Myotonic Dystrophy FOUNDATION

Mouse – Myotonic Dystrophy Animal Models & Tools

Animal models play a key role in basic, translational and clinical research. The following tables highlight and summarize available animal models and tools for myotonic dystrophy research. Literature links connect to the original publication.

This table summarizes available and commonly used **transgenic mouse lines** used in myotonic dystrophy (DM) research. The table also links to repositories through which mice are available for research. This table was last updated and reviewed in June 2024.

To find additional animal models or learn more about each respective system, please examine and follow the associated literature links and references within each table.

To find additional information and resources focused on myotonic dystrophy, visit the Myotonic Dystrophy Foundation website at: www.myotonic.org.

Mouse Models - Myotonic Dystrophy Animal Models & Tools

Transgenic Mouse Model	Description	CTG / Repeat	Flanking Sequence	Promoter	Human Expression	References	Catalog
DMPK KO						Reddy, S., Smith, D., Rich, M. et al. Mice lacking the myotonic dystrophy protein kinase develop a late onset progressive myopathy. Nat Genet 13, 325–335 (1996). https://doi.org/10.1038/ng0796-325 Fu, Y.-H.; Friedman, D.L.; Richards, S.; Pearlman, J.A.; Gibbs, R.A.; Pizzuti, A.; Ashizawa, T.; Rerryman, M.B.; Scarlato, G.; Fenwick, R.G.; et al. Decreased expression of myotonin-protein kinase messenger RNA and protein in adult form of myotonic dystrophy. Science 1993, 260, 235–238. Jansen, G.; Groenen, P.J.T.A.; Bächner, D.; Jap, P.H.K.; Coerwinkel, M.; Oerlemans, F.; Van Den Broek, W.; Gohlsch, B.; Pette, D.; Plomp, J.J.; et al. Abnormal myotonic dystrophy protein kinase levels produce only mild myopathy in mice. Nat. Genet. 1996, 13, 316–324. [CrossRef] Alwazzan, M.; Newman, E.; Hamshere, M.G.; Brook, J.D. Myotonic dystrophy is associated with a reduced level of RNA from the DMWD allele adjacent to the expanded repeat. Hum. Mol. Genet. 1999, 8, 1491–1497.	
HSASR / HSALR	Human skeletal α-actin (HSA) gene modified by the insertion of either 5 (HSA short repeat, HSASR) or 250 (HSA long repeat, HSALR) CTG repeats in the HSA 3′ UTR	250	human skeletal actin 3'UTR	Human ACTA1	Skeletal muscle	https://www.science.org/doi/10.1126/science.289.5485.1769 Mankodi A, Logigian E, Callahan L, McClain C, White R, Henderson D, Krym M, Thornton CA. Myotonic dystrophy in transgenic mice expressing an expanded CUG repeat. Science. 2000 Sep 8;289(5485):1769-73. doi: 10.1126/science.289.5485.1769. PMID: 10976074.	https://www.jax.org/strain/032031
DM5 / DM20 / DM300		5/20/300		Human DMPK		Seznec H, Lia-Baldini AS, Duros C, Fouquet C, Lacroix C, et al. (2000) Transgenic mice carrying large human genomic sequences with expanded CTG repeat mimic closely the DM CTG repeat intergenerational and somatic instability. Hum Mol Genet 9: 1185–1194. https://academic.oup.com/hmg/article/9/8/1185/604969?login=false	
DMSXL		1000	Human DMPK locus	Human DMPK	Ubiquitous	Gomes-Pereira M, Foiry L, Nicole A, Huguet A, Junien C, et al. (2007) CTG trinucleotide repeat "big jumps": large expansions, small mice. PLoS Genet 3: e52	
					Characterization of DMSXL	HuguetA,MedjaF,NicoleA, VignaudA,Guiraud-DoganC, etal. (2012)Molecular, Physiological, and Motor Performance Defects in DMSXL Mice Carrying 1,000 CTG Repeats from the Human DM1 Locus. PLoSGenet8(11):e1003043.doi:10.1371/journal.pgen.1003043	
TREDT960I	Homozygous for the TREDT960I transgene (TRE) and hemizygous for a muscle-specific reverse transactivator (MDAFrtTA); expression of reverse tetracycline transactivator (rtTA) transgene is driven by a cardiomyocyte-specific α myosin heavy chain promoter					Rao AN, Campbell HM, Guan X, Word TA, Wehrens XH, Xia Z, Cooper TA. Reversible cardiac disease features in an inducible CUG repeat RNA-expressing mouse model of myotonic dystrophy. JCI Insight. 2021 Mar 8;6(5):e143465. doi: 10.1172/jci.insight.143465. PMID: 33497365; PMCID: PMC8021116. Ginny R Morriss, Kimal Rajapakshe, Shixia Huang, Cristian Coarfa, Thomas A Cooper, Mechanisms of skeletal muscle wasting in a mouse model for myotonic dystrophy type 1, Human Molecular Genetics, Volume 27, Issue 16, 15 August 2018, Pages 2789–2804, https://doi.org/10.1093/hmg/ddy192	
EpA960	Inducible and heart-specific DM1 mouse model expressing expanded CUG RNA in the context of DMPK 3' UTR	960	Human DMPK 3'UTR	CMV	Indicible (tissue specific or ubiquitous)	Wang, G.-S.; Kearney, D.L.; Biasi, M.; De Taffet, G.; Cooper, T.A. Elevation of RNA-binding protein CUGBP1 is an early event in an inducible heart-specific mouse model of myotonic dystrophy. J. Clin. Invest. 2007, 117, 2802–2811.	
DM5 / DM200	Transgenic mice expressing the DMPK 3′ UTR as part of an inducible RNA transcript encoding green fluorescent protein (GFP)	5/200				Mahadevan MS, Yadava RS, Yu Q, Balijepalli S, Frenzel-McCardell CD, Bourne TD, Phillips LH. Reversible model of RNA toxicity and cardiac conduction defects in myotonic dystrophy. Nat Genet. 2006 Sep;38(9):1066-70. doi: 10.1038/ng1857. Epub 2006 Jul 30. PMID: 16878132; PMCID: PMC2909745.	
MBNL1 KO		na	Constitutive deletion of Mbnl1 exon 3		Ubiquitous	Kanadia RN, Johnstone KA, Mankodi A, Lungu C, Thornton CA, Esson D, Timmers AM, Hauswirth WW, Swanson MS. A muscleblind knockout model for myotonic dystrophy. Science. 2003 Dec 12;302(5652):1978-80. doi: 10.1126/science.1088583. PMID: 14671308.	https://www.jax.org/strain/037428
MBNL2 KO		na	Constitutive deletion of Mbnl2 exon 3		Ubiquitous	Charizanis K, Lee KY, Batra R, Goodwin M, Zhang C, Yuan Y, Shiue L, Cline M, Scotti MM, Xia G, Kumar A, Ashizawa T, Clark HB, Kimura T, Takahashi MP, Fujimura H, Jinnai K, Yoshikawa H, Gomes-Pereira M, Gourdon G, Sakai N, Nishino S, Foster TC, Ares M Jr, Darnell RB, Swanson MS. Muscleblind-like 2-mediated alternative splicing in the developing brain and dysregulation in myotonic dystrophy. Neuron. 2012 Aug 9;75(3):437-50. doi: 10.1016/j.neuron.2012.05.029. PMID: 22884328; PMCID: PMC3418517.	

Transgenic Mouse Model	Description	CTG / Repeat	Flanking Sequence	Promoter	Human Expression	References	Catalog
MBNL3 KO		na	Constitutive deletion of Mbnl3 exon 3		Ubiquitous	Poulos MG, Batra R, Li M, Yuan Y, Zhang C, Darnell RB, Swanson MS. Progressive impairment of muscle regeneration in muscleblind-like 3 isoform knockout mice. Hum Mol Genet. 2013 Sep 1;22(17):3547-58. doi: 10.1093/hmg/ddt209. Epub 2013 May 8. PMID: 23660517; PMCID: PMC3736872.	
miR-133a dKO		na	Double mutation, missing miR-133a-1 and miR-133a-2.			Liu, N.; Bezprozvannaya, S.; Shelton, J.M.; Frisard, M.I.; Hulver, M.W.; McMillan, R.P.; Wu, Y.; Voelker, K.A.; Grange, R.W.; Richardson, J.A.; et al. Mice lacking microRNA 133a develop dynamin 2-dependent centronuclear myopathy. J. Clin. Invest. 2011, 121, 3258–3268.	
MBNL1 / MBNL2 DKO		na	Constitutive deletion of Mbnl1 exon 3; Constitutive or conditional deletion of Mbnl2		Ubiquitous deletion of Mbnl1; Ubiquitous or tissue specific deletion of Mbnl2	Mbnl1; Mbnl2 double knockout (DKO) mice are embryonic lethal; Mbnl1−/−; Mbnl2+/− mice are viable and develop severe muscle wasting and heart conduction defects (Lee et al., 2013) Lee KY, Li M, Manchanda M, Batra R, Charizanis K, Mohan A, Warren SA, Chamberlain CM, Finn D, Hong H, Ashraf H, Kasahara H, Ranum LP, Swanson MS. Compound loss of muscleblind-like function in myotonic dystrophy. EMBO Mol Med. 2013 Dec;5(12):1887-900. doi: 10.1002/emmm.201303275. Epub 2013 Oct 8. PMID: 24293317; PMCID: PMC3914532.	
MBNL1 / MBNL3 DKO		na	Constitutive deletion of Mbnl1 exon 3; Constitutive deletion Mbnl3			Choi J, Personius KE, DiFranco M, Dansithong W, Yu C, Srivastava S, Dixon DM, Bhatt DB, Comai L, Vergara JL, Reddy S. Muscleblind-Like 1 and Muscleblind-Like 3 Depletion Synergistically Enhances Myotonia by Altering Clc-1 RNA Translation. EBioMedicine. 2015 Jul 31;2(9):1034-47. doi: 10.1016/j.ebiom.2015.07.028. PMID: 26501102; PMCID: PMC4588380.	
MBNL1 / MBNL2 / MBNL3 TKO		na	Constitutive deletion of Mbnl1 exon 3; Conditional deletion of Mbnl2 and Mbnl3		Ubiquitous deletion of Mbnl1; Ubiquitous or tissue specific deletion of Mbnl2 and Mbnl3	Thomas JD, Sznajder ŁJ, Bardhi O, Aslam FN, Anastasiadis ZP, Scotti MM, Nishino I, Nakamori M, Wang ET, Swanson MS. Disrupted prenatal RNA processing and myogenesis in congenital myotonic dystrophy. Genes Dev. 2017 Jun 1;31(11):1122-1133. doi: 10.1101/gad.300590.117. Epub 2017 Jul 11. PMID: 28698297; PMCID: PMC5538435.	
TRECUGBP1		na	Human CELF1 sequence downstream of Tet-inducible CMV promoter		Inducible (ubiquitous or tisse specific)	Koshelev M, Sarma S, Price RE, Wehrens XH, Cooper TA. Heart-specific overexpression of CUGBP1 reproduces functional and molecular abnormalities of myotonic dystrophy type 1. Hum Mol Genet. 2010 Mar 15;19(6):1066-75. doi: 10.1093/hmg/ddp570. Epub 2010 Jan 5. PMID: 20051426; PMCID: PMC2830830.	
TRECUGBP2		na	Human CELF2 sequence downstream of Tet-inducible CMV promoter		Inducible (ubiquitous or tisse specific)	Wang ET, Ward AJ, Cherone JM, Giudice J, Wang TT, Treacy DJ, Lambert NJ, Freese P, Saxena T, Cooper TA, Burge CB. Antagonistic regulation of mRNA expression and splicing by CELF and MBNL proteins. Genome Res. 2015 Jun;25(6):858-71. doi: 10.1101/gr.184390.114. Epub 2015 Apr 16. PMID: 25883322; PMCID: PMC4448682.	
GFP-DMPK-(CTG)X	Overexpression of the DMPK 3′-UTR including either wild-type (11) or expanded (91) CTG repeats		DMPK 3' UTR as part of an inducible RNA transcript encoding green fluorescent protein (GFP)			Mahadevan MS, Yadava RS, Yu Q, Balijepalli S, Frenzel-McCardell CD, Bourne TD, Phillips LH. Reversible model of RNA toxicity and cardiac conduction defects in myotonic dystrophy. Nat Genet. 2006 Sep;38(9):1066-70. doi: 10.1038/ng1857. Epub 2006 Jul 30. PMID: 16878132; PMCID: PMC2909745. Christopher J. Storbeck, Suzana Drmanic, Kate Daniel, James D. Waring, Frank R. Jirik, David J. Parry, Nazim Ahmed, Luc A. Sabourin, Joh-E Ikeda, Robert G. Korneluk, Inhibition of myogenesis in transgenic mice expressing the human DMPK 3′-UTR, Human Molecular Genetics, Volume 13, Issue 6, 15 March 2004, Pages 589–600, https://doi.org/10.1093/hmg/ddh064	
Tg26-hDMPK						D. Fearghas O'Cochlain, Carmen Perez-Terzic, Santiago Reyes, Garvan C. Kane, Atta Behfar, Denice M. Hodgson, Jeffrey A. Strommen, Xiao-Ke Liu, Walther van den Broek, Derick G. Wansink, Bé Wieringa, Andre Terzic, Transgenic overexpression of human DMPK accumulates into hypertrophic cardiomyopathy, myotonic myopathy and hypotension traits of myotonic dystrophy, Human Molecular Genetics, Volume 13, Issue 20, 15 October 2004, Pages 2505–2518, https://doi.org/10.1093/hmg/ddh266	
3 tetracycline-inducible transgenic mouse lines for skeletal muscle-specific expression of human CELF1.	Line1 expresses an unmodified version of CELF1 to serve as a control. 2 Lines with active CELF1 mutants to drive CELF1 expression to be predominantly nuclear (nuclear line, hCELF1nuc) or cytoplasmic (cytoplasmic line, hCELF1cyt)					Cox DC, Guan X, Xia Z, Cooper TA. Increased nuclear but not cytoplasmic activities of CELF1 protein leads to muscle wasting. Hum Mol Genet. 2020 Jun 27;29(10):1729-1744. doi: 10.1093/hmg/ddaa095. PMID: 32412585; PMCID: PMC7322576.	
Myh6-Cre double KO (DKO) (Mbnl1-/-; Mbnl2cond / cond; Myh6-Cre+/-) mice	Elimination of Mbnl1/2 in cardiomyocytes					Lee KY, Seah C, Li C, Chen YF, Chen CY, Wu CI, Liao PC, Shyu YC, Olafson HR, McKee KK, Wang ET, Yeh CH, Wang CH. Mice lacking MBNL1 and MBNL2 exhibit sudden cardiac death and molecular signatures recapitulating myotonic dystrophy. Hum Mol Genet. 2022 Sep 10;31(18):3144-3160. doi: 10.1093/hmg/ddac108. PMID: 35567413; PMCID: PMC9476621.	