Title: McLeod Neuroacanthocytosis Syndrome *GeneReview* Table 3 Authors: Jung HH, Danek A, Walker RH, Frey BM, Gassner C

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Note: The following information is provided by the authors listed above and has not been reviewed by *GeneReviews* staff.

## Table 3. XK Mutations

Exon	DNA Change	Protein Change	Reference
Whole gene	Major deletion	Absence of XK protein	Ho et al [1994], El Nemer et al [2000], Danek et al [2001a], Danek et al [2001b], Peng et al [2007]
Promotor + exon 1	Major deletion	Absence of XK protein	Ho et al [1994]
Promotor + exon 1	Major deletion	Absence of XK protein	Wendel et al [2004]
1	Major deletion	Absence of XK protein	Danek et al [2001a]
Exons 1 +	Major deletion	Absence of XK protein	Walker et al [2006]
1	254delG	V58YfsX71	Zeman et al [2005]
1	189G>A	W36X	Malandrini et al [1994], Danek et al [2001a]
IVS1	IVS1+1G>C	Splice-site mutation	Russo et al [2002]
2	7453 bp major deletion	Unknown	Singleton et al [2003]
2	350delT <sup>1</sup>	Y90TfsX39	Ho et al [1996]
2	479C>T	R133X	Dotti et al [2000], Danek et al [2001a]
2	533_534insC	Q151PfsX47	Ueyama et al [2000], Starling et al [2005]
2	545C>T	Q155X	Danek et al [2001a]
IVS2	IVS2+1G>A <sup>2</sup>	Splice-site mutation	Swash et al [1983], Ho et al [1994]
IVS2	IVS2+5G>A	Splice-site mutation	Daniels et al [1996]
IVS2	IVS2-1G>A <sup>3</sup>	Splice-site mutation	Swash et al [1983], Ho et al [1994]
3	746C>G	R222G	Russo et al [2002]
3	768_769delTT	F229YfsX35	Danek et al [2001a]
3	789G>A	W236X	Danek et al [2001a]

Exon	DNA Change	Protein Change	Reference
3	853delG	W257CfsX10	Danek et al [2001a]
3	938_942delCTCTA	L286YfsX15	Danek et al [2001a]
3	962T>C <sup>4</sup>	C294R	Danek et al [2001a]
3	977C>T <sup>5</sup>	Q299X	Jung et al [2001]
3	1020_1033del <sup>6</sup>	N313TfsX23	Allen et al [1961], Danek et al [2001a]
3	1023G>A 7	W314X	Supple et al [2001]
3	1061G>A	E327K	Jung et al [2003]
3	1095delT <sup>8</sup>	F338SfsX70	Hanaoka et al [1999]

## Notes:

A. The numbering of the cDNA starts from the first base in the GenBank entry Z32684, i.e. the A of the initiation codon is assigned as base 83.

B. For the frameshift mutation, the following nomenclature was used: the first amino acid change\_fsX\_the length of the shifted reading frame (www.genomic.unimelb.edu.au/mdi/mutnomen/recs.html#protein).

- 1. OMIM allelic variant 314850.003
- 2. OMIM allelic variant 314850.001
- 3. OMIM allelic variant 314850.002
- 4. OMIM allelic variant 314850.005
- 5. OMIM allelic variant 314850.008
- 6. OMIM allelic variant 314850.006
- 7. OMIM allelic variant 314850.007
- 8. OMIM allelic variant 314850.004

## References

Allen FH Jr, Krabbe SM, Corcoran PA. A new phenotype (McLeod) in the Kell blood-group system. Vox Sang. 1961;6:555–60.

Danek A, Rubio JP, Rampoldi L, Ho M, Dobson-Stone C, Tison F, Symmans WA, Oechsner M, Kalckreuth W, Watt JM, Corbett AJ, Hamdalla HH, Marshall AG, Sutton I, Dotti MT, Malandrini A, Walker RH, Daniels G, Monaco AP. McLeod neuroacanthocytosis: genotype and phenotype. Ann Neurol. 2001a;50:755–64

Danek A, Tison F, Rubio J, Oechsner M, Kalckreuth W, Monaco AP. The chorea of McLeod syndrome. Mov Disord. 2001b;16:882–9.

Dotti MT, Battisti C, Malandrini A, Federico A, Rubio JP, Circiarello G, Monaco AP. McLeod syndrome and neuroacanthocytosis with a novel mutation in the XK gene. Mov Disord. 2000;15:1282–4.

Hanaoka N, Yoshida K, Nakamura A, Furihata K, Seo T, Tani Y, Takahashi J, Ikeda S, Hanyu N. A novel frameshift mutation in the McLeod syndrome gene in a Japanese family. J Neurol Sci. 1999;165:6–9.

Ho M, Chelly J, Carter N, Danek A, Crocker P, Monaco AP. Isolation of the gene for McLeod syndrome that encodes a novel membrane transport protein. Cell. 1994;77:869–80.

Ho MF, Chalmers RM, Davis MB, Harding AE, Monaco AP. A novel point mutation in the McLeod syndrome gene in neuroacanthocytosis. Ann Neurol. 1996;39:672–5.

Jung HH, Hergersberg M, Kneifel S, Alkadhi H, Schiess R, Weigell-Weber M, Daniels G, Kollias S, Hess K. McLeod syndrome: a novel mutation, predominant psychiatric manifestations, and distinct striatal imaging findings. Ann Neurol. 2001a;49:384–92.

Jung HH, Hergersberg M, Vogt M, Pahnke J, Treyer V, Rothlisberger B, Kollias SS, Russo D, Frey BM. McLeod phenotype associated with a XK missense mutation without hematologic, neuromuscular, or cerebral involvement. Transfusion. 2003;43:928–38.

Malandrini A, Fabrizi GM, Palmeri S, Ciacci G, Salvadori C, Berti G, Bucalossi A, Federico A, Guazzi GC. Choreo-acanthocytosis like phenotype without acanthocytes: clinicopathological case report. A contribution to the knowledge of the functional pathology of the caudate nucleus. Acta Neuropathol (Berl). 1993;86:651–8.

Peng J, Redman CM, Wu X, Song X, Walker RH, Westhoff CM, Lee S. Insights into extensive deletions around the XK locus associated with McLeod phenotype and characterization of two novel cases. Gene. 2007;392:142–50.

Russo DC, Lee S, Reid ME, Redman CM. Point mutations causing the McLeod phenotype. Transfusion. 2002;42:287–93.

Singleton BK, Green CA, Renaud S, Fuhr P, Poole J, Daniels GL. McLeod syndrome resulting from a novel XK mutation. Br J Haematol. 2003;122:682–5.

Supple SG, Iland HJ, Barnett MH, Pollard JD. A spontaneous novel XK gene mutation in a patient with McLeod syndrome. Br J Haematol. 2001;115:369–72.

Swash M, Schwartz MS, Carter ND, Heath R, Leak M, Rogers KL. Benign X-linked myopathy with acanthocytes (McLeod syndrome). Its relationship to X-linked muscular dystrophy. Brain. 1983;106:717–33

Ueyama H, Kumamoto T, Nagao S, Masuda T, Sugihara R, Fujimoto S, Tsuda T. A novel mutation of the McLeod syndrome gene in a Japanese family. J Neurol Sci. 2000;176:151–4.

Walker RH, Rasmussen A, Rudnicki D, Holmes SE, Alonso E, Matsuura T, Ashizawa T, Davidoff-Feldman B, Margolis RL. Huntington's disease--like 2 can present as chorea-acanthocytosis. Neurology. 2003;61:1002–4.

Wendel S, Fontao-Wendel R, Levi JE, Aravechia MG, Bordokan RF, Russo D, Haddad MS. A McLeod phenotype detected by random screening for K:-4 [Kp(b-)] blood donors in Brazil. Transfusion. 2004;44:1579–87.

Zeman A, Daniels G, Tilley L, Dunn M, Toplis L, Bullock T, Poole J, Blackwood D. McLeod syndrome: lifelong neuropsychiatric disorder due to a novel mutation of the XK gene. Psychiatr Genet. 2005;15:291–3.