

## ***CONCLUSIONS***



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-Mitjançant l'anàlisi de lligament s'han pogut excloure les 5 formes de LGMD autosòmiques dominants prèviament descrites, com a possibles responsables de les manifestacions de la malaltia en el nostre pedigrí.

-També mitjançant l'anàlisi de lligament s'ha pogut mapar el gen responsable de la malaltia a 7q31-q32.

-A partir de l'anàlisi dels individus recombinants s'ha pogut delimitar la regió candidata final entre els marcadors D7S680 (centromèric) i D7S2544 (telomèric), abastant una distància d'unes 3,7 Megabases.

-Després d'escollir-la com a principal gen candidat donada la seva funció d'unió a actina i la seva expressió a múscul, s'ha exclòs la Filamina C com a gen responsable de la malaltia, no trobant-se cap mutació patogènica a la seva seqüència nucleotídica ni cap alteració a nivell d'expressió en individus afectes respecte dels sans. Tampoc s'ha trobat cap expansió en regions de seqüències repetitives del gen que poguessin suposar una causa de la malaltia i a la vegada una explicació del fenomen d'anticipació observat a la família estudiada. S'ha trobat un polimorfisme, el qual s'ha utilitzat com a marcador per acotar la regió candidata amb més precisió.

-Un cop exclosa la Filamina C, s'han identificat una sèrie de gens candidats a la regió lligada que podrien estar implicats en la malaltia, en base a la seva expressió a teixit muscular i/o funció (ARF5, Fascina 3, Calumenina, LOC63220, Transportina, UBE2H, HSPC216 i KIAA0265). Actualment s'està efectuant la seqüenciació d'alguns d'aquests gens, utilitzant-se també alguns polimorfismes puntuals trobats en ells com a marcadors addicionals per tal de delimitar encara més la regió on es troba el gen responsable de la malaltia. La utilització d'aquests nous polimorfismes és de gran utilitat, donada la dificultat de trobar nous marcadors microsatèl·lits polimòrfics amb prou grau d'heterozigositat perquè siguin informatius.

-La continua actualització de les diferents bases de dades contribuirà amb tota seguretat a delimitar definitivament les posicions i localitzacions exactes tant de marcadors com

de gens descrits i predits, permetent l'abordatge més precís dels possibles gens candidats.

## ***REFERÈNCIES***



**Adams MD, Dubnick M, Kerlavage AR, Moreno R, Kelley JM, Utterback TR, Nagle JW, Fields C, Venter JC** (1992) Sequence identification of 2375 human brain genes. *Nature* 355: 367-368.

**Adams JC, Clelland JD, Collett GDM, Matsumura F, Yamashiro S, Zhang L** (1999) Cell-matrix adhesions differentially regulate fascin phosphorylation. *Mol Biol Cell* 10: 4177-4190.

**Ahmed N, Nguyen TM, Morris GE** (1998) Flexible hinges in dystrophin. *Biochem Soc Trans* 26: S310.

**Ahn AH, Kunkel LM** (1995) Syntrophin binds to an alternatively spliced exon of dystrophin. *J Cell Biol* 128: 363-371.

**Ahn AH, Freener CA, Gussoni E, Yoshida M, Ozawa E, Kunkel LM** (1996) The three human syntrophin genes are expressed in diverse tissues, have distinct chromosomal locations, and each bind to dystrophin and its relatives. *J Biol Chem* 271: 2724-2730.

**Anderson LV, Harrison RM, Pogue R, Vafiadaki E, Pollitt C, Davison K, Moss JA, Keers S, Pyle A, Shaw PJ, Mahjneh I, Argov Z, Greenberg CR, Wrogemann K, Bertorini T, Goebel HH, Beckmann JS, Bashir R, Bushby KM** (2000) Secondary reduction in calpain 3 expression in patients with limb girdle muscular dystrophy type 2B and Miyoshi myopathy (primary dysferlinopathies). *Neuromuscul Disord* 10: 553-559.

**Aoki M, Liu J, Richard I, Bashir R, Britton S, Keers SM, Oeltjen J, Brown HEV, Marchand S, Bourg N, Beley C, McKenna-Yasek D, Arahata K, Bohlega S, Cupler E, Illa I, Majneh I, Barohn RJ, Urtizberea JA, Fardeau M, Amato A, Angelini C, Bushby K, Beckmann JS, Brown RH Jr, Phil D** (2001) Genomic organization of the dysferlin gene and novel mutations in Miyoshi myopathy. *Neurology* 57: 271-278.

**Attaix D, Aourousseau E, Combaret L, Kee A, Larbaud D, Ralliere C, Souweine B, Taillandier D, Tilignac T** (1998) Ubiquitin-proteasome-dependent proteolysis in skeletal muscle. *Reprod Nutr Dev* 38: 153-165.

**Ausubel FM, Brent R, Kingston RE, Moore DD, Seidman JG, Smith JA, Struhl K** (1994) *Current protocols in molecular biology*. New York : Greene Publishing Associates and Wiley-Interscience.

**Azibi K, Bachner L, Beckmann JS, Matsumura K, Hamouda E, Chaouch M, Chaouch A, Ait-Ouarab R, Vignal A, Weissenbach J** (1993) Severe childhood autosomal recessive muscular dystrophy with the deficiency of the 50 kDa dystrophin-associated glycoprotein maps to chromosome 13q12. *Hum Mol Genet* 2: 1423-1428.

**Barnes S** (1932) A myopathic family; with hypertrophic, pseudohypertrophic, atrophic and terminal (distal in upper extremities) stages. *Brain* 55: 1-46.

**Barohn RJ, Miller RG, Griggs RC** (1991) Autosomal recessive distal dystrophy. *Neurology* 41: 1365-1370.

**Bartoloni L, Horrigan SK, Viles KD, Gilchrist JM, Stajich JM, Vance JM, Yamaoka LH, Pericak-Vance MA, Westbrook CA, Speer MC** (1998) Use of a CEPH meiotic breakpoint panel to refine the locus of limb-girdle muscular dystrophy type 1A (LGMD1A) to a 2-Mb interval on 5q31. *Genomics* 54: 250-255.

**Bashir R, Strachan T, Keers S, Stephenson A, Mahjneh I, Marconi G, Nashef L, Bushby KM** (1994) A gene for autosomal recessive limb-girdle muscular dystrophy maps to chromosome 2p. *Hum Mol Genet* 3: 455-457.

**Beckmann JS, Richard I, Hillaire D, Broux O, Antignac C, Bois E, Cann H, Cottingham RW Jr, Feingold J, Kalil J, Lahtrop GM, Marcadet A, Masset M, Mignard C, Passos-Bueno MR, Pellerain N, Zatz M, Dausset J, Fardeau M, Cohen D** (1991) A gene for limb-girdle muscular dystrophy maps to chromosome 15 by linkage analysis. *CR Acad Sci Paris* 312: 141-148.

**Beckmann JS, Richard I, Broux O, Fougerousse F, Allamand V, Chiannikulchai N, Lim LE, Duclos F, Bourg N, Brenguier L, Pasturaud P, Quetier F, Roudaut C, Sunada Y, Meyer J, Dincer P, Lefranc G, Merlini L, Topaloglu H, Tome FMS, Cohen D, Jackson CE, Campbell KP, Fardeau M** (1996) Identification of muscle-specific calpain and  $\beta$ -sarcoglycan genes in progressive autosomal recessive muscular dystrophies. *Neuromusc Disord* 6: 455-462.

**Beckmann JS, Brown RH, Muntoni F, Urtizbera A, Bonnemann C, Bushby KM** (1999) 66<sup>th</sup>/67<sup>th</sup> ENMC sponsored international workshop: the limb-girdle muscular dystrophies, 26-28 March 1999, Naarden, the Netherlands. *Neuromuscul Disord* 9: 436-445.

**Bejaoui K, Hirabayashi K, Hentati F, Haines JL, Ben Hamida C, Belal S, Miller RG, McKenna-Yasek D, Weissenbach J, Rowland LP et al** (1995) Linkage of Miyoshi myopathy (distal autosomal recessive muscular dystrophy) locus to chromosome 2p12-14. *Neurology* 45: 768-772.

**Ben Hamida M, Hentati F** (1989) Tunisian severe childhood muscular dystrophy: a normal spinal cord and anterior horn neurons. *Muscle Nerve* 12: 156.

**Ben Othmane K, Ben Hamida M, Pericak-Vance MA, Ben Hamida C, Blel S, Carter SC, Bowcock AM, Petruhkin K, Gilliam TC, Roses AD et al** (1992) Linkage of Tunisian autosomal recessive Duchenne-like muscular dystrophy to the pericentromeric region of chromosome 13q. *Nat Genet* 2: 315-317.

**Betz RC, Schooser BG, Kasper D, Ricker K, Ramirez A, Stein V, Torbergesen T, Lee YA, Nothen MM, Wienker TF, Malin JP, Propping P, Reis A, Mortier W, Jentsch TJ, Vorgerd M, Kubisch C**



(2001) Mutations in CAV3 cause mechanical hyperirritability of skeletal muscle in rippling muscle disease. *Nat Genet* 28: 218-219.

**Bewick GS, Nicholson LB, Young C, Odonnell E, Slater CR** (1992) Different distributions of dystrophin and related proteins at nerve muscle junctions. *Neuroreport* 3: 857-860.

**Bione S, Maestrini E, Rivella S, Mancini M, Regis S, Romeo G, Toniolo D** (1994) Identification of a novel X-linked gene responsible for Emery-Dreifuss muscular dystrophy. *Nat Genet* 8: 323-327.

**Bonilla E, Samitt CE, Miranda AF, Hays AP, Salviati G, DiMauro S, Kunkel LM, Hoffman EP, Rowland LP** (1988) Duchenne muscular dystrophy: deficiency of dystrophin at the muscle cell surface. *Cell* 54: 447-452.

**Bonne G, di Barletta MR, Varnous S, Becane H, Hammouda E, Merlini L, Muntoni F, Greenberg CR, Gary F, Urtizbera JA, Duboc D, Fardeau M, Toniolo D, Schwartz K** (1999) Mutations in the gene encoding lamin A/C cause autosomal dominant Emery-Dreifuss muscular dystrophy. *Nat Genet* 21: 285-288.

**Bonnemann CG, Modi R, Noguchi S, Mizuno Y, Yoshida M, Gussoni E, McNally EM, Duggan DJ, Angelini C, Hoffman EP** (1995) Beta sarcoglycan (A3b) mutations cause autosomal recessive muscular dystrophy with loss of the sarcoglycan complex. *Nat Genet* 11: 266-273.

**Bonnemann CG, Passos-Bueno MR, McNally EM, Vainzof M, Moreira ES, Marie SK, Pavanello RCM, Noguchi S, Ozawa E, Zatz M, Kunkel LM** (1996) Genomic screening for  $\beta$ -sarcoglycan gene mutations: missense mutations may cause severe limb-girdle muscular dystrophy type 2E (LGMD2E). *Hum Mol Genet* 5: 1953-1961.

**Bork P, Sudol M** (1994) The WW domain: a signalling site in dystrophin? *Trends Biochem Sci* 19: 531-533.

**Botstein D, White RL, Skolnick M, Davis RW** (1980) Construction of a genetic linkage map in man using restriction fragment length polymorphisms. *Am J Hum Genet* 32: 314-331.

**Brais B, Bouchard JP, Xie YG, Rochefort DL, Chretien N, Tome FM, Lafreniere RG, Rommens JM, Uyama E, Nohira O, Blumen S, Korczyn AD, Heutink P, Mathieu J, Duranceau A, Codere F, Fardeau M, Rouleau GA, Korczyn AD** (1998) Short GCG expansions in the PABP2 gene cause oculopharyngeal muscular dystrophy. *Nat Genet* 18: 164-167.

**Bredt DS** (1998) No skeletal muscle derived relaxing factor in Duchenne muscular dystrophy. *Proc Natl Acad Sci USA* 95: 14592-14593.

**Brook JDMC, McCurrach ME, Harley HG, Buckler AJ, Church D, Aburatani H, Hunter K, Stanton VP, Thirion JP, Hudson T, Sohn R, Zemelman B, Snell RG, Rundle SA, Crow S, Davies J, Shelbourne P, Buxton J, Jones C, Juvonen V, Johnson K, Harper PS, Shaw DJ, Housman DE** (1992) Molecular basis of myotonic dystrophy: expansion of a trinucleotide (CTG) repeat at the 3' end of a transcript encoding a protein kinase family member. *Cell* 68: 799-808.

**Brooke MH, Fenichel GM, Griggs RC, Mendell JR, Moxley R, Miller JP, Province MA** (1983) Clinical Investigation in Duchenne dystrophy: 2. Determination of the "power" of therapeutic trials based on the natural history. *Muscle nerve* 6: 91-103.

**Brotschi EA, Hartwig JH, Stossel TP** (1978) The gelation of actin by actin-binding protein. *J Biol Chem* 253: 8988-8993.

**Bushby K, Beckmann JS** (1995) Report of the 30<sup>th</sup> and 31<sup>st</sup> ENMC international workshop- The limb-girdle muscular dystrophies- and proposal for a new nomenclature. *Neuromuscul Disord* 5: 337-343.

**Bushby K** (1997a) Limb girdle muscular dystrophy. A: Emery AEH, ed. Diagnostic criteria for neuromuscular disorders. 2<sup>nd</sup> ed. London UK: *Royal society of Medicine Press*: 17-22.

**Bushby K, Anderson LVB, Sewry C, Pogue R, Taylor JA, Pollitt C, Muntoni F** (1997b) Dystrophinopathy or sarcoglycanopathy- the importance of a full diagnostic assessment in suspected manifesting carriers of Duchenne and Becker muscular dystrophy. *J Med Genet* 34: S54 (abstract).

**Bushby KMD** (1999a) Making sense of the limb-girdle muscular dystrophies. *Brain* 122: 1403-1420.

**Bushby KMD** (1999b) The limb-girdle muscular dystrophies-multiple genes, multiple mechanisms. *Hum Mol Genet* 8, (10) Rev: 1875-1882.

**Buxton J, Shelbourne P, Davies J, Jones C, Van Tongeren T, Aslanidis C, John P, Jansen P, Anvet M, Riley B, Williamson R, Johnson K** (1992) Detection of an unstable fragment of DNA specific to individuals with myotonic dystrophy. *Nature* 355: 547-548.

**Caceres JF, Screatton GR, Krainer AR** (1998) A specific subset of SR proteins shuttles continuously between the nucleus and the cytoplasm. *Genes Dev* 12: 55-66.

**Campbell KP, Kahl SD** (1989) Association of dystrophin and an integral membrane glycoprotein. *Nature* 338: 259-262.

**Campuzano V, Montermini L, Molto MD, Pianese L, Cossee M, Cavalcanti F, Monros E, Rodius F, Duclos F, Monticelli A et al** (1996) Friedrich's ataxia: autosomal recessive disease caused by an intronic GAA triplet repeat expansion. *Science* 271: 1423-1427.

- Carpenter NJ** (1994) Genetic anticipation. Expanding tandem repeats. *Neurol Clin* 12: 683-697.
- Chakarova C, Wehnert MS, Uhl K, Sakthivel S, Vosberg HP, van der Ven PF, Furst DO** (2000) Genomic structure and fine mapping of the two human filamin gene paralogues FLNB and FLNC and comparative analysis of the filamin gene family. *Hum Genet* 107: 597-611.
- Chan YM, Bonnemann CG, Lidov HGW, Kunkel LM** (1998) Molecular organization of sarcoglycan complex in mouse myotubes in culture. *J Cell Biol* 143: 2033-2044.
- Chomczynski P, Sacchi N** (1987) Single step method of RNA isolation by acid guanidium thiocyanate-phenol-chloroform extraction. *Anal Biochem* 162: 156-159.
- Clark J, Moore L, Krasinkas A, Way J, Battley J, Tamkun J, Kahn RA** (1993) Selective amplification of additional members of the ADP-ribosylation factor (ARF) family: cloning of additional human and Drosophila ARF-like genes. *Proc Natl Acad Sci USA* 90: 8952-8956.
- Cohen D, Chumakov I, Weissenbach J** (1993) A first-generation physical map of the human genome. *Nature* 366: 698-701.
- Combaret L, Taillandier D, Voisin L, Samuels SE, Boepsflug-Tanguy O, Ataix D** (1996) No alteration in gene expression of components of the ubiquitin proteasome proteolytic pathway in dystrophin-deficient muscles. *FEBS Lett* 393: 292-296.
- Corrado K, Mills PL, Chamberlain JS** (1994) Deletion analysis of the dystrophin-actin binding domain. *FEBS Lett* 344: 255-260.
- Cottingham RW, Idury RM, Schaeffer AA** (1993) Faster sequential genetic linkage computations. *Am J Hum Genet* 53: 252-263.
- Couet J, Shengwen L, Okamoto T, Scherer PE, Lisanti MP** (1997a) Molecular and cellular biology of caveolae: paradoxes and plasticities. *Trends Cardiovasc Med* 7: 103-110.
- Couet J, Li S, Okamoto T, Ikezu T, Lisanti MP** (1997b) Identification of peptide and protein ligands for the caveolin-scaffolding domain: implications for the interaction of caveolin with caveolae-associated proteins. *J Biol Chem* 272: 6525-6533.
- Crosbie RH, Heighway J, Venzke DP, Lee JC, Campbell KP** (1997) Sarcospan, the 25- kDa transmembrane component of the dystrophin complex. *J Biol Chem* 272: 31221-31224.

**Crosbie RH, Straub V, Yun HY, Lee JC, Rafael J, Chamberlain JS, Dawson VL, Dawson T, Campbell KP** (1998) mdx muscle pathology is independent of nNOS perturbation. *Hum Mol Genet* 7: 823-829.

**Crosbie RH, Lebakken CS, Holt KH, Venzke DP, Straub V, Lee JC, Grady RM, Chamberlain JS, Sanes JR, Campbell KP** (1999) Membrane targeting and stabilization of sarcospan is mediated by the sarcoglycan subcomplex. *J Cell Biol* 145: 153-165.

**Cullen MJ, Walsh J, Stevenson SA, Rothery S, Severs NJ** (1998) Co-localization of dystrophin and  $\beta$ -dystroglycan demonstrated in en face view by double gold labeling of freeze-fractured skeletal muscle. *J Histochem Cytochem* 46: 945-953.

**Culligan K, Glover L, Dowling P, Ohlendieck K** (2001) Brain dystrophin-glycoprotein complex: persistent expression of  $\beta$ -dystroglycan, impaired oligomerization of Dp71 and up-regulation of utrophins in animal models of muscular dystrophy. *BMC Cell Biol* 2:2 (1471-2121/2/2).

**Cummings CJ, Zoghbi HY** (2000a) Fourteen and counting: unraveling trinucleotide repeat diseases. *Hum Mol Genet* 9: 909-916.

**Cummings CJ, Zoghbi HY** (2000b) Trinucleotide repeats: mechanisms and pathophysiology. *Annu Rev Genomics Hum Genet* 1: 281-328.

**Darnell J, Lodish H, Baltimore D** (1990) *Molecular Cell Biology*. 2<sup>nd</sup> Edition. Scientific American Books.

**Davies PJA, Wallach D, Willingham M, Pastan I, Lewis MS** (1980) Self-association of chicken gizzard filamin and heavy mero-filamin. *Biochemistry* 19: 1366-1372.

**Davis BM, McCurrach ME, Taneja KL, Singer RH, Housman DE** (1997) Expansion of a CUG trinucleotide repeat in the 3' untranslated region of myotonic dystrophy protein kinase transcripts results in nuclear retention of transcripts. *Proc Natl Acad Sci USA* 94: 7388-7393.

**Dib C, Faure S, Fizames C, Samson D, Drouot N, Vignal A, Millasseau P, Marc S, Hazan J, Seboun E, Lathrop M, Gyapay G, Morissette J, Weissenbach J** (1996) A comprehensive genetic map of the human genome based on 5.264 microsatellites. *Nature* 380: 152-154.

**Diehl SR, Ziegler J, Buck GA, Reynolds TR, Weber JL** (1990) Automated genotyping of human DNA polymorphisms. *Am J Hum Genet* 47: A177.

- Driss A, Amouri R, Ben Hamida C, Souilem S, Gouider-Khouja N, Ben Hamida M, Hentati F** (2000) A new locus for autosomal recessive limb-girdle muscular dystrophy in a large consanguineous tunisian family maps to chromosome 19q13.3. *Neuromuscul Disord* 4-5: 240-246.
- Duggan DJ, Gorospe JR, Fanin M, Hoffman EP, Angelini C** (1997) Mutations in the sarcoglycan genes in patients with myopathy. *N Engl J Med* 336: 618-624.
- Duh FM, Latif F, Weng Y, Geil L, Modi W, Stackhouse T, Matsumura F, Duan DR, Linehan WM, Lerman MI, et al** (1994) cDNA cloning and expression of the human homolog of the sea urchin fascin and Drosophila singed genes which encodes an actin-bundling protein. *DNA Cell Biol* 13: 821-827.
- Dürr A, Brice A, Lepage-Lezin A, Cancel G, Smadja D, Vernant JC, Agid Y** (1995) Dominant cerebellar ataxia type I linked to chromosome 12q (SCA2: spinocerebellar ataxia type 2). *Clin Neurosci* 3: 12-16.
- Eckert R, Randall D, Augustine G** (1988) Fisiología Animal. Mecanismos y Adaptaciones. 3ª Edició. Interamericana McGraw-Hill.
- Edwards RA, Bryan J** (1995) Fascins, a family of actin bundling proteins. *Cell Motil Cytoskeleton* 32: 1-9.
- Engelman JA, Zhang X, Galbiati F, Volonte D, Sotgia F, Pestell RG, Minetti C, Scherer PE, Okamoto T, Lisanti MP** (1998) Molecular genetics of the caveolin gene family: implications for human cancers, diabetes, Alzheimer disease and muscular dystrophy. *Am J Hum Genet* 63: 1578-1587.
- Ervasti JM, Ohlendieck K, Kahl SD, Gaver MG, Campbell KP** (1990) Deficiency of a glycoprotein component of the dystrophin complex in dystrophic muscle. *Nature* 345: 315-359.
- Ettinger AJ, Feng G, Sanes JR** (1997) Epsilon-Sarcoglycan, a broadly expressed homologue of the gene mutated in limb-girdle muscular dystrophy 2D. *J Biol Chem* 272: 32534-32538.
- Eymard B** (2001) Renewed interest in muscular dystrophy. *Rev Prat* 51: 262-269.
- Fabrizio E, Bonet-Kerrache A, Leger JJ, Mornet D** (1993) Actin-dystrophin interface. *Biochemistry* 32: 10457-10463.
- Feener CA, Koenig M, Kunkel LM** (1989) Alternative splicing of human dystrophin mRNA generates isoforms at the carboxy terminus. *Nature* 338: 509-511.

**Feinberg AP, Vogelstein B** (1983) A technique for radiolabeling DNA restriction endonuclease fragments to high specific activity. *Annal Biochem* 132: 6-13.

**Feit H, Silbergleit A, Schneider LB, Gutierrez JA, Fitoussi RP, Reyes C, Rouleau GA, Brais B, Jackson CE, Beckmann JS, Seboun E** (1998) Vocal cord and pharyngeal weakness with autosomal dominant distal myopathy: clinical description and gene localization to 5q31. *Am J Hum Genet* 63: 1732-1742.

**Feron O, Belhassen L, Kobzik L, Smith TW, Kelly RA, Michel T** (1996) Endothelial nitric oxide synthase targeting to caveolae. *J Biol Chem* 271: 22810-22814.

**Flanigan KM, Coffeen CM, Sexton L, Stauffer D, Brunner S, Leppert MF** (2001) Genetic characterization of a large, historically significant Utah kindred with facioscapulohumeral dystrophy. *Neuromuscul Disord* 11: 525-529.

**Frosk P, Weiler T, Nylen E, Sudha T, Greenberg CR, Morgan K, Fujiwara TM, Wrogemann K** (2002) Limb-girdle muscular dystrophy type 2H associated with mutation in TRIM32, a putative E3-ubiquitin-ligase gene. *Am J Hum Genet* 70: 663-672.

**Fu XD** (1995) The superfamily of arginine/serine-rich splicing factors. *RNA* 1: 663-680.

**Fujiwara T, Kawai A, Shimizu F, Hirano H, Okuno S, Takeda S, Ozaki K, Shimada Y, Nagata M, Watanabe T et al** (1995) Cloning, sequencing and expression of a novel cDNA encoding human vacuolar ATPase (14-kDa subunit). *DNA Res* 2: 107-111.

**Galbiati F, Volonté D, Minetti C, Chu J, Lisanti MP** (1999) Phenotypic behavior of caveolin-3 mutations that cause autosomal dominant limb girdle muscular dystrophy (LGMD-1C). *J Biol Chem* 274: 25632-25641.

**Galbiati F, Volonte D, Minetti C, Bregman DB, Lisanti MP** (2000) Limb-girdle muscular dystrophy (LGMD-1C) mutants of caveolin-3 undergo ubiquitination and proteasomal degradation. *J Biol Chem* 275: 37702-37711.

**Galbiati F, Engelman JA, Volonte D, Zhang XL, Minetti C, Li M, Hou H Jr, Kneitz B, Edelmann W, Lisanti MP** (2001) Caveolin-3 null mice show a loss of caveolae, changes in the microdomain distribution of the dystrophin-glycoprotein complex and t-tubule abnormalities. *J Biol Chem* 276: 21425-21433.

**Gámez J, Navarro C, Andreu AL, Fernández JM, Palenzuela L, Tejeira S, Fernández Hojas R, Schwartz S, Karadimas C, DiMauro S, Hirano M, Cervera C** (2001) Autosomal dominant limb-girdle muscular dystrophy. A large kindred with evidence for anticipation. *Neurology* 56: 450-454.

**Gariboldi M, Maestrini E, Canziani F, Manenti G, De Gregorio L, Rivella S, Chatterjee A, Herman GE, Archidiacono N, Antonacci R, Pierotti MA, Dragani TA, Toniolo D** (1994) Comparative mapping of the actin-binding protein 280 genes in human and mouse. *Genomics* 21: 428-430.

**Gavin RH** (1997) Microtubule-microfilament synergy in the cytoskeleton. A *International Review of Cytology*. Ed. Jeon KW. Academic Press, Inc: San Diego, London 173: 207-242.

**Ge H, Manley JL** (1990) A protein factor, ASF, controls cell-specific alternative splicing of SV40 early pre-mRNA in vitro. *Cell* 62: 25-34.

**Gilchrist JM, Pericak-Vance M, Silverman L, Roses AD** (1988) Clinical and genetic investigation in autosomal dominant limb-girdle muscular dystrophy. *Neurology* 38: 5-9.

**Goode BL, Drubin DG, Barnes G** (2000) Functional cooperation between the microtubule and actin cytoskeletons. *Curr Opin Cell Biol* 12: 63-71.

**Gorlin JB, Yamin R, Egan S, Stewart M, Stossel TP, Kwiatkowski DJ, Hartwig JH** (1990) Human endothelial actin-binding protein (ABP-280, nonmuscle filamin): a molecular leaf spring. *J Cell Biol* 111: 1089-1105.

**Gorlin JB, Henske E, Warren ST, Kunst CB, D'Urso M, Palmieri G, Hartwig JH, Bruns G, Kwiatkowski DJ** (1993) Actin-binding protein (ABP-280) filamin gene (FLN) maps telomeric to the color vision locus (R/GCP) and centromeric to G6PD in Xq28. *Genomics* 17: 496-498.

**Gregorio CC, Granzier H, Sorimachi H, Labeit S** (1999) Muscle assembly : a titanic achievement? *Curr Opin Cell Biol* 11: 18-25.

**Gullberg D, Tiger CF, Veiling T** (1999) Laminins during muscle development and in muscular dystrophies. *Cell Mol Life Sci* 56: 442-460.

**Gyapay G, Morissette J, Vignal A, Dib C, Fizames C, Millasseau P, Marc S, Bernardi G, Lathrop M, Weissenbach J** (1994) The 1993-94 Génethon human genetic linkage map. *Nat Genet*: 246-338.

**Hack AA, Groh ME, McNally EM** (2000) Sarcoglycans in muscular dystrophy. *Microsc Res Tech* 48: 167-180.

**Hall ZW, Sanes JR** (1993) Synaptic structure and development-the neuromuscular- junction. *Cell* 72: 99-121.

**Hamshere MG, Newman EE, Alwazzan M, Athwal BS, Brook JD** (1997) Transcriptional abnormality in myotonic dystrophy affects DPMK but not neighboring genes. *Proc Natl Acad Sci USA* 94: 7394-7399.

**Hance JE, Fu SY, Watkins SW, Beggs AH, Michalak M** (1999)  $\alpha$ -actinin-2 is a new component of the dystrophin-glycoprotein complex. *Arch Biochem Biophys* 363: 216-222.

**Haravuori H, Makela-Bengs P, Udd B, Partanen J, Pulkkinen L, Somer H, Peltonen L** (1998) Assignment of the tibial muscular dystrophy locus to chromosome 2q31. *Am J Hum Genet* 62: 620-626.

**Harley HG, Brook JD, Rundle SA, Crow S, Reardon W, Buckler AJ, Harper PS, Housman DE, Shaw DJ** (1992) Expansion of an unstable DNA region and phenotypic variation in myotonic dystrophy. *Nature* 355: 545-546.

**Harper PS, Harley HG, Reardon W, Shaw DJ** (1992) Anticipation in myotonic dystrophy: new light on an old problem. *Am J Hum Genet* 51: 10-16.

**Hassoni AA, Cullen MJ** (1999) Calcium homeostasis and ultrastructural studies in a patient with limb girdle muscular dystrophy type 2C. *Neuropath Appl Neurobiol* 25: 244-253.

**Hauser MA, Horrigan SK, Salmikangas P, Torian UM, Viles KD, Dancel R, Tim RW, Taivainen A, Bartoloni L, Gilchrist JM, Stajich JM, Gaskell PC, Gilbert JR, Vance JM, Pericak-Vance MA, Carpen O, Westbrook CA, Speer MC** (2000) Myotilin is mutated in limb girdle muscular dystrophy 1A. *Hum Mol Genet* 9, (14): 2141-2147.

**Hayashi YK, Chou FL, Engvall E, Ogawa M, Matsuda C, Hirabayashi S, Yokochi K, Ziober BL, Kramer RH, Kaufman SJ, Ozawa Z, Goto Y, Nonaka I, Tsukahara T, Wang JZ, Hoffman EP, Arahata K** (1998) Mutations in the integrin  $\alpha 7$  gene cause congenital myopathy. *Nat Genet* 19: 34-37.

**Hayashi YK, Ogawa M, Tagawa K, Noguchi S, Ishihara T, Nonaka I, Arahata K** (2001) Selective deficiency of  $\alpha$ -dystroglycan in Fukuyama-type congenital muscular dystrophy. *Neurology* 57: 115-121.

**HDCRG-Huntington's Disease Collaborative Research Group** (1994) A novel gene containing a trinucleotide repeat that is expanded and unstable on Huntington's disease chromosomes. *Cell* 72: 971-983.

**Helbling-Leclerc A, Zhang X, Topaloglu H, Cruaud C, Tesson F, Weisenbach J, Tome FM, Schwartz K, Fardeau M, Tryggvason K et al** (1995) Mutations in the laminin  $\alpha 2$ -chain gene (LAMA2) cause merosin-deficient congenital muscular dystrophy. *Nat Genet* 11: 216-218.



**Hock RS** (1999) Filamin. A: Kreis T, Vale , editors. *Guidebook to the cytoskeletal and motor proteins*. Oxford: Oxford University Press: 94-97.

**Holmes SE, O'hearn EE, McInnis MG, Gorelick-Feldman DA, Kleiderlein JJ, Callahan C, Kwak NG, Ingersoll-Ashworth RG, Sherr M, Sumner AJ, Sharp AH, Ananth U, Seltzer WK, Boss MA, Viera-Saecker AM, Epplen JT, Riess O, Ross CA, Margolis RL** (1999) Expansion of a novel CAG trinucleotide repeat in the 5' region of PPP2R2B is associated with SCA12. *Nat Genet* 23: 391-392.

**Holt KH, Campbell KP** (1998a) Assembly of the sarcoglycan complex-Insights for muscular dystrophy. *J Biol Chem* 273, (52): 34667-34670.

**Holt KH, Lim LE, Straub V, Venzke DP, Duclos F, Anderson RD, Davidson BL, Campbell KP** (1998b) Functional rescue of the sarcoglycan complex in the BIO 14.6 hamster using delta-sarcoglycan gene transfer. *Mol Cell* 1: 841-848.

**Holthuis JC, Schoonderwoert VT, Martens GJ** (1994) A vertebrate homolog of the actin-bundling protein fascin. *Biochim Biophys Acta* 1219: 184-188.

**Honore B, Vorum H** (2000) The CREC family, a novel family of multiple EF-hand, low-affinity Ca(2+)-binding proteins localised to the secretory pathway of mammalian cells. *FEBS Lett* 466: 11-18.

**Ikeuchi T, Asaka T, Saito M, Tanaka H, Higuchi S, Tanaka K, Saida K, Uyama E, Mizusawa H, Fukuhara N, Nonaka I, Takamori M, Tsuji S** (1997) Gene locus for autosomal recessive distal myopathy with rimmed vacuoles maps to chromosome 9. *Ann Neurol* 41: 432-437.

**Illa I** (2000) Distal myopathies. *J Neurol* 247: 169-174.

**Illa I, Serrano-Munuera C, Gallardo E, Lasa A, Rojas-Garcia R, Palmer J, Gallano P, Baiget M, Matsuda C, Brown RH** (2001) Distal anterior compartment myopathy: a dysferlin mutation causing a new muscular dystrophy phenotype. *Ann Neurol* 49: 130-134.

**Illarioshkin SN, Ivanova-Smolenskaya IA, Tanaka H, Vereshchagin NV, Markova ED, Poleshchuck VV, Lozhnikova SM, Sukhorukov VS, Limborska SA, Slominsky PA, Bulayeva KB, Tsuji S** (1996) Clinical and molecular analysis of a large family with three distinct phenotypes of progressive muscular dystrophy. *Brain* 119: 1895-1909.

**Illarioshkin SN, Ivanova-Smolenskaya IA, Greenberg CR, Nylen E, Sukhorukov VS, Poleshchuck VV, Markova ED, Wrogemann K** (2000) Identical dysferlin mutation in limb-girdle muscular dystrophy type 2B and distal myopathy. *Neurology* 55: 1931-1933.

**Imbert G, Saudou F, Yvert G, Devys D, Trottier Y, Garnier JM, Weber C, Mandel JL, Cancel G, Abbas N, Dürr A, Didierjean O, Stevanin G, Agid Y, Brice A** (1996) Cloning of the gene for spinocerebellar ataxia 2 reveals a locus with high sensitivity to expanded CAG/glutamine repeats. *Nat Genet* 14: 285-291.

**Ishikawa R, Yamashiro S, Kohama K, Matsumura F** (1998) Regulation of actin binding and actin bundling activities of fascin by caldesmon coupled with tropomyosin. *J Biol Chem* 273: 26991-26997.

**Izaurralde E, Adam S** (1998) Transport of macromolecules between the nucleus and the cytoplasm. *RNA* 4: 351-364.

**Janmey PA** (1991) Mechanical properties of cytoskeletal polymers. *Curr Opin Cell Biol* 3: 4-11.

**Jia Z, Petrounevitch V, Wong A, Moldoveanu T, Davies PL, Elce JS, Beckmann JS** (2001) Mutations in calpain 3 associated with limb girdle muscular dystrophy: analysis by molecular modeling and by mutation in m-calpain. *Biophys J* 80: 2590-2596.

**Joebsis GJ, Keizers H, Vreijling JP, de Visser M, Speer MC, Wolterman RA, Baas F, Bolhuis PA** (1996) Type VI collagen mutations in Bethlem myopathy, an autosomal dominant myopathy with contractures. *Nat Genet* 14: 113-115.

**Jones KJ, Kim SS, North KN** (1998) Abnormalities of dystrophin, the sarcoglycans and laminin  $\alpha 2$  in the muscular dystrophies. *J. Med Genet* 35: 379-386.

**Jung D, Yang B, Meyer J, Chamberlain JS, Campbell KP** (1995) Identification and characterization of the dystrophin anchoring site on beta-dystroglycan. *J Biol Chem* 270: 809-823.

**Kahn RA, Gilman AG** (1984) Purification of a protein cofactor required for ADP-ribosylation of the stimulatory regulatory component of adenylate cyclase by cholera toxin. *J Biol Chem* 259: 6228-6234.

**Kahn RA, Gilman AG** (1986) The protein cofactor necessary for ADP-ribosylation of Gs by cholera toxin is itself a GTP binding protein. *J Biol Chem* 261: 7906-7911.

**Kahn RA, Kern FG, Clark J, Gelmann EP, Rulka C** (1991) Human ADP-ribosylation factors. A functionally conserved family of GTP-binding proteins. *J Biol Chem* 266: 2606-2614.

**Kaiser P, Senfert W, Hofferer L, Kofler B, Sachsenmaier C, Herzog H, Jentsch S, Schweiger M, Schneider R** (1994) *J Biol Chem* 269: 8797-8802.

**Kataoka N, Bachorik JL, Dreyfuss G** (1999) Transportin-SR, a nuclear import receptor for SR proteins. *J Cell Biol* 145: 1145-1152.

**Katsanis N, Fisher EM** (1998) Identification, expression and chromosomal localization of ubiquitin conjugating enzyme 7 (UBE2G2), a human homologue of the *Saccharomyces cerevisiae* *ubc7* gene. *Genomics* 51: 128-131.

**Kawaguchi Y, Okamoto T, Taniwaki M, Aizawa M, Inoue M, Katayama S, Kawakami H, Nakamura S, Nishimura M, Akiguchi I, Kimura J, Narumiya S, Kakizuka A** (1994) CAG expansions in a novel gene for Machado-Joseph disease at chromosome 14q32.1. *Nat Genet* 8: 221-228.

**Kim IF, Mohammadi E, Huang RCC** (1999) Isolation and characterization of IPP, a novel human gene encoding an actin-binding, kelch-like protein. *Gene* 228: 73-83.

**Kinbara K, Sorimache H, Ishiura S, Suzuki K** (1997) Muscle-specific calpain, p94, interacts with the extreme C-terminal region of connectin, a unique region flanked by two immunoglobulin C2 motifs. *Arch Biochem Biophys* 342: 99-107.

**Knight SJ, Flannery AV, Hirst MC, Campbell L, Christodoulou Z, Phelps SR, Pointon J, Middleton-Price HR, Barnicoat A, Pembrey ME et al** (1993) Trinucleotide repeat amplification and hypermethylation of a CpG island in FRAXE mental retardation. *Cell* 74: 127-134.

**Kobayashi K, Nakahori Y, Miyake M, Matsumura K, Kondo-lida E, Nomura Y, Segawa M, Yoshioka M, Saito K, Osawa M, Hamano K, Sakakihara Y, Nonaka I, Nakagome Y, Kanazawa I, Nakamura Y, Tokunaga K, Toda T** (1998) An ancient retrotransposal insertion causes Fukuyama-type congenital muscular dystrophy. *Nature* 394: 388-392

**Koenig M, Hoffman E, Bertelson C, Monaco A, Feener C, Kunkel L** (1987) Complete cloning of the Duchenne muscular dystrophy (DMD) cDNA and preliminary genomic organization of the DMD gene in normal and affected individuals. *Cell* 50: 509-517.

**Koenig M, Monaco AP, Kunkel LM** (1988) The complete sequence of dystrophin predicts a rod-shaped cytoskeletal protein. *Cell* 53: 219-226.

**Koob MD, Moseley ML, Schut LJ, Benzow KA, Bird TD, Day JW, Ranum LP** (1999) An untranslated CTG expansion causes a novel form of spinocerebellar ataxia (SCA 8). *Nat Genet* 21: 379-384.

**Kumamoto T, Fujimoto S, Nagao O, Masuda T, Sugihara R, Ueyama H, Tsuda T** (1998) Proteasomes in distal myopathy with rimmed vacuoles. *Intern Med* 37: 746-752.

**Kumamoto T, Fujimoto S, Ito T, Horinouchi H, Ueyama H, Tsuda T** (2000) Proteasome expression in the skeletal muscles of patients with muscular dystrophy. *Acta Neuropathol* 100: 595-602.

**Lai MC, Lin RI, Tarn WY** (2001) Transportin-SR2 mediates nuclear import of phosphorylated SR proteins. *Proc Natl Acad Sci USA* 98: 10154-10159.

**Laing NG, Laing BA, Meredith C, Wilton SD, Robbins P, Honeyman K, Dorosz S, Kozman H, Mastaglia FL, Kakulas BA** (1995) Autosomal dominant distal myopathy: linkage to chromosome 14. *Am J Hum Genet* 56: 422-427.

**Laing NG, Mastaglia FL** (1999) Inherited skeletal muscle disorders. *Ann Hum Biol* 26 (6): 507-525.

**La Spada AR, Wilson EM, Lubahn DB, Harding AE, Fischbeck KH** (1991) Androgen receptor gene mutations in X-linked spinal and bulbar muscular atrophy. *Nature* 352: 77-79.

**Lathrop GM, Lalouel JM, Julier C, Ott J** (1984) Strategies for multilocus linkage analysis in humans. *Proc Natl Acad Sci USA* 81: 3443-3446.

**Lebeda RA, Johnson SK, Haun RS** (1999) Transcriptional regulation of the human ADP-ribosylation factor 5 (ARF5) gene. *Biochim Biophys Acta* 1445: 314-320.

**Lee BS, Gluck SL, Holliday LS** (1999) Interaction between vacuolar H<sup>+</sup>-ATPase and microfilaments during osteoclast activation. *J Biol Chem* 274: 29164-29171.

**Lewin B** (1990) *Genes IV*. Oxford University Press, New York.

**Li S, Okamoto T, Chun M, Sargiacomo M, Casanova JE, Hansen SH, Nishimoto I, Lisanti MP** (1995) Evidence for a regulated interaction between heterotrimeric G proteins and caveolin. *J Biol Chem* 270: 15693-15701.

**Li S, Couet J, Lisanti MP** (1996) Src tyrosin kinases, G $\alpha$  subunits and H-ras share a common membrane-anchored scaffolding protein, caveolin: caveolin binding negatively regulates the autoactivation of Src tyrosine kinases. *J Biol Chem* 271: 29182-29190.

**Lieberman U, Karlin S** (1984) Theoretical models of genetic map functions. *Theor Popul Biol* 25: 331-346.

**Lieberman AP, Fischbeck KH** (2000) Triplet repeat expansion in neuromuscular disease. *Muscle Nerve* 23: 843-850.

**Lim LE, Duclos F, Broux O, Bourg N, Sunada Y, Allamand V, Meyer J, Richard I, Moomaw C, Slaughter C, Tome FMS, Fardeau M, Jackson CE, Beckman JS, Campbell KP (1995)** Beta-sarcoglycan: characterization and role in limb-girdle muscular dystrophy linked to 4q12. *Nat Genet* 11: 257-265.

**Lindblad K, Zander M, Schalling M, Hudson T (1994)** Growing triplet repeats. *Nat Genet* 7: 124.

**Liu G, Thomas L, Warren RA, Enns CA, Cunningha CC, Hartwig JH, Thomas G (1997)** Cytoskeletal protein ABP-280 directs the intracellular trafficking of furin and modulates proprotein processing in the endocytic pathway. *J Cell Biol* 139: 1719-1733.

**Liu J, Aoki M, Illa I, Wu C, Fardeau M, Angelini C, Serrano C, Urtizbera JA, Hentati F, Hamida MB, Bohlega S, Culper EJ, Amato AA, Bossie K, Oeltjen J, Bejaoui K, McKenna-Yasek D, Hosler BA, Schurr E, Arahata K, de Jong PJ, Brown RH Jr (1998)** Dysferlin, a novel skeletal muscle gene, is mutated in Miyoshi myopathy and limb girdle muscular dystrophy. *Nat Genet* 20: 31-36.

**Maestrini E, Patrosso C, Mancini M, Rivella S, Rocchi M, Repetto M, Villa A, Frattini A, Zoppo M, Vezzoni P, Toniolo D (1993)** Mapping of two genes encoding isoforms of the actin binding protein ABP-280, a dystrophin like protein, to Xq28 and to chromosome 7. *Hum Mol Genet* 2: 761-766.

**Mahadevan M, Tsilfidis C, Sabourin L, Shutler G, Ameniya C, Jansen G, Neville C, Narang M, Barcelo J, O'Hoy K, Leblond S, Earle-Macdonald J, de Jong PJ, Wieringa B, Korneluk RG (1992)** Myotonic dystrophy mutation: an unstable CTG repeat in the 3' untranslated region of the gene. *Science* 255: 1253-1255.

**Mahjneh I, Marconi G, Bushby K, Anderson LV, Tolvanen-Mahjneh H, Somer H (2001)** Dysferlinopathy (LGMD2B): a 23-year follow-up study of 10 patients homozygous for the same frameshifting dysferlin mutations. *Neuromuscul Disord* 11: 20-26.

**Markesbery WR, Griggs RC, Leach RP, Lapham LW (1974)** Late onset hereditary distal myopathy. *Neurology* 23: 127-134.

**Martin AR (1994)** Amplification of neuromuscular transmission by postjunctional folds. *Proc Royal Soc B* 258: 321-326.

**Martorell L, Pujana MA, Volpini V, Sanchez A, Joven J, Vilella E, Estivill X (1997)** The repeat expansion detection method in the analysis of diseases with CAG/CTG repeat expansion: usefulness and limitations. *Hum Mutat* 10: 486-488.

**Matsumura K, Tome FMS, Huguet C, Azibi K, Chaouch M, Kaplan J-C, Fardeau M, Campbell KP** (1992) Deficiency of the 50K dystrophin-associated glycoprotein in severe childhood autosomal recessive muscular dystrophy. *Nature* 359: 320-322.

**Mayans O, van der Ven PF, Wihn M, Mues A, Young P, Furst DO, Wihmanns M, Gautel M** (1998) Structural basis for activation of the titin kinase domain during myofibrillogenesis. *Nature* 395: 863-869.

**McGowan KA, Marinkovich MP** (2000) Laminins and human disease. *Microsc Res Tech* 51: 262-279.

**McGuire RE, Daiger SP, Green ED** (1997) Localization and characterization of the human ADP-ribosylation factor 5 (ARF5) gene. *Genomics* 41: 481-484.

**McNally EM, Ly CT, Kunkel LM** (1998a) Human epsilon-sarcoglycan is highly related to  $\alpha$ -sarcoglycan (adhalin), the limb-girdle muscular dystrophy 2D gene. *FEBS Lett* 422: 27-32.

**McNally EM, de Sá Moreira E, Duggan DJ, Bönnemann CG, Lisanti MP, Lidov HGW, Vainzof M, Passos-Bueno MR, Hoffman EP, Zatz M, Kunkel LM** (1998b) Caveolin-3 in muscular dystrophy. *Hum Mol Genet* 7, (5): 871-877.

**Messina DN, Speer MC, Pericak-Vance MA, McNally EM** (1997) Linkage of familial dilated cardiomyopathy with conduction defect and muscular dystrophy to chromosome 6q23. *Am J Hum Genet* 61: 909-917.

**Miladi N, Bourguignon JP, Hentati F** (1999) Cognitive and psychological profile of a Tunisian population of limb girdle muscular dystrophy. *Neuromuscul Disord* 9: 352-354.

**Milhorat AT, Wolff HG** (1943) Studies in diseases of muscle XIII. Progressive muscular dystrophy of atrophic distal type: report on a family; report of autopsy. *Arch Neurol Psychiat* 49: 655-664.

**Miller SA, Dyke DD, Polesky HF** (1988) A simple salting out procedure for extracting DNA from human nucleated cells. *Nucl Acids Res* 16: 1215.

**Minetti C, Sotgia F, Bruno C, Scartezzini P, Broda P, Bado M, Masetti E, Mazzocco M, Egeo A, Donati MA, Volonté D, Galbiati F, Cordone G, Bricarelli FD, Lisanti MP, Zara F** (1998) Mutations in the caveolin-3 gene cause autosomal dominant limb-girdle muscular dystrophy. *Nat Genet* 18: 365-368.

**Miyagoe-Suzuki Y, Nakagawa M, Takeda S** (2000) Merosin and congenital muscular dystrophy. *Microsc Res Tech* 48: 181-191.

**Miyoshi K, Tada Y, Iwasa M** (1975) Autosomal recessive distal myopathy observed characteristically in Japan. *Jpn J Hum Genet* 20: 62-63.

**Miyoshi K, Kawai H, Iwasa M, Kusaka K, Nishino H** (1986) Autosomal recessive distal muscular dystrophy as a new type of progressive muscular dystrophy. Seventeen cases in eight families including an autopsied case. *Brain* 109: 31-54.

**Mizuno Y, Yoshida M, Nonaka I, Hirai S, Ozawa E** (1994a) Expression of utrophin (dystrophin-related protein) and dystrophin-associated glycoproteins in muscles from patients with Duchenne muscular dystrophy. *Muscle Nerve* 17: 206-216.

**Mizuno Y, Noguchi S, Yamamoto H, Yoshida M, Suzuki A, Hagiwara Y, Hayashi YK, Arahata K, Nonaka I, Hirai S, Ozawa E** (1994b) Selective defect of sarcoglycan complex in severe childhood autosomal recessive muscular dystrophy muscle. *Biochem Biophys Res Commun* 203: 979-983.

**Monaco AP, Neve RL, Colletti FC, Bertelson CJ, Kurnit DM, Kunkel LM** (1986) Isolation of candidate cDNAs for portions of the Duchenne muscular dystrophy gene. *Nature* 323: 646-650.

**Moreira ES, Vainzof M, Marie SK, Sertié AL, Zatz M, Passos-Bueno MR** (1997) The seventh form of autosomal recessive limb-girdle muscular dystrophy is mapped to 17q11-12. *Am J Hum Genet* 61: 151-159.

**Moreira ES, Wiltshire TJ, Faulkner G, Nilforoushan A, Vainzof M, Suzuki OT, Valle G, Reeves R, Zatz M, Passos-Bueno M, Jenne DE** (2000) Limb-girdle muscular dystrophy type 2G is caused by mutations in the gene encoding the sarcomeric protein telethonin. *Nat Genet* 24: 163-166.

**Muchir A, Bonne G, van der Kooi AJ, van Meegen M, Baas F, Bolhuis PA, deVisser M, Schwartz K** (2000) Identification of mutations in the gene encoding lamins A/C in autosomal dominant limb girdle muscular dystrophy with atrioventricular conduction disturbances (LGMD1B). *Hum Mol Genet* 9, (9): 1453-1459.

**Mues A, van der Ven FM, Young P, Fürst DO, Gautel M** (1998) Two immunoglobulin-like domains of the Z-disc portion of titin interact in a conformation-dependent way with telethonin. *FEBS Lett* 428: 111-114.

**Muller T, Schroder R, Zierz S** (2001) GCG repeats and phenotype in oculopharyngeal muscular dystrophy. *Muscle Nerve* 24: 120-122.

**Nagase T, Seki N, Ishikawa K, Ohira M, Kawarabayasi Y, Ohara O, Tanaka A, Kotani H, Miyajima N, Nomura N** (1996) Prediction of the coding sequences of unidentified human genes

(KIAA0201-KIAA0280) deduced by analysis of cDNA clones from cell line KG-1 and brain. *DNA Res* 3: 321-329, 341-354.

**Nawrotzki R, Loh NY, Ruegg MA, Davies KE, Blake DJ** (1998) Characterisation of  $\alpha$ -dystrobrevin in muscle. *J Cell Sci* 111: 2595-2605.

**Neer EJ** (1995) Heterotrimeric G proteins: organizers of transmembrane signals. *Cell* 80: 249-257.

**Neuromuscular disorders: gene location** (1999) *Neuromuscul Disord* 9: I-XIV.

**Nielsen JE, Koefoed P, Abell K, Hasholt L, Eiberg H, Fenger K, Niebuhr E, Sorensen SA** (1997) CAG repeat expansion in autosomal dominant pure spastic paraplegia linked to chromosome 2p21-p24. *Hum Mol Genet* 11: 1811-1816.

**Nigro V, de Sa Moreira E, Piluso G, Vainzof M, Belsito A, Politano L, Puca AA, Passos-Bueno MR, Zatz M** (1996) Autosomal recessive limb-girdle muscular dystrophy, LGMD2F, is caused by a mutation in the delta-sarcoglycan gene. *Nat Genet* 14: 195-198.

**Noguchi S, McNally EM, Ben Othmane K, Hagiwara Y, Mizuno Y, Yoshida K, Yamamoto H, Bonnemann CG, Gussoni E, Denton P, Kyriakides T, Middleton L, Hentati F, Ben Hamida M, Nonaka I, Vance JM, Kunkel LM, Ozawa E** (1995) Mutations in the dystrophin-associated protein  $\gamma$ -sarcoglycan in chromosome 13 muscular dystrophy. *Science* 270: 819-822.

**Nonaka I, Sunohara N, Ishiura S, Satoyoshi E** (1981) Familial distal myopathy with rimmed vacuole and lamellar (myeoloid) body formation. *J Neurol Sci* 51:141-155.

**Numata M, Ohkuma S, Iseki S** (1995) Expression and localization of mRNA for the 16 KD subunit of V-ATPase in the rat embryo. *J Histochem Cytochem* 43: 761-769.

**Oka N, Yamamoto M, Schwencke C, Kawabe J, Ebina T, Ohno S, Couet J, Lisanti MP, Ishikawa Y** (1997) Caveolin interaction with protein kinase C: isoenzyme-dependent regulation of kinase activity by the caveolin-scaffolding domain peptide. *J Biol Chem* 272: 33416-33421.

**Okamoto T, Schlegel A, Scherer PE, Lisanti MP** (1998) Caveolins, a family of scaffolding proteins for organizing "preassembled signaling complexes" at the plasma membrane. *J Biol Chem* 273: 5419-5422.

**Ono S, Yamakita Y, Yamashiro S, Matsudaira PT, Gnarr J, Obinata T, Matsumura F** (1997) Identification of an actin binding region and a protein kinase C phosphorylation site on human fascin. *J Biol Chem* 272: 2527-2533.



**Orr HT, Chung MY, Banfi S, Kwiatkowski TJ Jr, Servadio A, Beaudet AL, McCall AE, Duvick LA, Ranum LP, Zoghbi HY** (1993) Expansion of an unstable trinucleotide CAG repeat in spinocerebellar ataxia type 1. *Nat Genet* 4: 221-226

**Otani H, Yamamura T, Nakao Y, Hattori R, Fujii H, Ninomiya H, Kido M, Kawaguchi H, Osako M, Imamura H, Ohta T, Ohkuma S** (2000) Vacuolar H(+)-ATPase plays a crucial role in growth and phenotypic modulation of myofibroblasts in cultured human aphenous vein. *Circulation* 102 (19 Suppl 3): 269-274.

**Ott J** (1991) *Analysis of Human genetic Linkage*, 2<sup>nd</sup> ed. Baltimore, Johns Hopkins University Press.

**Ozawa E, Noguchi S, Mizuno Y, Hagiwara Y, Yoshida M** (1998) From dystrophinopathy to sarcoglycanopathy: evolution of a concept of muscular dystrophy (Review). *Muscle Nerve* 21: 421-438.

**Panegyres PK, Mastaglia FL, Kakulas BA** (1990) Limb girdle syndromes. Clinical, morphological and electrophysiological studies. *J Neurol Sci* 95: 201-218.

**Passos-Bueno MR, Oliveira JR, Bakker E, Anderson RD, Marie SK, Vainzof M, Roberds S, Campbell KP, Zatz M** (1993) Genetic heterogeneity for Duchenne-like muscular dystrophy (DLMD) based on linkage and 50 DAG analysis. *Hum Mol Genet* 2: 1945-1947.

**Passos-Bueno MR, Moreira ES, Vainzof M, Marie SK, Zatz M** (1996) Linkage analysis in autosomal recessive limb-girdle muscular (AR LGMD) maps a sixth form to 5q33-34 (LGMD 2F) and indicates that there is at least one more subtype of AR LGMD. *Hum Mol Genet* 5: 815-820.

**Pasternak C, Wong S, Elson EL** (1995) Mechanical function of dystrophin in muscle-cells. *J Cell Biol* 128: 355-361.

**Peltz SW, Brewer G, Bernstein P, Hart PA, Ross J** (1991) Regulation of mRNA turnover in eukaryotic cells. *Crit Rev Eukaryot Gene Expr* 1: 99-126.

**Peng SB, Crider BP, Tsai SJ, Xie XS, Stone DK** (1996) Identification of a 14 kDa subunit associated with the catalytic sector of clathrin-coated vesicle H<sup>+</sup>-ATPase. *J Biol Chem* 271: 3324-3327.

**Peng HB, Ali AA, Daggett DF, Rauvala H, Hassel JR, Smalheiser NR** (1998) The relationship between perlecan and dystroglycan and its implication in the formation of the neuromuscular junction. *Cell Adhesion Comm* 5: 475-489.

**Peters MF, Sadoulet-Puccio HM, Grady MR, Kramarcy MR, Kunkel LM, Sanes JR, Sealock R, Froehner SC** (1998) Differential membrane localization and intermolecular associations of alpha-dystrobrevin isoforms in skeletal muscle. *J Cell Biol* 142: 1269-1278.

**Piccolo F, Roberds SL, Jeanpierre M, Anderson RD, Leturcq F, Azibi K, Beldjord C, Carrie A, Recan D, Chaouch M, Reghis A et al** (1995) Primary adhalinopathy: a common cause of autosomal recessive muscular dystrophy of variable severity [errata publicada a *Nat Genet* ,11: 104 (1995)] . *Nat Genet* 10: 243-245.

**Piccolo F, Moore SA, Ford GC, Campbell KP** (2000) Intracellular accumulation and reduced sarcolemmal expression of dysferlin in limb-girdle muscular dystrophies. *Ann Neurol* 48: 902-912.

**Pogue R, Anderson LV, Pyle A, Sewry C, Pollitt C, Johnson MA, Davison K, Moss JA, Mercuri E, Muntoni F, Bushby KM** (2001) Strategy for mutation analysis in the autosomal recessive limb-girdle muscular dystrophies. *Neuromuscul Disord* 11: 80-87.

**Porter JD** (2000) Introduction to muscular dystrophy *Microsc Res Tech* 48: 127-130.

**Price SR, Mitch WE** (1998) Mechanisms stimulating protein degradation to cause muscle atrophy. *Curr Opin Clin Nutr Metab Care* 1: 79-93.

**Puca AA, Nigro V, Piluso G, Belsito A, Sampaolo S, Quaderi N, Rossi E, Di Iorio G, Ballabio A, Franco B** (1998) Identification and characterization of a novel member of the dystrobrevin family. *FEBS Lett* 425: 7-13.

**Pulst SM, Nechiporuk A, Starkman S** (1993) Anticipation in spinocerebellar ataxia type 2. *Nat Genet* 4: 8-10.

**Pulst SM, Nechiporuk A, Nechiporuk T, Gispert S, Chen XN, Lopes-Cendes I, Pearlman S, Starkman S, Orozco-Diaz G, Lunkes A, DeJong P, Rouleau GA, Auburger G, Korenberg JR, Figueroa C, Sahba S** (1996) Moderate expansion of a normally biallelic trinucleotide repeat in spinocerebellar ataxia type 2. *Nat Genet* 14: 269-276.

**Rafael JA, Brown SC** (2000) Dystrophin and utrophin : genetic analyses of their role in skeletal muscle. *Microsc Res Tech* 51 (3): 262-279.

**Razani B, Schlegel A, Lisanti MP** (2000) Caveolin proteins in signaling, oncogenic transformation and muscular dystrophy. *J Cell Sci* 113: 2103-2109.

**Reed PW, Davies JL, Copeman JB, Bennett ST, Palmer SM, Pritchard LE, Gough SC, Kawaguchi Y, Cordell HJ, Balfour KM et al** (1994) Chromosome-specific microsatellite sets for fluorescence-based, semi-automated genome mapping. *Nat Genet* 7: 390-395.

**Reeve JL, McArdle A, Jackson MJ** (1997) Age-related changes in muscle calcium content in dystrophin-deficient mdx mice. *Muscle Nerve* 20: 357-360.

**Richard I, Broux O, Allamand V, Fougerousse F, Chiannikulchai N, Bourg N et al** (1995) Mutations in the proteolytic enzyme calpain 3 cause limb-girdle muscular dystrophy type 2A. *Cell* 81: 27-40.

**Roberds SL, Leturcq F, Allamand V, Piccolo F, Jeanpierre M, Anderson RD, Lim LE, Lee JC, Tome FM, Romero NB, Fardeau M, Beckmann JS, Kaplan J, Campbell KP** (1994) Missense mutations in the adhalin gene linked to autosomal recessive muscular dystrophy. *Cell* 78: 625-633.

**Ross C** (1995) When more is less: pathogenesis of glutamine repeat neurodegenerative diseases. *Neuron* 15: 493-496.

**Sadoulet-Puccio HM, Rajala M, Kunkel LM** (1997) Dystrobrevin and dystrophin: an interaction through coiled-coil motifs. *Proc Natl Acad Sci USA* 94: 13873-13878.

**Saiki RK, Gelfand DH, Stoffel S, Scharf SJ, Higuchi R, Horn GT, Mullis KB, Erlich HA** (1988) Primer-directed enzymatic amplification of DNA with a thermostable DNA polymerase. *Science* 239: 487-491.

**Saishin Y, Shimada S, Morimura H, Sato K, Ishimoto I, Tano Y, Thyama M** (1997) Isolation of a cDNA encoding a photoreceptor cell-specific actin-bundling protein: retinal fascin. *FEBS Lett* 414: 381-386.

**Saishin Y, Ishikawa R, Ugawa S, Guo W, Ueda T, Morimura H, Kohama K, Shimizu H, Tano Y, Shimada S** (2000) Retinal fascin: functional nature, subcellular distribution, and chromosome localization. *Invest Ophthalmol Vis Sci* 41: 2087-2095.

**Sakaki M, Koike H, Takahashi N, Sasagawa N, Tomioka S, Arahata K, Ishiura S** (2001) Interaction between emerin and nuclear lamins. *J Biochem* 129: 321-327.

**Sakamoto A, Ono K, Abe M, Jasmin G, Eki T, Murakami Y, Masaki T, Toyo-oka T, Hanaoka F** (1997) Both hypertrophic and dilated cardiomyopathies are caused by mutation of the same gene, delta-sarcoglycan, in hamster: an animal model of disrupted dystrophin-associated glycoprotein complex. *Proc Natl Acad Sci USA* 94: 13873-13878.

**Salmikangas P, Mykkänen OM, Grönholm M, Heiska L, Kere J, Carpén O** (1999) Myotilin, a novel sarcomeric protein with two Ig-like domains, is encoded by a candidate gene for limb-girdle muscular dystrophy. *Hum Mol Genet* 8: 1329-1336.

**Sambrook J, Fritsch EF, Maniatis T** (1989) Molecular cloning: a laboratory manual. Ed: 2<sup>nd</sup>, Cold Spring Harbor Laboratory Press, Cold Spring Harbor.

**Sanpei K, Takano H, Igarashi S, Sato T, Oyake M, Sasaki H, Wakisaka A, Tashiro K, Ishida Y, Ikeuchi T, Koide R, Saito M, Sato A, Tanaka T, Hanyu S, Takiyama Y, Nishizawa M, Shimizu N, Nomura Y, Segawa M, Iwabuchi K, Eguchi I, Tanaka H, Takahashi H, Tsuji S** (1996) Identification of the spinocerebellar ataxia type 2 gene using a direct identification of repeat expansion and cloning technique, DIRECT. *Nat Genet* 14: 277-284.

**Sawin KE, Nurse P** (1998) regulation of cell polarity by microtubules in fission yeast. *J Cell Biol* 142: 457-471.

**Schalling M, Hudson TJ, Buetow KH, Housman DE** (1993) Direct detection of novel expanded trinucleotide repeats in the human genome. *Nat Genet* 4: 135-139.

**Schwartz AL, Ciechanover A** (1999) The ubiquitin-proteasome pathway and pathogenesis of human diseases. *Annu Rev Med* 50: 57-74.

**Selcen D, Stilling G, Engel AG** (2001) The earliest pathologic alterations in dysferlinopathy. *Neurology* 56: 1472-1481.

**Severs NJ** (1988) Caveolae: static in-pocketings of the plasma membrane, dynamic vesicles or plain artifact?. *J Cell Sci* 90: 341-348.

**Shields RW** (1986) Limb girdle syndromes. A: AG Engel and BQ Banker (Eds.), *Myopathy*, Vol.2. McGraw-Hill, New York : 1349-1365.

**Sketelj J, Crne-Finderle N, Strukelj B, Trontelj JV, Pette D** (1998) Acetylcholinesterase mRNA level and synaptic activity in rat muscles depend on nerve-induced pattern of muscle activation. *J Neurosci* 18: 1944-1952.

**Smalheiser NR, Kim E** (1995) Purification of cranin, a laminin-binding membrane protein: identity with dystroglycan and reassessment of its carbohydrate moieties. *Biol Chem* 270: 15425-15433.

**Smart EJ, Graf GA, McNiven MA, Sessa WC, Engelman JA, Scherer PE, Okamoto T, Lisanti MP** (1999) Caveolins, liquid-ordered domains and signal transduction. *Mol Cell Biol* 19: 7289-7304.

**Smith FJD, Eady RAJ, Leigh IM, McMillan JR, Rugg EL, Kellsell DP, Bryant SP, Spurr NK, Geddes JF, Kirtschig G, Milana G, de Bono AG, Owaribe K, Wiche G, Pulkkinen L, Uitto J, McLean WH, Lane EB** (1996) Plectin deficiency results in muscular dystrophy with epidermolysis bullosa. *Nat Genet* 134: 450-457.

**Song KS, Scherer PE, Tang ZL, Okamoto T, Li S, Chafel M, Cju C, Kohtz DS, Lisanti MP** (1996a) Expression of caveolin-3 in skeletal , cardiac and smooth muscle cells. *J Biol Chem* 271: 15160-15165.

**Song KS, Li S, Okamoto T, Quilliam L, Sargiacomo M, Lisanti MP** (1996b) Co-purification and direct interaction of Ras with caveolin, an integral membrane protein of caveolae microdomains: detergent-free purification of caveolae membranes. *J Biol Chem* 271: 9690-9697.

**Song KS, Tang ZL, Li S, Lisanti MP** (1997) Mutational analysis of the properties of caveolin-1: a novel role for the C-terminal domain in mediating homotyping caveolin-caveolin interactions. *J Biol Chem* 272: 4398-4403.

**Southern EM** (1975) Detection of specific sequences among DNA fragments separated by gel electrophoresis. *J Mol Biol* 98: 203-517.

**Southern EM** (1979) Gel electrophoresis of restriction fragments. *Methods Enzymol* 68: 152.

**Speer MC, Yamaoka LH, Gilchrist JH, Gaskell CP, Stajich JM, Vance JM, Kazantsev A, Lastra AA, Haynes CS, Beckmann JS, Cohen D, Weber JL, Roses AD, Pericak-Vance MA** (1992) Confirmation of genetic heterogeneity in limb-girdle muscular dystrophy: linkage of an autosomal dominant form to chromosome 5q. *Am J Hum Genet* 50: 1211-1217.

**Speer MC, Gilchrist JM, Chutkow JG, McMichael R, Westbrook CA, Stajich JM, Jorgenson EM, Gaskell PC, Rosi BL, Ramesar R, Vance JM, Yamaoka LH, Roses AD, Pericak-Vance MA** (1995) Evidence for locus heterogeneity in autosomal dominant limb-girdle muscular dystrophy. *Am J Hum Genet* 57: 1371-1376.

**Speer MC, Tandan R, Rao PN, Fries T, Stajich JM, Bolhuis PA, Joebis GJ, Vance JM, Viles KD, Sheffield KD, James C, Kahler SG, Pettenatti M, Gilbert JR, Denton PH, Yamaoka LH, Pericak-Vance MA** (1996) Evidence for locus heterogeneity in the Bethlem myopathy and linkage to 2q37. *Hum Mol Genet* 5: 1043-1046.

**Speer MC, Gilchrist JM, Stajich JM, Gaskell PC, Westbrook CA, Horrigan SK, Bartoloni L, Yamaoka LH, Scott WK, Pericak-Vance MA** (1998a) Evidence for anticipation in autosomal dominant limb-girdle muscular dystrophy. *J Med Genet* 35, (4): 305-308.

**Speer MC, Vance JM, Lennon-Graham F, Stajich JM, Viles KD, Gilchrist JM, Nigro V, McMichael R, Chutkow JG, Bartoloni L, Horrigan SK, Westbrook CA, Pericak-Vance MA (1998b)** Exclusion of identified LGMD1 loci from four dominant limb-girdle muscular dystrophy families. *Hum Hered* 48: 179-184.

**Speer MC, Vance JM, Grubber JM, Lennon Graham F, Stajich JM, Viles KD, Rogala A, McMichael R, Chutkow J, Goldsmith C, Tim RW, Pericak-Vance MA (1999)** Identification of a new autosomal dominant limb-girdle muscular dystrophy locus on chromosome 7. *Am J Hum Genet* 64: 556-562.

**Stahlhut M, van Deurs B (2000)** Identification of filamin as a novel ligand for caveolin-1: evidence for the organization of caveolin-1-associated membrane domains by the actin cytoskeleton. *Mol Biol Cell* 11: 325-337.

**Stearns T, Willingham MC, Botstein D, Kahn RA (1990)** ADP-ribosylation factor in functionally and physically associated with the Golgi complex. *Proc Natl Acad Sci USA* 87: 1238-1242.

**Stevenson AC (1953)** Muscular dystrophy in Northern Ireland I. An account of the condition in fifty-one families. *Ann Eugen* 18: 50-93.

**Straub V, Campbell KP (1997a)** Muscular dystrophies and the dystrophin-glycoprotein complex (Review). *Curr Opin Neurol* 10: 168-175.

**Straub V, Rafael JA, Chamberlain JS, Campbell KP (1997b)** Animal models for muscular dystrophy show different patterns of sarcolemmal disruption. *J Cell Biol* 139: 375-385.

**Sturt E (1976)** A mapping function for human chromosomes. *Ann Hum Genet* 40: 147-163.

**Suggs SV, Hirose T, Miyake T, Kawashima EH, Johnson MJ, Itakura K, Wallace RB (1981)** Developmental biology using purified genes. *Academic Press*, New York.

**Sugiyama JE, Glass DJ, Yancopoulos GD, Hall ZW (1997)** Laminin-induced acetylcholine receptor clustering: an alternative pathway. *J Cell Biol* 139: 181-191.

**Sunada Y, Ohi H, Hase A, Ohi H, Hosono T, Arata S, Higuchi S, Matsumura K, Shimizu T (2001)** Transgenic mice expressing mutant caveolin-3 show severe myopathy associated with increased nNOS activity. *Hum Mol Genet* 10: 173-178.

- Suzuki A, Yoshida M, Hayashi K, Mizuno Y, Hagiwara Y, Ozawa E** (1994) Molecular organization at the glycoprotein-complex-binding site of dystrophin. Three dystrophin-associated proteins bind directly to the carboxy-terminal portion of dystrophin. *Eur J Biochem* 220: 283-292.
- Suzuki A, Yoshida M, Ozawa E** (1995) Mammalian  $\alpha$ 1- and  $\beta$ 1-syntrophin bind to the alternative splice-prone region of the dystrophin COOH terminus. *J Cell Biol* 128: 373-381.
- Takafuta T, Wu G, Murphy GF, Shapiro SS** (1998) Human beta-filamin is a new protein that interacts with the cytoplasmic tail of glycoprotein Ib alpha. *J Biol Chem* 273: 17531-17538.
- Talim B, Ognibene B, Mattioli E, Richard I, Anderson LVB, Path MRC, Merlini L** (2001) Normal calpain expression in genetically confirmed limb-girdle muscular dystrophy type 2A. *Neurology* 56: 692-693.
- Tang Z, Scherer PE, Okamoto T, Song K, Chu C, Kohtz DS, Nishimoto I, Lodish HF, Lisanti MP** (1996) Molecular cloning of caveolin-3, a novel member of the caveolin gene family expressed predominantly in muscle. *J Biol Chem* 271: 2255-2261.
- Tawil R, Forrester J, Grggs RC, Mendell J, Kissel J, McDermott M, King W, Weiffenbach B, Figlewicz D** (1996) Evidence for anticipation and association of deletion size with severity in facioscapulohumeral muscular dystrophy. The FSH-DY Group. *Ann Neurol* 39: 744-748.
- Terwilliger JD, Ott J** (1994) *Handbook of human genetic linkage*. Johns Hopkins university Press, Baltimore.
- Thompson TG, Chan YM, Hack AA, Brosius M, Rajala M, Lidov HGW, McNally EM, Watkins S, Kunkel LM** (2000) Filamin 2 (FLN2): a muscle-specific sragoglycan interacting protein. *J Cell Biol* 148 (1): 115-126.
- Timpl R** (1996) Macromolecular organization of basement membranes. *Curr Opin Cell Biol* 8: 618-624.
- Toniolo D, Minetti C** (1999) Muscular dystrophies: alterations in a limited number of cellular pathways? *Curr Op Genet Dev* 9: 275-282.
- Tubb BE, Bardien-Kruger S, Kashork CD, Shaffer LG, Ramagli LS, Xu J, Siciliano MJ, Bryan J** (2000) Characterization of human retinal fascin gene (FSCN2) at 17q25: close physical linkage of fascin and cytoplasmic actin genes. *Genomics* 65: 146-156.

**Ueyama H, Kumamoto T, Nagao S, Masuda T, Horinouchi H, Fujimoto S, Tsuda T** (2001) A new dysferlin gene mutation in two Japanese families with limb-girdle muscular dystrophy 2B and Miyoshi myopathy. *Neuromuscul Disord* 11: 139-145.

**Uhl K, Jeschke B, Sakthivel S, Vosberg HP** (2000) Genomic sequence of the gamma-filamin gene (FLNC) on chromosome 7 (*Direct submission to GenBank, AF252549, unpublished*).

**Vainzof M, Passos-Bueno MR, Canovas M, Moreira ES, Pavanello RC, Marie SK, Anderson SV, Bonnemann CG, McNally EM, Nigro V, Kunkel LM, Zatz M** (1996) The sarcoglycan complex in the six autosomal recessive limb-girdle muscular dystrophies. *Hum Mol Genet* 5: 1963-1969.

**Valle G, Faulkner G, De Antoni A, Pacchioni B, Pallavicini A, Pandolfo D, Tiso N, Toppo S, Trevisan S, Lanfranchi G** (1997) Telethonin, a novel sarcomeric protein of heart and skeletal muscle. *FEBS Lett* 415: 163-168.

**van der Kooi AJ, Ledderhof TM, de Voogt WG, Res JCJ, Bouwsma G, Troost D, Busch HFM, Becker AE, de Visser M** (1996) A newly recognized autosomal dominant limb girdle muscular dystrophy with cardiac involvement. *Ann Neurol* 39: 636-642.

**van der Kooi AJ, van Meegeen M, Lederhof TM, McNally EM, de Visser M, Bolhuis PA** (1997) Genetic localization of a newly recognized autosomal dominant limb-girdle muscular dystrophy with cardiac involvement (LGMD 1B) to chromosome 1q11-21. *Am J Hum Genet* 60: 891-895.

**van der Ven PFM, Obermann WMJ, Lemke B, Gautel M, Weber K, Fürst DO** (2000a) Characterization of muscle filamin isoforms suggests a possible role of  $\gamma$ -filamin/ABP-L in sarcomeric Z-disc formation. *Cell Motil Cytoskeleton* 45: 149-162.

**van der Ven PFM, Wiesner S, Salmikangas P, Auerbach D, Himmel M, Kempa S, Hayeb K, Pacholsky D, Taivainen A, Schröder R, Carpén O, Fürst D** (2000b) Indications for a novel muscular dystrophy pathway:  $\gamma$ -Filamin, the muscle-specific filamin isoform, interacts with myotilin. *J Cell Biol* 151: 235-247.

**Vignos PJ, Spencer GE, Archibald KC** (1963) Management of progressive muscular dystrophy in childhood. *JAMA* 184: 89-96.

**Vlak M, van der Kooi E, Angelini C** (2000) Correlation of clinical function and muscle CT scan images in limb-girdle muscular dystrophy. *Neurol Sci* 21: 975-977.



**Vorum H, Liu X, Madsen P, Rasmussen HH, Honore B** (1998) Molecular cloning of a cDNA encoding human calumenin, expression in *Escherichia coli* and analysis of its Ca<sup>2+</sup> binding activity. *Biochim Biophys Acta* 1386: 121-131.

**Vorum H, Hager H, Christensen BM, Nielsen S, Honore B** (1999) Human calumenin localizes to the secretory pathway and is secreted to the medium. *Exp Cell Res* 248: 473-481.

**Wakayama Y, Inoue M, Murahashi M, Shibuya S, Himi T, Kojimo H, Oniki H** (1997) Ultrastructural localization of  $\alpha$ 1-syntrophin and neuronal nitric oxid synthase in normal skeletal myofiber and their relationship to each other and to dystrophin. *Acta Neuropathol* 94: 455-464.

**Wakayama Y, Inoue M, Kojima H, Murahashi M, Shibuya S, Jimi T, Hara H, Oniki H** (1999) Ultrastructural localization of  $\alpha$ -,  $\beta$ - and  $\gamma$ -sarcoglycan and their mutual relationship to dystrophin,  $\beta$ -dystroglycan and  $\beta$ -spectrin in normal skeletal myofiber. *Acta Neuropathol* 97: 288-296.

**Walton JN, Nattrass FJ** (1954) On the classification, natural history and treatment of the myopathies. *Brain* 77: 169-231.

**Walton JN, Gardner-Medwin D** (1991) The muscular dystrophies. A: Walton JN, editor. *Disorders of voluntary muscle*. 5<sup>th</sup> ed. Edinburgh: Churchill Livingstone: 519-568.

**Wang K, Ash JF, Singer SJ** (1975) Filamin, a new high-molecular-weight protein found in smooth muscle and non-muscle cells. *Proc Natl Acad Sci* 72: 4483-4486.

**Watanabe TK, Kawai A, Fujiwara T, Maekawa H, Hirai Y, Nakamura Y, Takahashi E** (1996) Molecular cloning of UBE2G, encoding a human skeletal muscle-specific ubiquitin-conjugating enzyme homologous to UBC7 of *C. Elegans*. *Cytogenet Cell Genet* 74: 146-148.

**Watkins SC, Cullen MJ, Hoffman EP, Billington L** (2000) Plasma membrane cytoskeleton of muscle: A fine structural analysis. *Microsc Res Tech* 48: 131-141.

**Way M, Parton RG** (1995) M-caveolin, a muscle-specific caveolin-related protein. *FEBS Lett* 376: 108-112.

**Weber JL, May PE** (1989) Abundant class of human DNA polymorphisms that can be typed using the polymerase chain reaction. *Am J Hum Genet* 44: 338-396.

**Webb TP, Bunday SE, Thake AI, Todd J** (1986) The frequency of the fragile X chromosome among schoolchildren in Coventry. *Am J Med Genet* 23: 573-580.

**Weiler T, Greenberg CR, Zelinski T, Nylen E, Coghlan G, Crumley MJ, Fujiwara TM, Morgan K, Wrogemann K** (1998) A gene for autosomal recessive limb-girdle muscular dystrophy in Manitoba Hutterites maps to chromosome region 9q31-q33: evidence for another limb-girdle muscular dystrophy locus. *Am J Hum Genet* 63: 140-147.

**Weissenbach J, Gyapay G, Dib C, Vignal A, Morissette J, Millasseau P, Vaysseix G, Lathrop M** (1992) A second-generation linkage map of the human genome. *Nature* 359: 794-801.

**Welander L** (1951) Myopathia distalis tarda hereditaria . *Acta Med Scand* 141: 1-124.

**Welsh CF, Moss J, Vaughan M** (1994) ADP-ribosylation factors: a family of approximately 20-kDa guanine nucleotide-binding proteins that activate cholera toxin. *Mol Cell Biochem* 138: 157-166.

**Wheather PR, Burkitt HG, Daniels VG** (1987) *Histología Funcional*. 2ª Edició. Editorial JIMS.

**Wijmenga C, Hewitt JE, Sandkuijl LA, Clark LN, Wright TJ, Dawerse HG, Gruter AM, Hofker MH, Moerer P, Williamson R, van Ommen GJB, Padberg GW, Frants RR** (1992) Chromosome 4q DNA rearrangements associated with facioescapulohumeral muscular dystrophy. *Nat Genet* 2: 26-30.

**Wilson GM, Sun Y, Lu H, Brewer G** (1999) Assembly of AUF1 oligomers on U-rich RNA targets by sequential dimer association. *J Biol Chem* 274: 33374-33381.

**Wood SJ, Slater CR** (1997) The contribution of postsynaptic folds to the safety factor for neuromuscular transmission in rat fast- and slow-twitch muscles. *J Physiol Lond* 500: 165-176.

**Wood SJ, Slater CR** (1998) Beta-spectrin is colocalized with both voltage-gated sodium channels and ankyrin (G) at the adult rat neuromuscular junction. *J Cell Biol* 140: 675-684.

**Xie Z, Xu W, Davie EW, Chung DW** (1998) Molecular cloning of human ABPL, an actin-binding protein homologue. *Biochem Biophys Res Commun* 251: 914-919.

**Xu WF, Xie Z, Chung DW, Davie EM** (1998) A novel human actin-binding protein homologue that binds to platelet glycoprotein Ib alpha. *Blood* 92: 1268-1276.

**Xue F, Cooley L** (1993) Kelch encodes a component of intercellular bridges in *Drosophila* egg chambers. *Cell* 72: 681-693.

**Yabe D, Taniwaki M, Nakamura T, Kanazawa N, Tashiro K, Honjo T** (1998) Human calumenin gene (CALU): cDNA isolation and chromosomal mapping to 7q32. *Genomics* 49: 331-333.

**Yamada H, Saito F, Fukuta-Ohi H, Zhong D, Hase A, Arai K, Okuyama A, Maekawa R, Shimizu T, Matsumura K** (2001) Processing of beta-dystroglycan by matrix metalloproteinase disrupts the link between the extracellular matrix and cell membrane via the dystroglycan complex. *Hum Mol Genet* 10 (15): 1563-1569.

**Yamaoka LH, Westbrook CA, Speer MC, Gilchrist JM, Jabs EW, Schweins EG, Stajich JM, Gaskell PC, Roses AD, Pericak-Vance MA** (1994) Development of a microsatellite genetic map spanning 5q31-q33 and subsequent placement of the LGMD1A locus between D5S178 and IL9. *Neuromuscul Disord* 4: 471-475.

**Yamashiro S, Yamakita Y, Ono S, Matsumura F** (1998) Fascin, an actin-bundling protein, induces membrane protrusions and increases cell motility of epithelial cells. *Mol Biol Cell* 9: 993-1006.

**Yamashiro-Matsumura S, Matsumura F** (1985) Purification and characterization of an F-actin-bundling 55-kilodalton protein from HeLa cells. *J Biol Chem* 260: 5087-5097.

**Yang B, Jung D, Rafael JA, Chamberlain JS, Campbell KP** (1995) Identification of a syntrophin binding to syntrophin triplet, dystrophin and utrophin. *J Biol Chem* 270: 4975-4978.

**Yokota T, Nagai H, Harada H, Mine N, Terada Y, Fujiwara H, Yabe A, Miyazaki K, Emi M** (2001) Identification, tissue expression and chromosomal position of a novel gene encoding human ubiquitin-conjugating enzyme E2-230 k. *Gene* 267: 95-100.

**Zahler AM, Lane WS, Stolk JA, Roth MB** (1992) SR proteins: a conserved family of pre-mRNA splicing factors. *Genes Dev* 6: 837-847.

**Zhang QH, Ye M, Wu XY, Ren SX, Zhao M, Zhao CJ, Fu G, Shen Y, Fan HY, Lu G, Zhong M, Xu XR, Han ZG, Zhang JW, Tao J, Huang QH, Zhou J, Hu GX, Gu J, Chen SJ, Chen Z** (2000) Cloning and functional analysis of cDNAs with open reading frames for 300 previously undefined genes expressed in CD34+ hematopoietic stem/progenitor cells. *Genome Res* 10: 1546-1560.

**Ziegler JS, Su Y, Corcoran KP, Nie L, Mayrand PE, Hoff LB, McBride LJ, Kronick MN, Diehl SR** (1992) Application of automated DNA sizing technology for genotyping microsatellite loci. *Genomics* 14: 1026-1031.

**Zimprich F, Djamshidian A, Hainfellner JA, Budka H, Zeitlhofer J** (2000) An autosomal dominant early adult-onset distal muscular dystrophy. *Muscle Nerve* 23: 1876-1879.

**Zhuchenko O, Bailey J, Bonnen P, Ashizawa T, Stockton DW, Amos C, Dobyns WB, Subramony SH, Zoghbi HY, Lee CC (1997)** Autosomal dominant cerebellar ataxia (SCA6) associated with small polyglutamine expansions in the  $\alpha_{1A}$ -voltage-dependent calcium channel. *Nat Genet* 15: 62-69.