

Additional file 3 for: Molecular evolutionary and structural analysis of human *UCHL1* gene demonstrates the relevant role of intragenic epistasis in Parkinson's disease and other neurological disorders

Muhammad Saqib Nawaz¹, Razia Asghar¹, Nashaiman Pervaiz¹, Shahid Ali¹, Irfan Hussain¹, Peiqi Xing², Yiming Bao^{2*} & Amir Ali Abbasi^{1*}

¹National Center for Bioinformatics, Program of Comparative and Evolutionary Genomics, Faculty of Biological Sciences, Quaid-i-Azam University, Islamabad 45320, Pakistan

²National Genomics Data Center; BIG Data Center & CAS Key Laboratory of Genome Sciences and Information, Beijing Institute of Genomics, Chinese Academy of Sciences, Beijing, 100101, China

*Corresponding authors

Y.B*:E-mail: baoym@big.ac.cn

A.A.A*:E-mail: abbasiam@qau.edu.pk

Additional file 3: Complete list of protein sequences used in this study.

UCHL1

>Homo sapiens Uchl1

MQLKPMEINPEMLNKVLSRLGVAGQWRFVDVLGLEEESLGSVPAPACALLLFLPLTAQHENFRKKQIEELKGQEVSPKV
YFMKQTIGNSCGTIGLIHAVANNQDKLGFEDGSVLKQFLSETEKMSPEDRAKCFEKNEAIQAAHDAVAQEGQCRVDDK
VNFHFILFNNVDGHLYELDGRMPFPVNHGASSEDLLKDAAKVCREFTEREQGEVRFSAVALCKAA

>Pan troglodytes Uchl1

MQLKPMEINPEMLNKVLSRLGVAGQWRFVDVLGLEEESLGSVPAPACALLLFLPLTAQHENFRKKQIEELKGQEVSPKV
YFMKQTIGNSCGTIGLIHAVANNQDKLGFEDGSVLKQFLSETEKMSPEDRAKCFEKNEAIQAAHDAVAQEGQCRVDDK
VNFHFILFNNVDGHLYELDGRMPFPVNHGASSEDLLKDAAKVCREFTEREQGEVRFSAVALCKAA

>Gorilla gorilla Uchl1

MQLKPMEINPEMLNKVLSRLGVAGQWRFVDVLGLEEESLGSVPAPACALLLFLPLTAQHENFRKKQIEELKGQEVSPKV
YFMKQTIGNSCGTIGLIHAVANNQDKLGFEDGSVLKQFLSETEKMSPEDRAKCFEKNEAIQAAHDAVAQEGQCRVDDK
VNFHFILFNNVDGHLYELDGRMPFPVNHGASSEDLLKDAAKVCREFTEREQGEVRFSAVALCKAA

>Macaca mulatta Uchl1

MQLKPMEINPEMLNKVLSRLGVAGQWRFVDVLGLEEESLGSVPAPACALLLFLPLTAQHENFRKKQIEELKGQEVSPKV
YFMKQTIGNSCGTIGLIHAVANNQDKLGFEDGSVLKQFLSETEKMSPEDRAKCFEKNEAIQAAHDAVAQEGQCRVDDK
VNFHFILFNNVDGHLYELDGRMPFPVNHGASSEGTLQDAAKVCREFTEREQGEVRFSAVALCKAA

>Cebus capucinus Uchl1

MQLKPMEINPEMLNKVLSRLGVAGQWRFVDVLGLEEESLGSVPAPACALLLFLPLTAQHENFRKKQIEELKGQEVSPKV
YFMKQTIGNSCGTIGLIHAVANNQDKLGFEDGSVLKQFLSETEKMSPEDRAKCFEKNEAIQAAHDAVAQEGQCRVDDK
VNFHFILFNNVDGHLYELDGRMPFPVNHGTSSEDTLLQDAAKVCREFTEREQGEVRFSAVALCKAA

>Otolemur garnettii Uchl1

MQLKPMEINPEMLNKVLARLGVAGQWRFADVLGLEEESLGSVPAPACALLLFLPLTAQHENFRKKQIEELKGQEVSPV
YFMKQTIGNSCGTIGLIHAVANNRDKLEFEDGSVLKQFLSETEKMSPEDRAKCFEKNEAIQAAHDAVAQEGQCRVDDK
VNFHFILFNNVDGHLYELDGRMPFPVNHGASSEDCLLQDAAKVCREFTEREQGEVRFSAVALCKAA

>Mus musculus Uchl1

MQLKPMEINPEMLNKVLAKLGVAGQWRFADVLGLEEETLGSVPSPACALLLFLPLTAQHENFRKKQIEELKGQEVSPKV
YFMKQTIGNSCGTIGLIHAVANNQDKLEFEDGSVLKQFLSETEKLSPEDRAKCFEKNEAIQAAHDSVAQEGQCRVDDKV
NFHFILFNNVDGHLYELDGRMPFPVNHGASSEDSLLQDAAKVCREFTEREQGEVRFSAVALCKAA

>Rattus norvegicus Uchl1

MQLKPMEINPEMLNKVLAKLGVAGQWRFADVLGLEEETLGSVPSPACALLLFLPLTAQHENFRKKQIEELKGQEVSPKV
YFMKQTIGNSCGTIGLIHAVANNQDKLEFEDGSVLKQFLSETEKLSPEDRAKCFEKNEAIQAAHDSVAQEGQCRVDDKV
NFHFILFNNVDGHLYELDGRMPFPVNHGASSEDSLLQDAAKVCREFTEREQGEVRFSAVALCKAA

>Equus caballus Uchl1

MQLKPMEINPEMLNKVLARLGVAGQWRFVDVLGLEEETLGSVPAPACALLLFLPLTAQHENFRKKQIEELKGQEVSPK
VYFMKQTIGNSCGTIGLIHAVANNQDKLEFEDGSVLKQFLSETEKLSPEDRAKCFEKNEAIQAAHDAVAQEGQCRVDDK
VNFHFILFNNVDGHLYELDGRMPFPVNHGASSEDLLLQDAAKVCREFTEREQGEVRFSAVALCKAA

>Tursiops truncatus Uchl1

MQLKPMEINPEMLNKVLARLGVAGQWRFEDVLGLEEESLGSVPAPACALLLFLPLTAQHENFRKKQIEELKGQEVSPKV
YFMKQTIGNSCGTIGLIHAVANNQDKLEFEDGSVLKQFLSETEKLSPEDRAKCFEKNEAIQAAHDAVAQEGQCRVDDKV
NFHFILFNNVDGHLYELDGRMPFPVNHGASSEGSLLQDAAKVCREFTEREQGEVRFSAVALCKAA

>Bos taurus Uchl1

MLQKPMEINPEMLNKVLRTRGVAGQWRFEDVLGLEEESLGSVPAPACALLLFLPLTAQHENFRKKQIEELKGQEVSPKV
YFMKQTIGNSCGTIGLIHAVANNQDKLEFEDGSVLKQFLSETEKLSPEDRAKCFEKNEAIQAAHDAVAQEGQCRVDDKV
NHFHILFNNVDGHLIELDGRMPFPVNHGTSSSEDSLLQDAAKVCREFTEREQGEVRFSAVALCKAA

>Felis catus Uchl1

MLQKPMEINPEMLNKVLSRLGVAGQWRFADVLGLEEEALGSVPAPACALLLFLPLTAQHENFRKKQIEELKGQEVSPK
VYFMKQTIGNSCGTIGLIHAVANNQDKLEFEDGSVLKQFLSETEKLSPEDRAKCFEKNEAIQAAHDAVAQEGQCRVDDK
VNFHILFNNVDGHLIELDGRMPFPVNHGTSSSEDSLLQDAAKVCREFTEREQGEVRFSAVALCKAA

>Canis lupus familiaris Uchl1

MLQKPMEINPEMLNKQVLRARLVAGQWRFADVLGLEDEALGSVPAPACALLLFLPLTAQHENFRKKQIEELKGQEVSP
KVYFMKQTIGNSCGTIGLIHAVANNQDKLEFEDGSVLKQFLSETEKLSPEDRAKCFEKNEAIQAAHDAVAQEGQCRVDD
KVNHFHILFNNVDGHLIELDGRMPFPVNHGTSSSEDSLLQDAAKVCREFTEREQGEVRFSAVALCKAA

>Pteropus vampyrus Uchl1

MLQKPMEINPEMLNKVLRARLVAGQWRFVDVLGLEDEALSSVPAPACALLLFLPLTAQHENFRKKQIEELKGQEVSPK
VYFMKQTIGNSCGTIGLIHAVANNQDKLEFDDGSVLRQFLSETEKLSPEDRAKCFEKNEAIQAAHDAVAQEGQCRVDD
KVNHFHILFNNVDGHLIELDGRMPFPVNHGSSSEDSLLQDAAKVCREFTEREQGEVRFSAVALCKAA

>Myotis lucifugus Uchl1

MLQKPMEINPEMLNKVLRARLVAGQWRFVDVLGLEEDALSSVPAPVACALLLFLPLTAQHENFRKKQIEELKGQEVSPK
VYFMKQTIGNSCGTIGLIHAVANNQDKLEFEDGSVLKQFLSETEKLSPEDRAKCFEKNEAIQTAHDAVAQEGQCRVDDK
VNFHILFNNVDGHLIELDGRMPFPVNHGTAEDSLLQDAAKVCREFTEREQGEVRFSAVALCKAT

>Erinaceus uropaeus Uchl1

MLQKPMEINPEMLNKXXXXXXGQWRFVDVLGLEDESLSVPAPACALLLFLPLTAQHENFRKKQIEELKGQEVSPK
VYFMKQTIGNSCGTIGLIHAVANNQDKLEFEDGSVLKQFLSETEKLSPEDRAKCFEKNEAIQAAHDAVAQEGQCRVDDK
VNFHILFNNVDGHLIELDGRMPFPVNHGSSSEDSLMQDAAKVCREFTEREQGEVRFSAVALCKAA

>Echinops telfairi Uchl1

MLQKPMEINPEMLNKVSGVSRPPGAPGTPRRRRPPGGAPPCAFPRPPEFGWGLGSVPAPACALLLFLPLTAQHENF
RKKQIEELKGQEVSPKVYFMKQTIGNSCGTIGLIHAVANNQDKLAFENGSVLKQFLSETEKMSPEDRAKCFEKNEAIQAA
HDAVAQEGQCRVDDKVNHFHILFNNVEGHLYELDGRMPFPVNHGSSSEDSLLQDAAKVCREFTEREQGEVRFSAVAL
CKAA

>Monodelphis domestica Uchl1

MLQKPMEINPEMLNKVLRTRGVGGDWKFVDVLGLEEDVLGTVPAPACALLLFLPLTAQHENFRKKQIEELKGQEVSPK
VYFMKQTVGNSCGTIGLIHAVANNQDKLNFDDGSVLKQFISETAKLSPEDRAKCFEKNEAIQAAHDAVAQEGQCRVDD
EVNFHILFNNVDGHLIELDGRMPFPINHGNSDESVLKGAEEICRQFTEREQGEVRFSAVALCKCA

>Gallus gallus Uchl1

MAWQPMEINPEMLNKVLSRLGVSPGWRFVDVLGFEEALGAVPSPACALLLFLPLTEQHENFRKKQTEKIKDQEISSK
VYFLKQTVSNSCGTIGLIHAVANNKDKVKLDEGSALKKFLDETADLSPEERAKRFANNKAIQEVHNSVAQEGQCRVEDN
SVNFHILFANVDGHLIELDGRLPFPVNHGTSSDDLKDSAKICRQFTEREKGEVRFSAVAFCKSA

>Anolis carolinensis Uchl1

MAWQPMEINPEMLNKVLSRLGIAPGWRFVDVLGFEEESLNAVNPACALLLFLPLTAQHENFRKKQVEELKGQEVSS
KVYFLKQTASNCGTIGLIHAIANNQDKILFDEGSALKEFLNATADLSPDERAKRLENNKAIQDAHNAVAEEGQCRAEDD
KVNHFHILFASVDGQLYELDGRMPFPINHGASSDDTLKASAKVCRQFTEREQGEVRFSAVALSKSA

>Latimeria chalumnae Uchl1

MWQPMEINPEMLNKVLRARLVGSGSWHLVDVLGLEEESLASVPTPVCALMMLLFLPLTAQHESFRKKQMEEVAEKQVN
PKVYFMKQTVNNSCGTVGLVHAVANNQDKLKFEDDSALKQFLTETADMSAGDRAKCLEKNKIIQEAHDAIAKEGLCRV
EEGSVNFHIFITANIDGNLYELDGRMSFPVNHGSTTKDILLQDAAKICRQFTEREQGEVRFSAVALCKVK

>Oryzias latipes Uchl1

MEWTPMEINPEMLNKIMSKLGVGDSWRFVDVLGLEGEQLSAVPKPCALMMLLFLPLTQQHESFRAQQADKVDDGSEV
YFLKQKAGNSCGTIALHAVANNKDKMAFDAGSALKKFLFLEETANMSPDDRAKHLEQNKAIYDAHNEVAMQGCRCRPE
ADKINFHFIANAKGNLYECDGKMDGPNHGETTEESFLADAACKVCRGFTEREKDEVRFSAVALCRS

>Gasterosteus aculeatus Uchl1

MEWTPMEINPEMLNKMMLNLGVGESWRFSDVLGFEDQLSAVPKPCCALMLLPLTQQHESFRQQQADSVDGSG
VYFLKQTASNSCGTIAMHLHAVANNKSKMSFEGGSALKKFLDETANMSADDRAKHLEKNKAIWEAHNEVAAQQGQCRP
EADKVNHFHIAFVNVTGQLYEFDGRMNGPVKHGATKDDSFVMDAAKVCRGFIEREQGEQPLYLCMWSLSDSFIL

>Tetraodon nigroviridis Uchl1

MEWTPMELNPEMLNMLMTSLGVNESWRFVDVVGLESEQLSAVPKPCCALMLLPLTQQHESFRKQQADKIVEETGV
YFLKQMAPNSCGTVALLHAVANNKGKLTFAASDVLQKFLDETADMSSDDRAKHLEKN

>Takifugu rubripes Uchl1

MEWTAMELNPEMLNLLMKSLGVNESWRFVDVVGLESEQLSAVPKPCCSLMLLPLTQQHETFRKQQADKIAEDSGV
YFLKQTASNSCGTIALHAVANNKGKFAFASGSVLEKFLNETANMSPEDRAKHLENNKTIFDAHNEVASQQGQCRPAAD
KVNHFHIFVNVNGQLYEFDGRVNGPVKHGSTSDESIFIMDAAKVCHGFMEREQGEVRFSSVALCQS

>Danio rerio Uchl1

MEWKPMELNPEMLNKVLSKLGVGSKWRFVDVLGLEDESLSGVSPCCAMMLLPLTQQHEDFRSKQSVGDCKDVYF
LKQTVVNSCGTVGLVHAVANNQDSIDFDNNSALKKFLSATSGMSPAERAKELEQNKAIQETHDAVADEGQCRPEADK
VNFHFIFVNVNGRLYELDGRIDGPVSHGPTKPDFVMDAARVCREFMEREKGEVRFSAVALCKA

>Lepisosteus oculatus Uchl1

STAMEWKPMELNPEMLNKVLSKLGVDWRFVDVLGFEDPLASVPKPSCAVMLLPLTPQHETFREKQSTELAEEKAK
EIPSVYFIKQTIIVNSCGTVGLLHAVANNKDKLEFKSGSALKSFLDKTASMSAEDRAKELEKSQAIHTAHDEVAEAGQCRV
EEDKVNHFHIFINVDGHLIELDGRMSVPVDHGATKDDSFIMDAKICRQFVEREKGEVRFSAVALCKAA

>Callorhinchus milii Uchl1

MEWKAMEINPEMLNKCMTLRLGVAASWKVFDVLGLETESLSMVSPVCALLLPLSQQHESFRGTQTSSELTGKGIDSK
IYFLRQTISNSCGTVGLVHTIANNQDKFTFVEGSTLKKFLTETADLSAERAKHLEQNKDIHSAHDATAEEGHCRIHEDGT
NHFHIFVDVDGHLIELDGRMPFPIDHGETSKDTLLQDSAKICRQFMERDQEEVRFSTAVALSKA

>Rhincodon typus Uchl1

MEWKPMELNPEMLNKLSRLGVASSWKVFDVLGLENESLSMVSPVCALMLLPLSQQHESYRERQTSSELSGKGIDSKI
YFVKQTISNSCGTXGLINTIANNQDKLDFVEGSVLKKFLNETVDLSAERAKQLEKQEQEICAHDATAEEGECRVHEDGT
NHFHIFVGVDDHLYELDGRMPFPIDHGETSNDQLLQDSAKICRQFMERDQGEVRFSTAVALSKAS