Gill Blood Group System

Number of antigens 1

High prevalence	GIL

Terminology

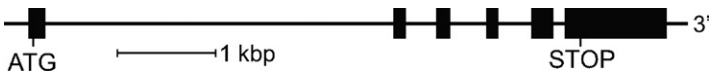
ISBT symbol (number)	GIL (029)
History	Named after the family name of the first antigen-negative proband. Became a system in 2002 after the antigen was shown to be located on aquaglyceroporin.

Expression

Other blood cells	Absent from platelets
Tissues	Kidney medulla and cortex, basolateral membrane of collecting duct cells, small intestine, stomach, colon, spleen, airways, skin, eye[1–3]

Gene[2,4]

Chromosome	9p13.3
Name	(*AQP3*)
Organization	Six exons spanning approximately 6 kbp of gDNA
Product	Aquaglyceroporin, AQP3; a member of the major intrinsic protein (MIP) family of water channels



Database accession numbers

GenBank	NM_004925 (mRNA)
Entrez Gene ID	360

The Blood Group Antigen (3/e). DOI: http://dx.doi.org/10.1016/B978-0-12-415849-8.00031-4

Molecular basis of silencing *GIL* (GIL_{null} phenotype)[5]

The reference allele *GIL*01* (Accession number NM_004925) encodes GIL (GIL1). The nucleotide difference from this allele, and amino acid affected, are given.

Allele encodes	Allele name	Exon	Nucleotide	Restriction enzyme	Ethnicity (prevalence)
GIL− or GIL:−1	*GIL*N.01*	Exon 5 skipped, fs, Stop	IVS5+1g>a	*Pml*I+	Americans, French, Germans (Rare)

Amino acid sequence

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MGRQKELVSR  CGEMLHIRYR  LLRQALAECL  GTLILVMFGC  GSVAQVVLSR   50
GTHGGFLTIN  LAFGFAVTLG  ILIAGQVSGA  HLNPAVTFAM  CFLAREPWIK  100
LPIYTLAQTL  GAFLGAGIVF  GLYYDAIWHF  ADNQLFVSGP  NGTAGIFATY  150
PSGHLDMING  FFDQFIGTAS  LIVCVLAIVD  PYNNPVPRGL  EAFTVGLVVL  200
VIGTSMGFNS  GYAVNPARDF  GPRLFTALAG  WGSAVFTTGQ  HWWWVPIVSP  250
LLGSIAGVFV  YQLMIGCHLE  QPPPSNEEEN  VKLAHVKHKE  QI         292
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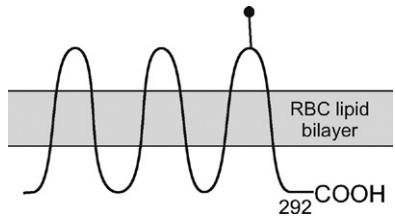
Carrier molecule

A multipass membrane protein.



M_r (SDS-PAGE)	46,000; after N-glycosidase F treatment to 26,000
CHO: N-glycan	1
Cysteine residues	6
Copies per RBC	25,000

Function

A water channel that also transports nonionic small molecules such as urea and glycerol.

AQP3 is important in regulating epidermal structure and function[6].
RBCs from a GIL-negative proband had reduced glycerol permeability.

Disease association

No disease association has been noted.

Comments

By Western blotting, RBC membranes from different people have different levels of expression of AQP3. AQP3 is present in the membrane as dimers, trimers, and tetramers[7].

References

[1] Agre, P., et al., 2002. Aquaporin water channels: from atomic structure to clinical medicine. J Physiol London 542, 3–16.
[2] Ishibashi, K., et al., 1994. Molecular cloning and expression of a member of the aquaporin family with permeability to glycerol and urea in addition to water expressed at the basolateral membrane of kidney collecting duct cells. Proc Natl Acad Sci USA 91, 6269–6273.
[3] Roudier, N., et al., 2002a. AQP3 deficiency in humans and the molecular basis of a novel blood group system, GIL. J Biol Chem 277, 45854–45859.
[4] Inase, N., et al., 1995. Isolation of human aquaporin 3 gene. J Biol Chem 270, 17913–17916.
[5] Roudier, N., et al., 2002b. Erythroid expression and oligomeric state of the AQP3 protein. J Biol Chem 277, 7664–7669.
[6] Qin, H., et al., 2011. Aquaporin-3 in keratinocytes and skin: its role and interaction with phospholipase D2. Arch Biochem Biophys 508, 138–143.
[7] Ledvinova, J., et al., 1997. Blood group B glycosphingolipids in α-galactosidase deficiency (Fabry disease): influence of secretor status. Biochim Biophys Acta 1345, 180–187.

GIL Antigen

Terminology

ISBT symbol (number)	GIL1 (029001 or 29.1)
Obsolete name	Gill
History	Reported in 1981; name derived from the first antigen-negative proband who made the alloantibody.

Occurrence

Five GIL– probands were American, French, and German.

Expression

Cord RBCs	Slightly weaker than on RBCs from adults

Molecular basis associated with GIL antigen

GIL-negative RBCs lack aquaglyceroporin (AQP3).

Effect of enzymes and chemicals on GIL antigen on intact RBCs

Ficin/Papain	Resistant (enhanced)
Trypsin	Resistant (enhanced)
α-Chymotrypsin	Resistant (enhanced)
DTT 200 mM	Resistant
Acid	Resistant

In vitro characteristics of alloanti-GIL

Immunoglobulin class	IgG
Optimal technique	IAT
Complement binding	Yes

Clinical significance of alloanti-GIL

Transfusion reaction	Hemolytic
HDFN	Positive DAT, but no clinical HDFN

Comments

There may be heterogeneity among the five reported anti-GIL[1].

Reference

[1] Daniels, G.L., et al., 1998. GIL: a red cell antigen of very high frequency. Immunohematology 14, 49–52.