Supplementary Table S1: List of genes, their position and function identified within haploblocks containing the ten most associated SNPs for direct calving difficulty.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| BTA | Haploblock position | Gene | Position | Function |
| 18 | 56607357-56812286 | SIGLEC-5 | [57,124,825-57,141,257](http://jun2011.archive.ensembl.org/Bos_taurus/Location/View?db=core;g=ENSBTAG00000037537;r=18:57124825-57141257;t=ENSBTAT00000031802) | Also known as SIGLEC12.Sialic acid-binding immunoglobulin-like lectins (SIGLECs) are a family of cell surface proteins belonging to the immunoglobulin superfamily. They mediate protein-carbohydrate interactions by selectively binding to different sialic acid moieties present on glycolipids and glycoproteins. |
|  |  | CD33 | [57,110,869-57,119,752](http://jun2011.archive.ensembl.org/Bos_taurus/Location/View?db=core;g=ENSBTAG00000004608;r=18:57110869-57119752) | Putative adhesion molecule of myelomonocytic-derived cells that mediates sialic-acid dependent binding tocells.  |
|  |  | C18H19orf75 | [57,267,927-57,270,979](http://jun2011.archive.ensembl.org/Bos_taurus/Location/View?db=core;g=ENSBTAG00000038024;r=18:57267927-57270979;t=ENSBTAT00000053013) | Sialic acid-binding immunoglobulin-like lectins |
|  |  | IGLON5 | [57,308,171-57,313,994](http://jun2011.archive.ensembl.org/Bos_taurus/Location/View?db=core;g=ENSBTAG00000019473;r=18:57308171-57313994;t=ENSBTAT00000025938) | Belongs to the immunoglobulin superfamily |
|  |  | VSIG10L | [57,318,113-57,328,795](http://jun2011.archive.ensembl.org/Bos_taurus/Location/View?db=core;g=ENSBTAG00000020447;r=18:57318113-57328795;t=ENSBTAT00000027247) | V-set and immunoglobulin domain containing 10 like. V-set domains are Ig-like domains resembling the antibody variable domain. V-set domains are found in diverse protein families, including immunoglobulin light and heavy chains; in several T-cell receptors such as CD2 (Cluster of Differentiation 2), CD4, CD80, and CD86; in myelin membrane adhesion molecules; in junction adhesion molecules (JAM); in tyrosine-protein kinase receptors; and in the programmed cell death protein 1 (PD1). |
|  |  | CLDND2 | [57,346,840-57,348,122](http://jun2011.archive.ensembl.org/Bos_taurus/Location/View?db=core;g=ENSBTAG00000020450;r=18:57346840-57348122;t=ENSBTAT00000027251) | Tight junction forming protein |
|  |  | **NKG7** | [57,350,257-57,353,010](http://jun2011.archive.ensembl.org/Bos_taurus/Location/View?db=core;g=ENSBTAG00000009137;r=18:57350257-57353010;t=ENSBTAT00000012042) | Natural killer cell protein 7. Found expressed in NK cells. |
|  |  | **ETFB** | [57,333,562-57,346,053](http://jun2011.archive.ensembl.org/Bos_taurus/Location/View?db=core;g=ENSBTAG00000020449;r=18:57333562-57346053;t=ENSBTAT00000027250) | The electron transfer flavoprotein serves as a specific electron acceptor for several dehydrogenases, including five acyl-CoA dehydrogenases, glutaryl-CoA and sarcosine dehydrogenase. It transfers the electrons to the main mitochondrial respiratory chain via ETF-ubiquinone oxidoreductase (ETF dehydrogenase) |
|  |  | **LIM2** | [57,357,213-57,364,362](http://jun2011.archive.ensembl.org/Bos_taurus/Location/View?db=core;g=ENSBTAG00000003231;r=18:57357213-57364362;t=ENSBTAT00000004191) | Present in the thicker 16-17 nm junctions of mammalian lens fiber cells, where it may contribute to cell junctional organization. Acts as a receptor for calmodulin. May play an important role in both lens development and cataractogenesis. |
|  |  | **SIGLEC10** | [57,372,841-57,379,872](http://jun2011.archive.ensembl.org/Bos_taurus/Location/View?db=core;g=ENSBTAG00000008852;r=18:57372841-57379872;t=ENSBTAT00000004195) | Sialic acid-binding immunoglobulin-like lectins |
|  |  | ZNF175 | [57,437,817-57,447,909](http://jun2011.archive.ensembl.org/Bos_taurus/Location/View?db=core;g=ENSBTAG00000040603;r=18:57437817-57447909;t=ENSBTAT00000052898) | Down-regulates the expression of several chemokine receptors. |
|  |  | **SIGLEC14** | [57,562,649-57,566,637](http://jun2011.archive.ensembl.org/Bos_taurus/Location/View?db=core;g=ENSBTAG00000035868;r=18:57562649-57566637;t=ENSBTAT00000026429) | Sialic acid-binding immunoglobulin-like lectins |
|  |  | **HAS1** | [57,601,946-57,609,339](http://jun2011.archive.ensembl.org/Bos_taurus/Location/View?db=core;g=ENSBTAG00000017672;r=18:57601946-57609339;t=ENSBTAT00000023502) | Hyaluronan or hyaluronic acid (HA) is a high molecular weight unbranched polysaccharide. It has variety of functions, including space filling, lubrication of joints, and providing of a matrix through which cells can migrate. HA is actively produced during wound healing and tissue repair to provide a framework for in growth of blood vessels and fibroblasts.  |
|  |  | **ZNF577** | [57,659,498-57,672,731](http://jun2011.archive.ensembl.org/Bos_taurus/Location/View?db=core;g=ENSBTAG00000008968;r=18:57659498-57672731;t=ENSBTAT00000031816) | Zinc finger and may be involved in transcriptional regulation |
|  |  | **ZNF432** | [57,720,462-57,728,282](http://jun2011.archive.ensembl.org/Bos_taurus/Location/View?db=core;g=ENSBTAG00000006954;r=18:57720462-57728282;t=ENSBTAT00000031814) | Zinc finger and may be involved in transcriptional regulation |
| 17 | No haplobock | N/A | N/A | N/A |
| 6 | 66199733-668099119 | NONE | N/A | N/A |
| 22 | 12830183-12985630 | CCR8 | [12,835,708-12,836,244](http://jun2011.archive.ensembl.org/Bos_taurus/Location/View?db=core;g=ENSBTAG00000015483;r=22:12835708-12836244;t=ENSBTAT00000020577)  | This gene encodes a member of the beta chemokine receptor family, which is predicted to be a seven transmembrane protein similar to G protein-coupled receptors. It has been suggested to have a role in regulation of monocyte chemotaxis and thymic cell apoptosis. More specifically, this receptor may contribute to the proper positioning of activated T cells within the antigenic challenge sites and specialized areas of lymphoid tissues. |
|  |  | THEM4 | [12,838,604-12,844,384](http://jun2011.archive.ensembl.org/Bos_taurus/Location/View?db=core;g=ENSBTAG00000015493;r=22:12838604-12844384;t=ENSBTAT00000020594) | The protein encoded by this gene negatively regulates protein kinase B activity by inhibiting phosphorylation |
|  |  | SLC25A38 | [12,846,582-12,861,550](http://jun2011.archive.ensembl.org/Bos_taurus/Location/View?db=core;g=ENSBTAG00000022721;r=22:12846582-12861550) | Mitochondrial carrier required during erythropoiesis. Probably involved in the biosynthesis of heme, possibly by facilitating 5-aminolevulinate (ALA) production. May act by importing glycine into mitochondria or by exchanging glycine for ALA across the mitochondrial inner membrane |
|  |  | **RPSA** | [12,885,044-12,898,466](http://jun2011.archive.ensembl.org/Bos_taurus/Location/View?db=core;g=ENSBTAG00000009757;r=22:12885044-12898466;t=ENSBTAT00000012866) | Required for the assembly and/or stability of the 40S ribosomal subunit. Required for the processing of the 20S rRNA-precursor to mature 18S rRNA in a late step of the maturation of 40S ribosomal subunits. Also functions as a cell surface receptor for laminin. Plays a role in cell adhesion to the basement membrane and in the consequent activation of signaling transduction pathways. May play a role in cell fate determination and tissue morphogenesis |
|  |  | **LOC515736** | [12,863,845-12,881,080](http://jun2011.archive.ensembl.org/Bos_taurus/Location/View?db=core;g=ENSBTAG00000009760;r=22:12863845-12881080;t=ENSBTAT00000012869) | Possibly encodes the enzyme caspase 15. Many of these enzymes are part of a proteolytic cascade that plays a cental role in cell death by apoptosis. |
|  |  | **MOBP** | [12,924,547-12,956,464](http://jun2011.archive.ensembl.org/Bos_taurus/Location/View?db=core;g=ENSBTAG00000009774;r=22:12924547-12956464;t=ENSBTAT00000012891) | May play a role in compacting or stabilizing the myelin sheath, possibly by binding the negatively charged acidic phospholipids of the cytoplasmic membrane |
| 5 | 96358013- 96966605 | No genes | N/A | N/A |
| 6 | 13429879-13649338 | ANK2 | [13,341,234-13,554,826](http://jun2011.archive.ensembl.org/Bos_taurus/Location/View?db=core;g=ENSBTAG00000002392;r=6:13341234-13554826;t=ENSBTAT00000003097) | This gene encodes a member of the ankyrin family of proteins that link the integral membrane proteins to the underlying spectrin-actin cytoskeleton. Ankyrins are involved in cell motility, activation, proliferation, contact and the maintenance of specialized membrane domains.  In humans the protein encoded by this gene is required for targeting and stability of Na/Ca exchanger 1 in cardiomyocytes.  |
| 16 | 73071792-73506712 | **PLXNA2** | [73,453,456-73,658,974](http://jun2011.archive.ensembl.org/Bos_taurus/Location/View?db=core;g=ENSBTAG00000001173;r=16:73453456-73658974;t=ENSBTAT00000001558)  | This gene encodes a member of the plexin-A family of semaphorin co-receptors. Semaphorins are a large family of secreted or membrane-bound proteins that mediate repulsive effects on axon pathfinding during nervous system development. A subset of semaphorins are recognized by plexin-A/neuropilin transmembrane receptor complexes, triggering a cellular signal transduction cascade that leads to axon repulsion.  |
| 17 | 13327070- 13349026 | NONE | N/A | N/A |
| 23 | 15228064-15504926 | NONE | N/A | N/A |
| 23 | No haploblock | N/A | N/A | N/A |