like_7         | AY505485                  | (Andersen et al. 2004)                |
| Mamu-KIR3DS06 | Mamu-KIR3DS06*002:02 | KIR3DH-like8          | EU688985                  | (Moreland et al. 2011)                |
| Mamu-KIR3DS06 | Mamu-KIR3DS06*003 | None                  | GU112298                  | (Blokhuis et al. 2010)                |
| Mamu-KIR3DS06 | Mamu-KIR3DS06*004 | KIR3DH18              | EU702464                  | (Blokhuis et al. 2009a)               |
| Mamu-KIR3DS06 | Mamu-KIR3DS06*005 | None                  | GU112260                  | (Blokhuis et al. 2010)                |
| Mamu-KIR3DS06 | Mamu-KIR3DS06*006 | None                  | GU112314                  | (Blokhuis et al. 2010)                |
| Mamu-KIR3DSW07 | Mamu-KIR3DSW07*001 | KIR3DH7               | EU702453, GU112272        | (Blokhuis et al. 2009a; Blokhuis et al. 2010) |
| Mamu-KIR3DSW07 | Mamu-KIR3DSW07*002 | KIR3DH5               | FN424258                  | (Kruse et al. 2010)                   |
| Mamu-KIR3DSW08 | Mamu-KIR3DSW08*001 | KIR3DH-like_1         | AY505479                  | (Andersen et al. 2004)                |
| Mamu-KIR3DSW08 | Mamu-KIR3DSW08*002 | KIR3DH-like_2         | AY505480                  | (Andersen et al. 2004)                |
| Mamu-KIR3DSW08 | Mamu-KIR3DSW08*003 | KIR3DH-like_3         | AY505481                  | (Andersen et al. 2004)                |
| Mamu-KIR3DSW08 | Mamu-KIR3DSW08*004 | KIR3DH-like_4         | AY505482                  | (Andersen et al. 2004)                |
| Mamu-KIR3DSW08 | Mamu-KIR3DSW08*005 | KIR3DH12              | EU702467                  | (Blokhuis et al. 2009a)               |
| Mamu-KIR3DSW08 | Mamu-KIR3DSW08*006 | KIR3DH2               | FN424254                  | (Kruse et al. 2010)                   |
| Mamu-KIR3DSW08 | Mamu-KIR3DSW08*007 | KIR3DH3               | FN424255                  | (Kruse et al. 2010)                   |
| Mamu-KIR3DSW08 | Mamu-KIR3DSW08*008 | None                  | GU112325                  | (Blokhuis et al. 2010)                |
| Mamu-KIR3DSW08 | Mamu-KIR3DSW08*009 | None                  | GU112328                  | (Blokhuis et al. 2010)                |
| Mamu-KIR3DSW08 | Mamu-KIR3DSW08*010 | KIR3DSW08             | JN613297                  | (Hellmann et al. 2011)                |
| Mamu-KIR3DSW08 | Mamu-KIR3DSW08*011 | KIR3DH4               | GU564158                  | (Chaichompoo et al. 2010)             |
| Mamu-KIR3DSW08 | Mamu-KIR3DSW08*012 | KIR3DH5               | GU564159                  | (Chaichompoo et al. 2010)             |
| Mamu-KIR3DSW09 | Mamu-KIR3DSW09*001 | KIR3DH5*001-BNB       | EU419030                  | (Moreland et al. 2011)                |
| Mamu-KIR3DSW09 | Mamu-KIR3DSW09*002 | KIR3DH5-like1         | EU688986                  | (Moreland et al. 2011)                |
| Mamu-KIR3DSW09 | Mamu-KIR3DSW09*003 | None                  | GU112301                  | (Blokhuis et al. 2010)                |
| Mamu-KIR3DSW09 | Mamu-KIR3DSW09*004 | KIR3DH20              | EU702466, GU112273        | (Blokhuis et al. 2009a), (Blokhuis et al. 2010) |
| Mamu-KIR3DSW09 | Mamu-KIR3DSW09*005 | mmKIR3DH-1            | FN424249                  | (Krete et al. 2010)                   |
| Mamu-KIR3DSW09 | Mamu-KIR3DSW09*006 | KIR3DH-8              | GU564162                  | (Chaichompoo et al. 2010)             |
| Mamu-KIR3DLX1 | Mamu-KIR3DLX1*001 | KIR3DL0               | DQ157756                  | (Sambrook et al. 2006)                |
out of exon 4, also two Ig domain KIR variants are expressed. The majority of the rhesus macaque gene sequence appears orthologous to hominoid KIR3DL3 sequences, the exception being exon 3 [encoding the D0 domain] which appears more like the hominoid KIR2DL5 sequences. This sequence relationship coupled with the presence of splice variants that lacked exon 4 led to the naming of some of these sequences as Mamu-KIR2DL5. The presence of the intact gene as evidenced by the published genomic sequence, as well as the existence of full-length [three Ig domain containing] sequences has led us to propose naming this gene as Mamu-KIR3DL20. This distinguishes this gene from the remaining Mamu-KIR3DL as well as retaining the name of one of the first mRNA sequences that

| Table 5 Allele designations and their previous names |
|----------------------------------------------------|
| Gene      | Allele designation | Previous designations | Accession number | Reference       |
|----------------------------------------------------|
| Patr-KIR2DL4 | Patr-KIR2DL4*001 | None                | HM068617         | (Abi-Rached et al. 2010) |
| Patr-KIR2DL4 | Patr-KIR2DL4*002 | None                | AC155174, AF258804 | (Khakoo et al. 2000) |
| Patr-KIR2DL4 | Patr-KIR2DL4*003 | None                | BX842589         | (Sambrook et al. 2005) |
| Patr-KIR2DL5 | Patr-KIR2DL5*001 | None                | HM068617         | (Abi-Rached et al. 2010) |
| Patr-KIR2DL5 | Patr-KIR2DL5*002 | None                | AF274005         | (Rajalingam et al. 2001) |
| Patr-KIR2DL5 | Patr-KIR2DL5*003 | None                | AC155174         |                |
| Patr-KIR2DL5 | Patr-KIR2DL5*004 | None                | BX842589         | (Sambrook et al. 2005) |
| Patr-KIR2DL5 | Patr-KIR2DL5*005 | None                | AF258805         | (Khakoo et al. 2000) |
| Patr-KIR2DL6 | Patr-KIR2DL6*001 | None                | BX842589, AM292662 | (Sambrook et al. 2005) |
| Patr-KIR2DL6 | Patr-KIR2DL6*002 | None                | AF258806         |                |
| Patr-KIR2DL6 | Patr-KIR2DL6*003 | None                | AM292661         |                |
| Patr-KIR2DL7 | Patr-KIR2DL7*001 | None                | HM068617         | (Abi-Rached et al. 2010) |
| Patr-KIR2DL8 | Patr-KIR2DL8*001 | None                | HM068617         | (Abi-Rached et al. 2010) |
| Patr-KIR2DL8 | Patr-KIR2DL8*002 | None                | AC155174, AM279149 | Biassoni, unpublished |
| Patr-KIR2DL8 | Patr-KIR2DL8*003 | None                | BX842589         | (Sambrook et al. 2005) |
| Patr-KIR2DL9 | Patr-KIR2DL9*001 | None                | AC155174         |                |
| Patr-KIR2DL9 | Patr-KIR2DL9*002 | None                | AM292657         | Biassoni, unpublished |
| Patr-KIR2DS4 | Patr-KIR2DS4*001 | None                | HM068617         |                |
| Patr-KIR2DS4 | Patr-KIR2DS4*002 | None                | AF258807         |                |
| Patr-KIR3DL1 | Patr-KIR3DL1*001:01 | None        | AC155174         |                |
| Patr-KIR3DL1 | Patr-KIR3DL1*001:02 | None        | AF266729         | (Rajalingam et al. 2001) |
| Patr-KIR3DL1 | Patr-KIR3DL1*002 | None                | BX842589, AF258798 | (Sambrook et al. 2005) |
| Patr-KIR3DL1 | Patr-KIR3DL1*003 | None                | AF266730         | (Rajalingam et al. 2001) |
| Patr-KIR3DL1 | Patr-KIR3DL1*004 | None                | AF258799         |                |
| Patr-KIR3DL1 | Patr-KIR3DL1*005 | None                | HM068617         |                |
| Patr-KIR3DL3 | Patr-KIR3DL3*001 | None                | HM068617         |                |
| Patr-KIR3DL3 | Patr-KIR3DL3*002 | None                | BX842589         |                |
| Patr-KIR3DL3 | Patr-KIR3DL3*003 | None                | AC155174         |                |
| Patr-KIR3DL3 | Patr-KIR3DL3*004 | None                | AY327500         |                |
| Patr-KIR3DL4 | Patr-KIR3DL4*001:01 | None        | AM400232         | Biassoni, unpublished |
| Patr-KIR3DL4 | Patr-KIR3DL4*001:02 | None        | AF258800         | (Khakoo et al. 2000) |
| Patr-KIR3DL4 | Patr-KIR3DL4*002 | None                | HM068617         | (Abi-Rached et al. 2010) |
| Patr-KIR3DL5 | Patr-KIR3DL5*001 | None                | AM400235         | Biassoni, unpublished |
| Patr-KIR3DL5 | Patr-KIR3DL5*003:01 | None        | AF258801         | (Khakoo et al. 2000) |
| Patr-KIR3DL5 | Patr-KIR3DL5*004 | None                | AC155174, AM292659 | Biassoni, unpublished |
| Patr-KIR3DS2 | Patr-KIR3DS2*001 | None                | AC155174         |                |
| Patr-KIR3DS2 | Patr-KIR3DS2*002 | None                | AF258803         |                |
| Patr-KIR3DS6 | Patr-KIR3DS6*001 | None                | AM396937         | Biassoni, unpublished |
variants, now known to occupy this position, were named Patr.

These analyses have defined 13 different KIR genes. In addition, the analysis of chimpanzee KIR haplotypes, the framework gene at the telomeric end is a lineage II KIR gene. Formerly, two variants, now known to occupy this position, were named Pr-KIR3DL1/2 and Pr-KIR3DL3. The name Pr-KIR3DL1/2 was given to reflect its close relationship to both human KIR3DL1 and KIR3DL2. Although segregation analysis showed that Pr-KIR3DL3 and KIR3DL1/2 were never present on the same haplotype, Pr-KIR3DL3 was given a different name because it has a distinctive sequence. We are renaming the Pr-KIRDL1/2 and Pr-KIR3DL3 as allelic variants of Patr-KIR3DL1, the new name for the framework gene at the telomeric end of the chimpanzee KIR locus. This will allow the Patr-KIR3DL3 name to be given to the gene previously known as Patr-KIRC1, and which is orthologous to human KIR3DL3, the framework gene at the centromeric end of the KIR locus. See Table 2 for further details. A full list of Patr-KIR sequences is described in Table 4.

The identification of sequences in other Macaque species will follow the same rules, and use the species prefix (Mama-KIR), and that genes would be named to match the closest rhesus gene.

**Naming chimpanzee KIR genes**

Three studies (Abi-Rached et al. 2010; Khakoo et al. 2000; Sambrook et al. 2005) have described complete sequences of three chimpanzee haplotypes. In addition, the analysis of chimpanzee KIR genotypes has inferred the organization of genes infers the existence of another 17 chimpanzee KIR haplotypes. These analyses have defined 13 different Patr-KIR genes.

In all chimpanzee KIR haplotypes, the framework gene at the telomeric end is a lineage II KIR gene. Formerly, two variants, now known to occupy this position, were named Pr-KIR3DL1/2 and Pr-KIR3DL3. The name Pr-KIR3DL1/2 was given to reflect its close relationship to both human KIR3DL1 and KIR3DL2. Although segregation analysis showed that Pt-KIR3DL3 and KIR3DL1/2 were never present on the same haplotype, Pt-KIR3DL3 was given a different name because it has a distinctive sequence. We are renaming the Pr-KIRDL1/2 and Pr-KIR3DL3 as allelic variants of Patr-KIR3DL1, the new name for the framework gene at the telomeric end of the chimpanzee KIR locus. This will allow the Patr-KIR3DL3 name to be given to the gene previously known as Patr-KIRC1, and which is orthologous to human KIR3DL3, the framework gene at the centromeric end of the KIR locus. See Table 2 for further details. A full list of Patr-KIR sequences is described in Table 4.

**Naming orangutan KIR genes**

In the initial description of orangutan KIR cDNA (Guethlein et al. 2002), the sequences were given letter designations because their relationships, either alleles or genes, were uncertain. Subsequent studies (Guethlein et al. 2007a; Guethlein et al. 2017; Locke et al. 2011; Mager et al. 2001) have provided complete sequences of three orangutan KIR haplotypes, as well as genotyping data that has allowed the structures of two additional KIR haplotypes to be inferred. These genomic...
The orangutan (Pongo pygmaeus) is now divided into two series corresponding to the two species of orangutan: Popy for P. pygmaeus and Poab for P. abelii, depending on species of origin. Some KIR alleles are present in both orangutan species. These alleles shared have been given a different name in each species (Guethlein et al. 2017; Guethlein et al. 2015), see Table 3: for further details. A full list of *Popy-KIR* and *Poab-KIR* sequences is given in Table 6.

### Naming cattle KIR genes

Assembly of the first cattle *KIR* haplotype allowed previously known cDNA sequences to be assigned to particular genes and allelic relationships to be defined (Dobromylskyj and Ellis 2007; Guethlein et al. 2007a; Hammond et al. 2016; Mager et al. 2001; Sanderson et al. 2014). This presents the opportunity to adopt an accurate and logical nomenclature system. Cattle *KIR* cDNA sequences were previously named using the established convention of Ig domain number and tail length. However, these alleles were annotated prior to the discovery of a second deeply divergent *KIR* lineage, the *KIR3D* lineage (Guethlein et al. 2007a). The majority of the expanded cattle *KIR* belong to this second lineage. In developing a nomenclature system for the cattle *KIR*, we have incorporate their lineage ancestry within the name. Cattle *KIR* have been prefixed with a four-letter species designation “Bota” (*Bos taurus*) in line with non-human primates. Where possible previously named *Bota-KIR* has retained the same name with only the addition of an “X” after the domain number if from the *KIR3DX* lineage. There are three exceptions; *Bota-KIR3DL1P* and *Bota-KIR3DL3*, which are allelic,
and Bota-KIR3DL2. These previously described cDNA sequences are all members of the KIR3DX lineage. Based on their position in the cattle haplotype and their relationships to other genes, Bota-KIR3DL1P was renamed Bota-KIR3DXL6*001N, Bota-KIR3DL3 was renamed Bota-KIR3DXL6*002, and Bota-KIR3DL2 was renamed Bota-KIR3DXL4. We have identified 16 cattle KIR genes. The proposed nomenclature for cattle KIR is given in Table 7.

Future guidelines

The sequences described in this report will be included in the Immuno Polymorphism Database (IPD) (Robinson et al. 2013). They will be maintained as a component of the IPD and be accessible at https://www.ebi.ac.uk/ipd/nhkir/. New sequences for any of the above species can be submitted using the current submission tool. As with the other databases, there are requirements that should be met before formal names can be given and the submitted KIR are included in the database. First, submission of full-length sequences is encouraged and for some species like rhesus macaque is already mandatory. Second, novel sequences must be confirmed, either through their replication in multiple individuals or at a minimum by coming from multiple independent PCR/cloning experiments. Full guidelines for submission of non-human KIR sequences to IPD can be found at https://www.ebi.ac.uk/ipd/nhkir/submission/help.

As KIR sequence data from other species reaches the level of the species included in this report, those species can be included in the database. The inclusion of a species will be at the discretion of the Nomenclature Committee and IPD and will be based on the number of sequences available as well as evidence of identified genes and haplotype structure.

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