

Additional file 1: Sequence and protein translation of feline *CMAH*

The composite feline sequence of *CMAH* is presented with its protein translation listed above the cDNA sequence.

Identified DNA variants are presented in bold and underlined. Mutations that cause an amino acid change are presented with an underlined codon, the mutation and protein code in bold. The cDNA sequence of the dog [Ensembl:

ENSCAFT00000016708], human [GenBank: AF074480] and mouse [GenBank: D21826] are presented below the cat.

Missing sequences are presented as dashes. The 2 codons of exon 1 have not yet been identified in the dog, 2 additional codons are absent downstream. Approximately 31 amino acids are deleted in humans, causing inactivation of the enzyme.

(Please see the next page).

	1.....10.....20.....30.....40.....50.....60.....70.....
Protein	M G S I E Q T T E V L L C L S P G E A A D L K E G
Cat	ATGGGCAGCATTGAACAGACGACGGAGGTCTTGTGTGT <u>Y</u> TGTCACCTGGAGAAGCTGCTGACCTGAAGGAAGGA
Dog	-----.....A..A..A..A..C..C..CA.....CATT....T...CA.T.....
Human	C.....A..A..T..A..C.....C..A.....TT....T...CAGT..T.....
Mouse	...ATGGA..GGA.....AG.T..A..C..C..ACC.....T....CT....T...CA....C.....G
	...80.....90.....100.....110.....120.....130.....140.....150
Protein	I N F L R N K K T G K D F I L Y K S K N R V R A C
Cat	ATCAATTTCTTGAGAAACAAGAAG <u>R</u> CCGGCAAAGATTTTCATTCTGTACAAGAGCAAGAATCGC RT GAGGGCGTGC
Dog	TC....T....C..T.....A...C..C.....AT.....A.C..C...A...
Human	TC.C..T....GC..T.....C.A.G.CT.....AT....GC..AC.....A...
Mouse	T..TC....T....CT..T..G....G.A....T.A.....GAG...G.C.ATC.A.A...A...
	160.....170.....180.....190.....200.....210.....220.....
Protein	K N V C K H Q G G L F I K D I E D L D G R S V R C
Cat	AAGAACGTGTGCAAGCATCAAGGAGGCCTGTTCATAAAAGACATCGAAGATTTAGACGGAAGGTCTGTCAAGATGC
Dog	TA.....G.....T.....T.....
Human	TA.....C.....T.....G.....C.....-----
Mouse	C.C.....C..G.....G.....G.....T.....C..T.A....
	..230.....240.....250.....260.....270.....280.....290.....300
Protein	T K H N W R L D V S T M K <u>Y</u> V N P P G S F C Q D E
Cat	ACAAAGCACAACTGGAGGTTGGATGTGAGCACCATGAAAWACGTCAATCCCCCAGGCAGCTTCTGTCAAGACGAA
Dog	A.....A..A.....G..TA....C.....A.....T...
Human	-----
Mouse	A..A..C.....TA....C..T....G.....G
	310.....320.....330.....340.....350.....360.....370.....
Protein	L V V E M D E E N G L L L L E L N P P N P W D S E
Cat	CTAGTTGTTGAAATGGATGAAGAMAATGGACTTTTACTTCTAGAACTGAATCCTCCCAATCCCTGGGATTCAAGAA
Dog	T..C.....
Human	----.....A.C..C.....G..T.....T..C..T....C.T.C.G
Mouse	..C...A.....A.C....G....CC..GG.....C....T..C.....C..T..T

	..380.....390.....400.....410.....420.....430.....440.....450
Protein	P R S P E H L A F G E V Q I T Y L T H A C M D L K
Cat	CCCAGATCTCCTGAACATTTGGCTTTTGGAGAAGTGCAGATCACGTACCTCACCCACGCCTGCATGGACCTCAAG
Dog	G.....G.....A.A-----G.T.....T.....
Human	G.G.....A.....A.A.T.....T.T.....
Mouse	G.....G.A.A.....G.....A.....A.A.T.....T.T.....
	460.....470.....480.....490.....500.....510.....520.....
Protein	L G D K R M V F D P W L T G P A F A R G W W L L H
Cat	CTGGGAGACAAGAGGATGGTGTGTTGACCCCTGGTTAACGGGTCTGCGTTGCGCCGAGGCTGGTGGCTGCTGCAC
Dog	C.....TA.....C.T.....G.A.....
Human	T.A.....A.....T.....TC.....T.T.....T.A.....T.....C..T
Mouse	T.....C.A.....A.....T.....TT..C.....T.T.....A.....T.....A..T
	..530.....540.....550.....560.....570.....580.....590.....600
Protein	E P P S D W L E R L C Q A D L I Y I S H M H S D H
Cat	GAGCCTCCGTCTGATTGGCTGGAGAGGCTGTGCCAGGCAGACCTGATTTACATCAGTCACATGCACTCAGACCAC
Dog	C.....A.....A.....C.....T.....G.....T
Human	A.....C.....C.....TC.....
Mouse	A.....C..T.....A.A.....C.....T.....C.....
	610.....620.....630.....640.....650.....660.....670.....
Protein	L S Y P T L K E L A G R R P D I P I Y V G N T E R
Cat	CTGAGTTACCCACACTGAAGGAGCTGGCTGGGAGAAGACCGGATATTCCCATTTATGTTGGAACACGGAAAGA
Dog	..C..C.....G.....A..T..A.....A.....
Human	AA..T.....A.....A.....G
Mouse	C.....T..C.....C.....TT.CCA....C....A..C.....CG....A.....G
	..680.....690.....700.....710.....720.....730.....740.....750
Protein	P V F W N L N Q S G V Q L T N I N I V P F G I W Q
Cat	CCTGTATTTTGAATCTGAATCAGAGCGGTGTCCAGTTGACCAATATCAATATAGTGCCATTCGGAATATGGCAG
Dog	T.....G.....T.....
Human	T.....G.C.....T.....
Mouse	G.....C..G.....T..C...GG...A..T..C.....CG.G..T.....T.....A

Protein	760.....770.....780.....790.....800.....810.....820.....
Cat	Q V D K N L R F M I L M D G V H P E M D T C I I V
Dog	CAGGTAGACAAAAATCTTCGATTCATGATCTTGATGGATGGCGTTTCATCCTGAGATGGACACTTGCATTATTGTG
Human	G.....C..T.....
Mouse	G...G..G.....C.....A.....C...
Protein	..830.....840.....850.....860.....870.....880.....890.....900
Cat	E Y K G H K I L N T V D C T R P N G G R L P E K V
Dog	GAGTATAAAGGTCATAAGATACTTAATACAGTGGACTGCACCAGACCCAATGGGGGAAGGTTGCCTGAGAAGGTT
Human	C.....A.....C...T..A.....C.....AT.....
Mouse	C.....A.....C..C.....C.T.....A...
Protein	910.....920.....930.....940.....950.....960.....970.....
Cat	A L M M S D F A G G A S G F P M T F S G G K F T E
Dog	GCTCTAATGATGAGTGATTTTGCTGGAGGAGCATCAGGCTTTCCAATGACTTTTCAGTGGTGGAATTTACCGAG
Human	T...
Mouse	G...T...
Protein	980.....990.....1000.....1010.....1020.....1030.....1040.....1050
Cat	E W K A Q F I K A E R K K L L N Y K A R L V K D L
Dog	GAATGGAAAGCCCA ^R TTTCATTAAAGCAGAGAGGAAGAAGCTCTTGAAGTACAAGGCCCGGCTGGTGAAGGACCTA
Human	G.G.....GA...A.....A.....
Mouse	G.....G..T..A..A.GA....TC...T....A..T.A.....G
Protein	1060.....1070.....1080.....1090.....1100.....1110.....1120.....
Cat	Q P R I Y C P F A G Y F V E S H P S D K Y I K E T
Dog	CAACCCCGAATTTATTGCCCTTTGCTGGGTATTTTGTGGAATCTCACCCATCAGACAAGTATATTAAGGAAACA
Human	T.....C.....T.....C..T.....
Mouse	..G.....C..C..T..G.....C.....G.....T.....C.....

	.1130.....1140.....1150.....1160.....1170.....1180.....1190.....1200
Protein	N I K N D P N E L N N L I K K N S D V V T W T P R
Cat	AACATCAAAAATGACCCAAATGAACTCAATAATCTTATCAAGAAAACTCTGATGTGGTAACGTGGACCCACGG
Dog	G..T.....A...A.....A
Human	C.....C.....C.....A...A.....T..A
Mouse	C.....C.G....C.....G.....C....G..A.....A
	1210.....1220.....1230.....1240.....1250.....1260.....1270.....
Protein	P G A T L D L S R M L K D P T D S K G I I E P P E
Cat	CCTGGAGCCACTCTTGATCTGAGTCGGATGCTAAAGGACCCGACAGACAGCAAGGGCATCATAGARCCCTCCAGAG
Dog	A.....A..T.....G.....A.T
Human	..G.....C.....G.AA.A.....G.....T.GA.....G.....
Mouse	C..TGTC..C..C..TG.CA.....G.....A.....TG.G..G.....
	.1280.....1290.....1300.....1310.....1320.....1330.....1340.....1350
Protein	G T K I Y K D S W D F E P Y L N I L N A A V G D E
Cat	GGGACCAAGATCTACAAGGATTCTGGGACTTTGAACCCTATTTGAACATCTTGAATGCTGCTGTAGGAGATGAG
Dog	A..A..T.....G...A.....AG.....A...A.....A
Human	A..A..T.....T.....T.....GAA.....C.....A
Mouse	A.....T.....GC..G..CC..G.G.....T.....CA.....A
	1360.....1370.....1380.....1390.....1400.....1410.....1420.....
Protein	I F L H S S W I K E Y F T W A G F K D Y N L V V R
Cat	ATATTTCTTCACTCATCCTGGATAAAAGAATACTTCACYTGGGCKGGATTTAAGGATTACAACCTGGTGGTCAGG
Dog	T.....T.....A.....T.....
Human	T.....T.....T.....A.....T.....
Mouse	..C..CTG...T.....T.....G.....G.....T.....A.....
	.1430.....1440.....1450.....1460.....1470.....1480.....1490.....1500
Protein	M I E T D E D F S P F P G G Y D Y L V D F L D L S
Cat	ATGATTGAAACAGATGAGGACTTCAGCCCTTTTCCYGGAGGATATGACTATTTGGTTGACTTTCTAGACTTATCC
Dog	A.....T.....T.....T.....
Human	G.....AT.....T.....T.....
Mouse	A..T.....G..C.....C....G.....T.....

	1510.....1520.....1530.....1540.....1550.....1560.....1570.....
Protein	F P K E R P S R E H P Y E E I R S R V D V I R H V
Cat	TTTCCAAAAGAGAGACCAAGCCGGGAACACCCGTATGAGGAAATTCGGAGCCGGGTTGACGTCATCAGACACGTG
Dog	A.....G..T.....T.....T.T...
Human	..C.....A.....CAA..A.....T..C.....C.AT.....G..T.....
Mouse	G.....A.....C.....G..T..T.....A.....C.AT.....G..T.....GT.....
	.1580.....1590.....1600.....1610.....1620.....1630.....1640.....1650
Protein	V K N G L L W D D L Y I G F Q T R L Q R S P D I Y
Cat	GTAAAGAACGGTCTTCTCTGGGAC <u>RACT</u> TGTATATAGGATTCCAAACCCGGCTGCAACGGAGTCCTGACATATAC
Dog	..G..A..T.....A.....T.....G...GA.....
Human	..G.....T.....A.....T..G.....A.....C..G...GA.....
Mouse	..G.....C..G..G.....T..TC.....T.....G.....AT...TG...GAC.....T.....
	1660.....1670.....1680.....1690.....1700.....1710.....1720.....
Protein	H H L F W N H F Q I K L P L T P P N W R S F L M H
Cat	CATCACCTGTTTTGGAACCATTTTCAAATAAAACTCCCTCTCACGCCACCCAACCTGGAGGTCCTTCCTGATGCAC
Dog	T.....A.T.....T.....
Human	T.....C.....A.....A...A.....A.....TG.
Mouse	T.....T.....G.....A..A.....A..G.....A.....
	..380.....390.....400.....410.....420.....430.....440.....450
Protein	C G *
Cat	TGTGGGTAG
Dog	
Human	A.C...AATGGGCCTGCGATTTTGCAATTCTCTACAGAAAGAA
Mouse	AT...