Supplementary Material

Investigating common molecular signatures and network motifs within a group of neurodegenerative diseases

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Table 1: Common genes between NDs

#Disease1	#Disease2	Common genes	Number of common genes
Alzheimer'sDisease	AmyotrophicLateralSclerosis	APP, PSEN1, MAPT, SNCA, CASP3, MT3, CHAT, CDK5, PRNP, NOS1, GDNF, BDNF, NGF, SQSTM1, EIF2AK2, SYP, RTN4, GFAP, TARDBP, CYCS, GRN, MAP2, NGFR, MAOB, NTRK1, CST3, SOD1, NTRK2, SLC18A3, SLC1A2, SLC1A3, GAP43	32
Alzheimer'sDisease	FrontotemporalDementia	RELN, APP, SORL1, PSEN2, PSEN1, APOE, MAPT, SNCA, BCHE, PRNP, ACHE, PIN1, SQSTM1, PCSK1N, TARDBP, GRN, STH, SOD1	18
Alzheimer'sDisease	Huntington'sDisease	BDNF, PRNP, CASP8, GRIN2B, CASP3, SOD1, GAPDH, GRIN2A, GRIN1, CYCS, SQSTM1, CASP2, CHAT, DLG4, ITPR1	15
Alzheimer'sDisease	LewyBodyDisease	APP, PSEN1, APOE, MAPT, SNCA, SNCB, BCHE, CDK5, PRNP, ACHE, TARDBP, GRN, MAOB, SNCG	14
Alzheimer'sDisease	Parkinson'sDisease	MAPT, MT-ND1, SNCA, MAOB, GDNF, SNCB, UCHL1, SNCG, BDNF, CASP3, SOD1, APOE, CDK5, NGF, APP, HMOX1, MAPK8, CHAT, CYCS, ACHE, CAT, SLC6A4, STH, CASP9, NOS1, MAP2, NQO1, BCHE, GRIN2B, SQSTM1, NTRK2, GAPDH, MAPK3	33
Alzheimer'sDisease	PeroxisomeBiogenesisDisorder 1b	CAT	1
Alzheimer'sDisease	PrionDisease	APP, MAPT, ADAM10,IL1B, PRNP, MAP2	6
Alzheimer'sDisease	RefsumDisease	CAT	1
Alzheimer'sDisease	SpinalCordInjury	GDNF, GFAP, BDNF, TNF, CASP3, NGFR, NOS1, GRIN1	8
Alzheimer'sDisease	ToxicEncephalopathy	HMOX1, BACE1, CASP3, BDNF, MAOB, PRNP, APP, NGF, GRIN2B, ACHE, GRIN2A, CYCS, SNCA, SLC1A2, MAPK8, IL1B, GFAP	17
AmyotrophicLateralSclerosis	Friedreich'sataxia	ATXN2, SETX, TFRC	3
AmyotrophicLateralSclerosis	FrontotemporalDementia	SOD1, TARDBP, NEFH, C9orf72, VCP, UBQLN2, SQSTM1, FUS, CHCHD10, HNRNPA1, PFN1, CHMP2B, CCNF, UNC13A, TBK1, TREM2, MAPT, TMEM106B, GRN, SNCA, APP, RPS27A, PSEN1, HNRNPA2B1, TUBA4A, PRNP, INA	27
AmyotrophicLateralSclerosis	Huntington'sDisease	HTT, BDNF, PRNP, TGM2, CASP3, CREBBP, CALB1, SOD1, CYCS, SQSTM1, PPARGC1A, CHAT, CASP1, CNTF	14
AmyotrophicLateralSclerosis	LewyBodyDisease	TARDBP, MAPT, GRN, CDK5, SNCA, APP, RPS27A, MAOB, PSEN1, PRNP, TH	11
AmyotrophicLateralSclerosis	Parkinson'sDisease	SOD1, SQSTM1, ATXN2, CNTF, RNF19A, MAPT, GDNF, CDK5, CHAT, BDNF, SNCA, CASP3, NGF, HTT, PVALB, NOS1, APP, SOD2, CNR1, RPS27A, MAOB, HSPA8, CYCS, NTRK2, TH, CALB1, TGM2, MAP2, TSPO	29
AmyotrophicLateralSclerosis	PrionDisease	MAPT, APP, MAP2, PRNP	4
AmyotrophicLateralSclerosis	SpinalCordInjury	GDNF, BDNF, GFAP, CASP3, NOS1, NGFR	6
AmyotrophicLateralSclerosis	Spinocerebellarataxia	ATXN2	1
AmyotrophicLateralSclerosis	ToxicEncephalopathy	CASP3, TH, BDNF, MAOB, PRNP, APP, NGF, CYCS, SNCA, SLC1A2, GFAP	11
Ataxia-telangiectasia	Friedreich'sataxia	APTX	1
Ataxia-telangiectasia	Huntington'sDisease	TP53	1
Friedreich'sataxia	Huntington'sDisease	ATXN3, ATXN1	2
Friedreich'sataxia	Parkinson'sDisease	ATXN3, ACO1, ATXN2	3
Friedreich'sataxia	RefsumDisease	TTPA	1
Friedreich'sataxia	Spinocerebellarataxia	ATXN3, CACNA1A, ATXN2	3
FrontotemporalDementia	Huntington'sDisease	PRNP, SOD1, SQSTM1	3
FrontotemporalDementia	LewyBodyDisease	PSEN1, MAPT, GRN, TARDBP, SNCA, APOE, APP, RPS27A, ACHE, PRNP, LRRK2, BCHE	12
FrontotemporalDementia	Parkinson'sDisease	MAPT, LRRK2, SNCA, SOD1, APOE, APP, ACHE, STH, BCHE, RPS27A, SQSTM1	11

FrontotemporalDementia	PrionDisease	PRNP, MAPT, APP	3
FrontotemporalDementia	ToxicEncephalopathy	SNCA, APP, ACHE, ACHE, PRNP	4
Huntington'sDisease	LewyBodyDisease		1
Huntington'sDisease	Parkinson'sDisease	HTT, BDNF, GRIN2B, TGM2, CASP3, TBP, CALB1, SOD1, GAPDH, CYCS, AKT1, ATXN3, SQSTM1, CHAT, GRM5, ADORA2A, CNTF	17
Huntington'sDisease	PrionDisease	PRNP	1
Huntington'sDisease	SpinalCordInjury	BDNF,CASP3, GRIN1	3
Huntington'sDisease	Spinocerebellarataxia	ATXN3	1
Huntington'sDisease	ToxicEncephalopathy	BDNF, PRNP, GRIN2B, CASP3, GRIN2A, CYCS, AKT1	7
LewyBodyDisease	Parkinson'sDisease	MAPT, GBA, LRRK2, PRKN, SNCAIP, SNCA, TH, PARK7, SLC6A3, MAOB, SNCB, SLC18A2, SNCG, CYP2D6, APOE, CDK5, APP, ACHE, BCHE, RPS27A	20
LewyBodyDisease	PrionDisease	MAPT, PRNP, APP	3
LewyBodyDisease	ToxicEncephalopathy	SNCA, SLC6A3, SLC18A2, ACHE, MAOB, PRNP, TH, APP	8
Parkinson'sDisease	PeroxisomeBiogenesisDisorder 1b	CAT	1
Parkinson'sDisease	PrionDisease	MAPT, MAP2, APP	3
Parkinson'sDisease	RefsumDisease	CAT	1
Parkinson'sDisease	SpinalCordInjury	GDNF, NOS1, BDNF, CASP3, PDYN	5
Parkinson'sDisease	Spinocerebellarataxia	ATXN2, ATXN3	2
Parkinson'sDisease	ToxicEncephalopathy	HMOX1, TRPV1, CASP3, TH, BDNF, SLC6A3, MAOB, APP, NGF, GRIN2B, ACHE, SLC18A2, CYCS, SNCA, MAPK8, AKT1	16
PeroxisomeBiogenesisDisorder 1b	RefsumDisease	PHYH, PEX7, CAT, PEX5, PEX16, HSD17B4, PEX14, GNPAT	8
PrionDisease	ToxicEncephalopathy	PRNP, IL1B, APP	3
SpinalCordInjury	ToxicEncephalopathy	GFAP, BDNF, CASP3	3

Table 2: Common genes between PPI networks

#Disease1	#Disease2	Common genes	Number of common genes
Alzheimer'sDisease	AmyotrophicLateralSclerosis	APBB1, APP, XIAP, CASP3, CDK5, CDK5R1, NOS1, CYCS, NTRK1, NGF, SNCA, PSEN1, MAPT, TARDBP, SOD1, SQSTM1, RTN4, BDNF, NTRK2, NGFR	20
Alzheimer'sDisease	Friedreich'sataxia	CALM2, NDUFAB1, CACNA1A	3
Alzheimer'sDisease	FrontotemporalDementia	APP, PIN1, SNCA, PSEN2, PSEN1, TARDBP, SOD1, SQSTM1	8
Alzheimer'sDisease	Huntington'sDisease	XIAP, CASP3, GRIN1, GRIN2A, DLG4, GRIN2B, CASP8, CASP2, SOD1, GAPDH, SQSTM1	11
Alzheimer'sDisease	LewyBodyDisease	APP, SNCA, PSEN1	3
Alzheimer'sDisease	Parkinson'sDisease	MT-ND1, NDUFAB1, VPS29, VPS35, VPS26A, APP, CASP3, CDK5, CASP9, NOS1, GRIN2B, MAPK3, CYCS, SNCA, MAPT, SOD1, GAPDH, CAT, SQSTM1, HMOX1, BDNF, NTRK2, SLC6A4	23
Alzheimer'sDisease	PeroxisomeBiogenesisDisorder 1b	CAT	1
Alzheimer'sDisease	RefsumDisease	CAT	1
Alzheimer'sDisease	SpinalCordInjury	CALM2, NOS2, CALM1, XIAP, CASP3, CALM3, NOS1, GRIN1	8
Alzheimer'sDisease	Spinocerebellarataxia	CALM2, CACNA1A	2
Alzheimer'sDisease	ToxicEncephalopathy	APBB1, APP, XIAP, CASP3, GRIN1, GRIN2A, GRIN2B, CYCS, SNCA, BDNF	10
AmyotrophicLateralSclerosis	FrontotemporalDementia	FAU, RPS16, RPS12, RPS24, RPS27A, NPLOC4, UFD1L, VCP, FAF1, UBXN7, RPS10, DERL1, CHMP2B, UBA52, APP, FUS, UBQLN2, TUBA4A, SOD1, SNCA, TARDBP, SQSTM1, PSEN1, PRNP, HNRNPA2B1, HNRNPA1	26

AmyotrophicLateralSclerosis	Huntington'sDisease	CREBBP, CITED2, XIAP, CASP3, SOD1, SQSTM1, HTT	7
AmyotrophicLateralSclerosis	LewyBodyDisease	FAU, RPS16, RPS12, RPS24, RPS27A, RPS10, UBA52, APP, SNCA, PSEN1, TH	11
AmyotrophicLateralSclerosis	Parkinson'sDisease	RPS27A, CASP3, APP, CDK5, NOS1, CALB1, PVALB, HSPA8, SOD2, SOD1, SNCA, SQSTM1, CYCS, MAPT, BDNF, NTRK2, HTT, RNF19A, TH	19
AmyotrophicLateralSclerosis	SpinalCordInjury	XIAP, CASP3, NOS1	3
AmyotrophicLateralSclerosis	ToxicEncephalopathy	XIAP, CASP3, APBB1, APP, SNCA, CYCS, BDNF, TH	8
Ataxia-telangiectasia	Huntington'sDisease	TP53	1
Friedreich'sataxia	Parkinson'sDisease	NDUFAB1	1
Friedreich'sataxia	SpinalCordInjury	CALM2	1
Friedreich'sataxia	Spinocerebellarataxia	CACNA1A, CALM2	2
FrontotemporalDementia	Huntington'sDisease	SQSTM1, SOD1	2
FrontotemporalDementia	LewyBodyDisease	FAU, RPS16, RPS12, RPS24, RPS27A, SNCA, APP, LRRK2, PSEN1, RPS10, UBA52	11
FrontotemporalDementia	Parkinson'sDisease	RPS27A, SNCA, APP, LRRK2, SQSTM1, SOD1	6
FrontotemporalDementia	ToxicEncephalopathy	SNCA, APP	2
Huntington'sDisease	Parkinson'sDisease	TBP, GRIN2B, AKT1, SOD1, GAPDH, HTT, SQSTM1, CASP3	8
Huntington'sDisease	SpinalCordInjury	GRIN1, XIAP, CASP3	3
Huntington'sDisease	Spinocerebellarataxia	TAF10	1
Huntington'sDisease	ToxicEncephalopathy	GRIN2B, AKT1, GRIN2A, GRIN1, XIAP, CASP3	6
LewyBodyDisease	Parkinson'sDisease	SLC6A3, SNCA, APP, TH, LRRK2, SNCAIP, PARK2, RPS27A	8
LewyBodyDisease	ToxicEncephalopathy	SLC6A3, SNCA, APP, TH	4
Parkinson'sDisease	PeroxisomeBiogenesisDisorder 1b	CAT	1
Parkinson'sDisease	RefsumDisease	CAT	1
Parkinson'sDisease	SpinalCordInjury	CASP3, NOS1	2
Parkinson'sDisease	ToxicEncephalopathy	SNCA, CYCS, AKT1, CASP3, GRIN2B, SLC6A3, TH, APP, BDNF, NTF3	10
PeroxisomeBiogenesisDisorder 1b	RefsumDisease	PEX5, PEX14, ACAA1, PEX7, PEX19, HSD17B4, CAT	7
SpinalCordInjury	Spinocerebellarataxia	CALM2	1
SpinalCordInjury	ToxicEncephalopathy	XIAP, CASP3, GRIN1	3

Table 3: Common pathways between PPI networks

PAIR OF DISEASES	NUMBER OF COMMON PATHWAYS	KEGG PATHWAY NAME
AD,ALS	3	Alzheimer's disease
		Apoptosis
		Amyotrophic lateral sclerosis (ALS)
AD, FRIEDREICH ATAXIA	3	Alzheimer's disease
		Dopaminergic synapse
		Calcium signaling pathway
AD, FD	2	Alzheimer's disease
		Amyotrophic lateral sclerosis (ALS)
AD, HD	4	Alzheimer's disease

		Amyotrophic lateral sclerosis (ALS)
		Apoptosis
		Long-term potentiation
AD, LBD	3	Alzheimer's disease
		Dopaminergic synapse
		Amphetamine addiction
AD, PD	3	Alzheimer's disease
		Amyotrophic lateral sclerosis (ALS)
		Neurotrophin signaling pathway
AD, SPINAL CORD INJURY	6	Alzheimer's disease-Homo sapiens
		Amyotrophic lateral sclerosis (ALS)
		Long-term potentiation-Homo sapiens
		Amphetamine addiction
		Circadian entrainment
		Calciumsignalingpathway
AD, SPINOCEREBELLAR	4	Long-term potentiation
		Dopaminergic synapse
		Amphetamine addiction
		Calcium signaling pathway
AD, TOXIC ENCEPHALOPATHY	4	Alzheimer's disease
		Dopaminergic synapse
		Amphetamine addiction
		Amyotrophic lateral sclerosis (ALS)
ALS, FRIEDREICH ATAXIA	1	Alzheimer's disease-Homo sapiens
ALS, FD	3	Amyotrophic lateral sclerosis (ALS)
		Alzheimer's disease
		Ribosome
ALS, HD	6	Amyotrophic lateral sclerosis (ALS)
		Alzheimer's disease
		Huntington's disease
		Apoptosis
		Mitophagy

		Cocaine addiction-Homo sapiens
ALS, LBD	3	Alzheimer's disease
		Ribosome
		Cocaine addiction
ALS, PD	4	Amyotrophic lateral sclerosis (ALS)
		Alzheimer's disease
		Huntington's disease
		Cocaine addiction
ALS, PRION	1	Ribosome
ALS, SPINAL CORD INJURY	2	Alzheimer'sdisease
		Amyotrophic lateral sclerosis (ALS)
ALS, TOXIC ENCEPHALOPATHY	4	Amyotrophic lateral sclerosis (ALS)
		Alzheimer's disease
		Huntington's disease
		Cocaine addiction
FRIEDREICH, FD	1	Alzheimer's disease
FRIEDREICH, HD	2	Alzheimer's disease-Homo sapiens
		Nicotine addiction
FRIEDREICH, LBD	2	Dopaminergic synapse
		Alzheimer's disease
FRIEDREICH, PD	1	Alzheimer's disease
FRIEDREICH, SPINAL CORD INJURY	3	Calcium signaling pathway
		Phototransduction
		Alzheimer's disease-Homo sapiens
FRIEDREICH, SPINOCEREBELLAR	5	Dopaminergic synapse
		Calcium signaling pathway
		Nicotine addiction
		Phototransduction
		Type II diabetes mellitus
FRIEDREICH, TOXIC ENCEPHALOPATHY	3	Dopaminergic synapse
		Alzheimer's disease
		Nicotine addiction
FD, HD	2	Alzheimer's disease
		Amyotrophic lateral sclerosis (ALS)
FD, LBD	3	Ribosome

		Alzheimer's disease
		Notch signaling pathway
FD, PD	2	Amyotrophic lateral sclerosis (ALS)
		Alzheimer's disease
FD, PRION	1	Ribosome
FD, SPINAL CORD INJURY	2	Alzheimer's disease
		Amyotrophic lateral sclerosis (ALS)
FD, TOXIC ENCEPHALOPATHY	2	Alzheimer's disease
		Amyotrophic lateral sclerosis (ALS)
HD, LBD	2	Alzheimer's disease
		Cocaine addiction
HD, PD	4	Huntington's disease
		Amyotrophic lateral sclerosis (ALS)
		Alzheimer's disease
		Cocaine addiction
HD, SPINAL CORD INJURY	3	Alzheimer's disease
		Long-term potentiation
		Amyotrophic lateral sclerosis (ALS)
HD, SPINOCEREBELLAR	3	Basal transcription factors-Homo sapiens
		Nicotine addiction
		Long-term potentiation
HD, TOXIC ENCEPHALOPATHY	5	Huntington's disease
		Amyotrophic lateral sclerosis (ALS)
		Alzheimer's disease
		Cocaine addiction
		Nicotine addiction
LBD, PD	3	Parkinson's disease
		Alzheimer's disease
		Cocaine addiction
LBD, PRION	1	Ribosome
LBD, SPINAL CORD INJURY	2	Alzheimer's disease
		Amphetamine addiction

LBD, SPINOCEREBELLAR	2	Amphetamine addiction
		Dopaminergic synapse
LBD, TOXIC ENCEPHALOPATHY	6	Parkinson's disease
		Alzheimer's disease
		Cocaine addiction
		Amphetamine addiction
		Dopaminergic synapse
		Alcoholism
PD, SPINAL CORD INJURY	2	Alzheimer's disease
		Amyotrophic lateral sclerosis (ALS)
PD, TOXIC ENCEPHALOPATHY	5	Parkinson's disease
		Alzheimer's disease
		Huntington's disease
		Amyotrophic lateral sclerosis (ALS)
		Cocaine addiction
PEROXISOME, REFSUM	7	Peroxisome
		Biosynthesis of unsaturated fatty acids
		Glyoxylate and dicarboxylate metabolism
		Primary bile acid biosynthesis
		alpha-Linolenic acid metabolism
		Tryptophan metabolism
		Fatty acid degradation
SPINAL CORD INJURY, SPINOCEREBELLAR	4	Calcium signaling pathway
		Amphetamine addiction
		Long-term potentiation
		Phototransduction
SPINAL CORD INJURY, TOXIC ENCEPHALOPATHY	3	Alzheimer's disease
		Amphetamine addiction
		Amyotrophic lateral sclerosis (ALS)
SPINOCEREBELLAR, TOXIC ENCEPHALOPATHY	3	Dopaminergic synapse
		Amphetamine addiction
		Nicotine addiction

Table 4: Top 10 significantly enriched pathways for each ND

AD	ALS	*Ataxia-telangiectasia*	*Friedreich Ataxia*	FD	HD	LB	PD	*Peroxisome*	Refsum	Spinal Cord	Spinocerebellarataxia	Toxic Enc
Alzheimerdisease	Amyotrophiclateralsclerosis (ALS)	Non-homologousend-joining	Sulfurrelaysystem	Ribosome	Basaltranscriptionfactors	Ribosome	Proteasome	Biosynthesis of unsaturated fatty acids	Peroxisome	Arginine biosynthesis	Phototransduction	Cocaineaddiction
Amyotrophiclateralsclerosis (ALS)	Apoptosis	Homologousrecombination	Thiaminemetabolism	Spliceosome	Huntingtondisease	Parkinsondisease	Amyotrophiclateralsclerosis (ALS)	Glyoxylate and dicarboxylate metabolism	Biosynthesis of unsaturated fatty acids	Phototransduction	Dopaminergicsynapse	Alzheimerdisease
Long-termpotentiation	Alzheimer disease	p53 signalingpathway	Phototransduction	Priondiseases	Amyotrophiclateralsclerosis (ALS)	Cocaineaddiction	Parkinsondisease	Primarybileacidbiosynthesis	Primarybileacidbiosynthesis	Pertussis	Nicotineaddiction	Amyotrophiclateralsclerosis (ALS)
Amphetaminedaddiction	Cocainedaddiction	DNA replication	Nicotineaddiction	Protein processing in endoplasmic reticulum	Viralcarcinogenesis	Amphetamine addiction	Epstein-Barrvirusinfection	alpha-Linolenicacid metabolism	PPAR signalingpathway	Circadian entrainment	Basaltranscriptionfactors	Amphetamine addiction
Apoptosis	Legionellosis	Cellcycle	Dopaminergicsynapse	Ferroptosis	Cocaineaddiction	Folatebiosynthesis	Alzheimerdisease	Alanine, aspartate and glutamate metabolism	alpha-Linolenicacid metabolism	Long-termpotentiation	Type II diabetes mellitus	Parkinsondisease
Dopaminergicsynapse	Huntingtondisease	Mismatchrepair	Porphyrin and chlorophyllmetabolism	Notchsignalingpathway	Mitophagy	Alzheimerdisease	Cocaineaddiction	Glycine, serine and threonine metabolism	Glyoxylate and dicarboxylate metabolism	Ampheta mineaddiction	Calciumsignalingpathway	Nicotineaddiction
Tuberculosis	MAPK signalingpathway	Cellularsenescence	Type II diabetes mellitus	Amyotrophiclateralsclerosis (ALS)	Nicotineaddiction	Tyrosinemetabolism	Huntingtondisease	Tryptophanmetabolism	Lysosome	Alzheimerdisease	Long-termdepression	Huntingtondisease
Circadianentrainment	Mitophagy	Fanconianemiapathway	Retrogradeendocannabinoidsignaling	Alzheimerdisease	Long-termpotentiation	Dopaminergicsynapse	Colorectalcancer	Fattyaciddegradation	Tryptophanmetabolism	Arginine and prolinemetabolism	Long-termpotentiation	Alcoholism

Neurotrophinsignalingpathway	Ribosome	Nucleotideexcisionrepair	Alzheimerdisease	Necroptosis	Apoptosis	Notchsignalingpathway	Toxoplasmosis	ABC transporters	Fattyaciddegradation	Amyotrophiclateralsclerosis (ALS)	Amphetamineaddiction	Dopaminergicsynapse
Calciumsignalingpathway	RNA transport	Baseexcisionrepair	Calciumsignalingpathway	SNARE interactions in vesicular transport	Alzheimerdisease	Ribosome	Neurotrophinsignalingpathway	Biosynthesis of unsaturated fatty acids	Valine, leucine and isoleucine degradation	Calciumsignalingpathway	Reninsecretion	Smallcelllungcancer

Table 5: Metrices of Diseases part 1

DISEASES\METRICES	NODES	EDGES	MAX DEGREE	MEAN DEGREE	MAX STRENGTH	MEAN STRENGTH	MAX EIGENVECTOR	MEAN EIGENVECTOR
ALZHEIMER'S DISEASE	146	363	35	4.972	31.687	3.611	1	0.099
AMYOTROPHIC LATERAL SCLEROSIS	113	180	10	3.185	9.111	2.203	1	0.079
ATAXIA TELANGIACTASIA	20	53	13	5.3	8.995	3.424	1	0.424
FRIEDREICH'S ATAXIA	10	10	4	2	2.719	1.630	1	0.4505
FRONTOTEMPORAL DEMENTIA	38	66	8	3.47	7.171	2.443	1	0.184831
HUNTINGTON'S_DISEASE	36	66	12	3.666	10.242	2.472	1	0.203
LEWY BODY DISEASE	15	28	7	3.733	5.902	2.864	1	0.424
PARKINSON'S DISEASE	91	394	27	8.659	25.942	7.725	1	0.275
PEROXISOME BIOGENESIS DISORDER 1B	21	46	11	4.380	7.818	2.853	1	0.3787143
PRION DISEASE	5	9	4	3.6	3.992	3.592	1	0.9292
REFSUM DISEASE	10	12	5	2.4	3.297	1.684	1	0.4745
SPINAL CORD INJURY	9	12	5	2.666	3.968	2.174	1	0.5384444
SPINOCEREBELLAR ATAXIA	6	3	1	1	0.953	0.927	1	0.3333333
TOXIC ENCEPHALOPATHY	16	12	3	1.5	2.143	1.133	1	0.2658125

Table 6: Metrices of Diseases part 2

DISEASES\METRICES	MAX WEIGHTED EIGENVECTOR	MEAN WEIGHTED EIGENVECTOR	MAX CLOSENESS	MEAN CLOSENESS	MAX BETWEENNESS	MEAN BETWEENNESS	TRANSITIVITY	CLUSTER COEFFICIENT
ALZHEIMER'S DISEASE	1	0.099	0.000318	0.00027	2173000	205.280	0.3579	0.3507
AMYOTROPHIC LATERAL SCLEROSIS	1	0.0795	0.000313	0.00025	1400	129.380	0.5181477	0.2260079
ATAXIA TELANGIACTASIA	1	0.4243	0.019216	0.015927	46.5	6.2	0.4098	0.4087
FRIEDREICH'S ATAXIA	1	0.4505	0.022701	0.018002	7	1.1	0.5625	0.3166667
FRONTOTEMPORAL	1	0.184831	0.001495	0.001172474	131	13.526	0.7386364	0.4632832

DEMENTIA								
DISEASES\METRICES	**WEIGHTED CLUSTER COEFFICIENT**	**ASSORTATIVITY**	**COMMUNITIES**	**MODULARITY**	**AVG SHORTEST PATH LENGTH NETWORK**	**AVG SHORTEST PATH LENGTH ER RANDOM NETWORK**	**CLUSTER COEFFICIENT ER RANDOM NETWORK**	**SMALL WORLD PROPERTY**
HUNTINGTON'S_DISEASE	1	0.2036667	0.004009	0.003305167	144	28.833	0.46	0.3612494
LEWY BODY DISEASE	1	0.424	0.064566	0.04739447	48	13	0.7894737	0.4266667
PARKINSON'S DISEASE	1	0.275	0.001336	0.001148769	1479	106.065	0.943473	0.4402148
PEROXISOME BIOGENESIS DISORDER 1B	1	0.3787143	0.017194	0.01408262	15.0	9.380	0.4854772	0.5426441
PRION DISEASE	1	0.9289824	0.250627	0.2305228	1	0.2	0.875	0.9
REFSUM DISEASE	1	0.4745	0.035813	0.028605 7	10	2.8	0.5	0.3733333
SPINAL CORDINJURY	1	0.5384444	0.043033	0.03464667	5	1.333	0.6	0.4814815
SPINOCEREBELLAR ATAXIA	1	0.3333333	0.040167	0.040117	0	0	0	0
TOXIC ENCEPHALOPATHY	1	0.2658125	0.007363	0.01948875	15	2.75	0	0

Table 7: Metrices of Diseases part 3

ALZHEIMER'S DISEASE	0.3599	0.0732	15	0.61	4.632	3.218	0.0276	8.828
AMYOTROPHIC LATERAL SCLEROSIS	0.2302392	0.579202	20	0.84	4.899	3.972	0.0147	12.461
ATAXIA TELANGIACTASIA	0.4131	-0.2810043	5	0.18	1.792	1.836	0.2257	1.856
FRIEDREICH'S ATAXIA	0.3072447	0.4736842	4	0.38	1.529	1.681	0.15	2.321
FRONTOTEMPORAL DEMENTIA	0.4685162	0.6611111	7	0.68	3.052	2.803	0.4632832	4.973
HUNTINGTON'S _DISEASE	0.366754	0.2767374	6	0.47	3.153	2.755	0.086	3.642
LEWY BODY DISEASE	0.4274835	0.3754209	2	0.32	2.761	1.952	0.2549206	1.183
PARKINSON'S DISEASE	0.4434868	0.9065337	9	0.33	3.718	2.307	0.08847	3.087
PEROXISOME BIOGENESIS DISORDER 1B	0.5399686	-0.06901233	3	0.31	2.122	2.128	0.2890401	1.883
PRION DISEASE	0.8999916	-0.5	1	-2.8e-17	1.1	1.1	0.9	1
REFSUM DISEASE	0.367791	0.2222222	3	0.32	1.965	1.714	0.2166667	1.502
SPINAL CORD INJURY	0.4881417	0.0952381	3	0.2	1.545	1.833	0.3851852	1.482
SPINOCEREBELLAR ATAXIA	0	Nan	3	0.67	1	1.25	0	Nan
TOXIC ENCEPHALOPATHY	0	-0.173913	5	0.67	2.257	2.818	0.3851852	0

Table 8: Common Hubs

PAIR OF DISEASES	UNIPROT ID	GENE SYMBOL	GENE NAME
AD, ALS	P04629	NTRK1	Neurotrophic tyrosine kinase
	P01138	NGF	Beta-Nerve Growth Factor
	P00441	SOD1	Superoxide Dismutase 1
	Q13501	SQSTM1	Sequestosome 1
AD, FRIEDREICH'S ATAXIA	P0DP24	CALM2	Calmodulin 2
	O00555	CACNA1A	Voltage-dependent P/Q-type calcium channel subunit alpha-1A
AD, FD	Q13501	SQSTM1	Sequestosome 1
AD, LBD	P37840	SNCA	Synuclein Alpha
AD, PD	P37840	SNCA	Synuclein Alpha
	Q13501	SQSTM1	Sequestosome 1
AD - SPINAL CORD INJURY	P0DP23	CALM1	Calmodulin 1
	P0DP24	CALM2	Calmodulin 2
	P0DP25	CALM3	Calmodulin 3
AD, SPINOCEREBELLAR	P0DP24	CALM2	Calmodulin 2
AD, TOXIC_ENCEPHALOPATHY	P05067	APP	Amyloid-beta A4 protein
	P37840	SNCA	Synuclein Alpha
ALS, FD	Q9UHD9	UBQLN2	Ubiquilin 2
	P46783	RPS10	Ribosomal Protein S10

	Q92890	UFD1L	Ubiquitin Recognition Factor In ER Associated Degradation 1
	P62249	RPS16	Ribosomal Protein S16
	P62847	RPS24	Ribosomal Protein S24
	P62979	RPS27A	Ribosomal Protein S27a
	Q3MIH3	UBA52	Ubiquitin A-52 Residue Ribosomal Protein Fusion Product 1
	P62861	FAU	FAU, Ubiquitin Like And Ribosomal Protein S30 Fusion
	Q13501	SQSTM1	Sequestosome 1
	Q8TAT6	NPLOC4	Nuclear protein localization protein 4 homolog
	P25398	RPS12	Ribosomal Protein S12
	P04156	PRNP	Prion Protein
	P22626	HNRNPA2B1	Heterogeneous nuclear ribonucleoproteins A2/B1
ALS, LBD	P46783	RPS10	Ribosomal Protein S10
	P62847	RPS24	Ribosomal Protein S24
	P62979	RPS27A	Ribosomal Protein S27a
	Q3MIH3	UBA52	Ubiquitin A-52 Residue Ribosomal Protein Fusion Product 1
	Q3MIH3	UBA52	Ubiquitin A-52 Residue Ribosomal Protein Fusion Product 1
ALS, PD	Q13501	SQSTM1	Sequestosome 1
	P10636	MAPT	Microtubule-associated protein tau
ALS, PRION	P39019	RPS19	Ribosomal Protein S19
ALS, TOXIC ENCEPHALOPATHY	P99999	CYCS	Cytochrome C
FREIDREICH'S ATAXIA,SPINAL CORD INJURY	P0DP24	CALM2	Calmodulin 2
FREIDREICH'S ATAXIA,SPINOCEREBELLAR	P0DP24	CALM2	Calmodulin 2
FD, LBD	Q3MIH3	UBA52	Ubiquitin A-52 Residue Ribosomal Protein Fusion Product 1
	P62847	RPS24	Ribosomal Protein S24
	P46783	RPS10	Ribosomal Protein S10
	P25398	RPS12	Ribosomal Protein S12
	P62979	RPS27A	Ribosomal Protein S27a
FD, PD	Q13501	SQSTM1	Sequestosome 1
HD, PD	P20226	TBP	TATA-Box Binding Protein
HD, SPINOCEREBELLAR	Q12962	TAF10	TAF10 RNA polymerase II, TATA-Box Binding Protein Associated Factor 10
HD,TOXIC ENCEPHALOPATHY	Q05586	GRIN1	Glutamate Ionotropic Receptor NMDA Type Subunit 1
LBD, PD	P37840	SNCA	Synuclein Alpha
LBD, TOXIC ENCEPHALOPATHY	P37840	SNCA	Synuclein Alpha
PD, TOXIC ENCEPHALOPATHY	P37840	SNCA	Synuclein Alpha
PBD1B-REFSUM	O00628	PEX7	peroxisomal biogenesis factor 7
	P50542	PEX5	peroxisomal biogenesis factor 7
SPINAL CORD INJURY-SPINOCEREBELLAR	P0DP24	CALM2	Calmodulin 2
SPINAL CORD INJURY-TOXIC ENCEPHALOPATHY	P42574	CASP3	Caspase 3

Table 9: Common bridges

PAIR OF DISEASES	UNIPROT ID	GENE SYMBOL	GENE NAME
AD,ALS	Q13501	SQSTM1	Sequestosome 1
PBD1B-REFSUM	O00628	PEX7	peroxisomal biogenesis factor 7

Table 10: Common Articulation Points

PAIR OF DISEASES	UNIPROT ID	GENE SYMBOL	GENE NAME
AD,ALS	P29475	NOS1	Nitric oxide synthase 1
	P05067	APP	Amyloid-beta A4 protein
	Q16620	NTRK2	Neurotrophic tyrosine kinase
	Q13501	SQSTM1	Sequestosome 1
	Q00535	CDK5	Cyclin Dependent Kinase 5
AD, FD	Q13526	PIN1	Peptidylprolyl Cis/Trans Isomerase, NIMA-Interacting 1
	P37840	SNCA	Synuclein Alpha
	P05067	APP	Amyloid-beta A4 protein
	P00441	SOD1	Superoxide Dismutase 1
	Q13501	SQSTM1	Sequestosome 1
AD, HD	P00441	SOD1	Superoxide Dismutase 1
	Q13501	SQSTM1	Sequestosome 1
AD, LBD	P05067	APP	Amyloid-beta A4 protein
	P37840	SNCA	Synuclein Alpha
AD, PD	P37840	SNCA	Synuclein Alpha
	P29475	NOS1	Nitric Oxide Synthase, brain
	P00441	SOD1	Superoxide Dismutase 1
	Q16620	NTRK2	Neurotrophic tyrosine kinase
	Q13501	SQSTM1	Sequestosome 1
AD, SPINAL CORD INJURY	P29475	NOS1	Nitric Oxide Synthase, brain
AD, TOXIC_ENCEPHALOPATHY	P05067	APP	Amyloid-beta A4 protein
	P37840	SNCA	Synuclein Alpha
	P99999	CYCS	Cytochrome C
ALS, FD	Q13501	SQSTM1	Sequestosome 1
	P05067	APP	Amyloid-beta A4 protein
ALS, HD	Q13501	SQSTM1	Sequestosome 1
ALS, LBD	P05067	APP	Amyloid-beta A4 protein
ALS, PD	Q13501	SQSTM1	Sequestosome 1
	Q16620	NTRK2	Neurotrophic tyrosine kinase
	P29475	NOS1	Nitric Oxide Synthase, brain

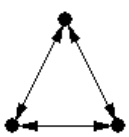
	P11142	HSPA8	Heat shock 70kDa protein 8
ALS, SPINAL CORD INJURY	P29475	NOS1	Nitric Oxide Synthase, brain
ALS, TOXIC ENCEPHALOPATHY	P99999	CYCS	Cytochrome C
	P98170	XIAP	X-Linked Inhibitor Of Apoptosis
	P42574	CASP3	Caspase 3
FD, HD	P00441	SOD1	Superoxide Dismutase 1
	Q13501	SQSTM1	Sequestosome 1
FD, PD	P00441	SOD1	Superoxide Dismutase 1
	Q13501	SQSTM1	Sequestosome 1
	P37840	SNCA	Synuclein Alpha
	Q5S007	LRRK2	Leucine Rich Repeat Kinase 2
FD, TOXIC ENCEPHALOPATHY	P05067	APP	Amyloid-beta A4 protein
	P37840	SNCA	Synuclein Alpha
HD, PD	P00441	SOD1	Superoxide Dismutase 1
	Q13501	SQSTM1	Sequestosome 1
LBD, PD	P37840	SNCA	Synuclein Alpha
LBD, TOXIC ENCEPHALOPATHY	P37840	SNCA	Synuclein Alpha
	P05067	APP	Amyloid-beta A4 protein
PD, SPINAL CORD INJURY	P29475	NOS1	Nitric Oxide Synthase, brain
PD, TOXIC ENCEPHALOPATHY	P37840	SNCA	Synuclein Alpha

Table 11: Common genes that are hubs and articulation points or bridges simultaneously

PAIR OF DISEASES	UNIPROT ID	GENE SYMBOL	GENE NAME	COMMENTS

AD,ALS	Q13501	SQSTM1	Sequestosome 1	hub,bridge, articulation
AD, FD	Q13501	SQSTM1	Sequestosome 1	hub, articulation
AD, LBD	P37840	SNCA	Synuclein Alpha	hub, articulation
AD, PD	P37840	SNCA	Synuclein Alpha	hub, articulation
	Q13501	SQSTM1	Sequestosome 1	hub, articulation
AD, TOXIC_ENCEPHALOPATHY	P05067	APP	Amyloid-beta A4 protein	hub, articulation
	P37840	SNCA	Synuclein Alpha	hub, articulation
ALS, FD	Q13501	SQSTM1	Sequestosome 1	hub, articulation
ALS, PD	Q13501	SQSTM1	Sequestosome 1	hub, articulation
ALS, TOXIC ENCEPHALOPATHY	P99999	CYCS	Cytochrome C	hub, articulation
FD, PD	Q13501	SQSTM1	Sequestosome 1	hub, articulation
LBD, PD	P37840	SNCA	Synuclein Alpha	hub, articulation
LBD, TOXIC ENCEPHALOPATHY	P37840	SNCA	Synuclein Alpha	hub, articulation
PD, TOXIC ENCEPHALOPATHY	P37840	SNCA	Synuclein Alpha	hub, articulation
PBD1B-REFSUM	O00628	PEX7	peroxisomal biogenesis factor 7	hub, bridge

Table 12: 3 node network motifs - experiments

Characteristics /Diseases	ID	Adj	Frequency [Original]	Mean-Freq [Random]	Standard-Dev [Random]	Z-score	p- Value
AD	238		15.669%	0.57931%	0.0020854	72.358	0

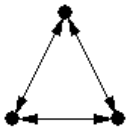
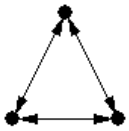
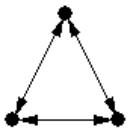
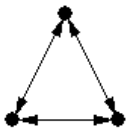
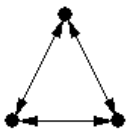
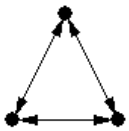
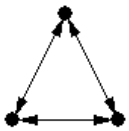
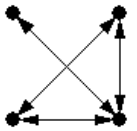
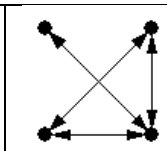
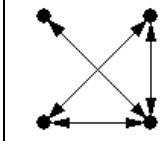
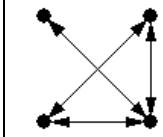
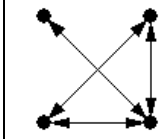
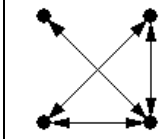
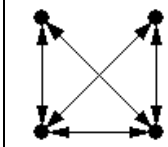
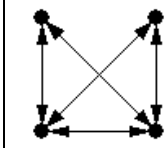
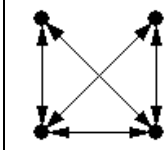
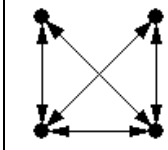
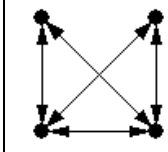
ALS	238		26.386%	0.600093%	0.00099348	264.99	0
FD	238		48.507%	1.0288%	0.0057228	82.964	0
HD	238		22.115%	0.37726%	0.0033201	65.475	0
LBD	238		55.556%	15.285%	0.021516	18.716	0
PD	238		94.356%	88.249%	0.00086776	70.373	0
Spinal cord injury	238		33.333%	12.5%	0	Undefined	0
Toxic Encephalopathy	78		100%	100%	0	Undefined	0
Peroxisome biogenesis disorder	238		23.926%	4.3532%	0.0055487	35.275	0

Table 13: 4 node network motifs – experiments

Characteristics /Diseases	ID	Adj	Frequency [Original]	Mean-Freq [Random]	Standard-Dev [Random]	Z-score	p- Value
AD	4958		18.855%	1.7625%	0.0061489	27.798	0

ALS	4958		22.166%	0.14295%	0.0026185	84.106	0
Ataxia-telangiectasia	4958		25.846%	18.758%	0.0063396	11.181	0.002
FD	4958		25.103%	2.6258%	0.013031	17.25	0
HD	4958		31.287%	0.088046%	0.0075141	40.465	0
Peroxisome biogenesis disorder	4958		30.072%	5.4878%	0.011132	22.084	0
AD	13278		5.8847%	0.15461%	0.001092	52.472	0
ALS	13278		8.9787%	0.0028797%	0.00011526	778.74	0
Ataxia-telangiectasia	13278		13.641%	6.8306%	0.0017722	38.428	0
FD	13278		14.403%	0.15165%	0.0017892	79.654	0
HD	13278		10.673%	0.025022%	0.00059427	179.17	0

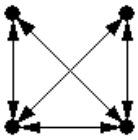
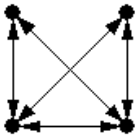
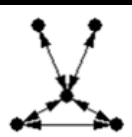
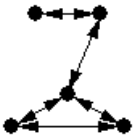
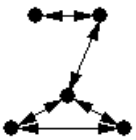
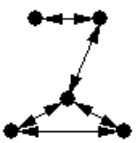
LBD	13278		12.821%	8.5144%	0.016245	2.6507	0
Peroxisome biogenesis disorder	13278		11.957%	0.41345%	0.0031345	36.826	0

Table 14: 5 node network motifs - experiments

Characteristics /Diseases	ID	Adj	Frequency [Original]	Mean-Freq [Random]	Standard-Dev [Random]	Z-score	p- Value
AD	1084606		15.507%	1.2451%	0.0035057	40.682	0
ALS	1084606		2.7552%	0.059241%	0.0010796	24.973	0
HD	1084606		10.46%	0.51646%	0.0048208	20.627	0
Peroxisome biogenesis disorder	1084606		8.7307%	4.2351%	0.0055944	8.0358	0
AD	1082430		23.723%	22.141%	0.0053065	2.9812	0.009
LBD	1082430		4.717%	2.5487%	0.0074041	2.9285	0.001
AD	8948910		4.4262%	0.49889%	0.0015215	25.812	0
ALS	8948910		13.868%	0.087719%	0.0014661	93.992	0
FD	8948910		20.39%	1.1426%	0.0052964	36.342	0

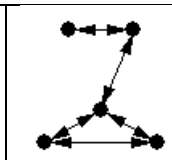
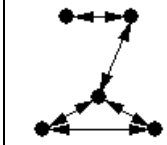
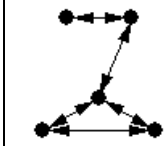
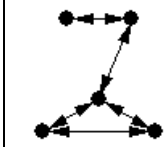
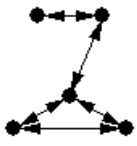
HD	8948910		8.6086%	0.41093%	0.0030057	27.274	0
LBD	8948910		13.208%	5.3531%	0.014872	5.2814	0
PD	8948910		0.30076%	0.0201863%	0.00033042	8.4405	0.001
Peroxisome biogenesis disorder	8948910		12.074%	0.80886%	0.0041524	27.13	0

Table 15: 5 node network motifs– LBD

Characteristics /Diseases	ID	Adj	Frequency [Original]	Mean-Freq [Random]	Standard-Dev [Random]	Z-score	p- Value
LBD	7598014		9.434%	0.35984%	0.0023799	38.129	0
LBD	1289662		15.094%	1.4764%	0.0055939	24.344	0
LBD	8948910		13.208%	5.3531%	0.014872	5.2814	0

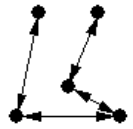
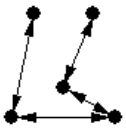
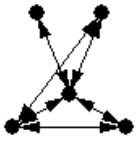
LBD	1082430		4.717%	2.5487%	0.0074041	2.9285	0.001
LBD	2133644		25.472%	16.754%	0.030254	2.8814	0
LBD	16510910		10.377%	0%	0	Undefined	0

Table16: 5 node network motifs

Characteristics /Diseases	ID	Adj	Frequency [Original]	Mean-Freq [Random]	Standard-Dev [Random]	Z-score	p- Value
HD	1150398		9.5596%	0.042987%	0.0011152	85.335	0
HD	2133678		8.1582%	0.56604%	0.0091283	8.4122	0
Peroxisome biogenesis disorder	2133644		13.437%	5.7576%	0.0015215	25.812	0
Peroxisome biogenesis disorder	1150398		9.5975%	0.7698%	0.0053311	16.559	0
FD	16510910		7.8091%	0%	0	Undefined	0

FD	1289662		13.449%	0%	0	Undefined	0
Ataxia-telangiectasia	1150398		9.7058%	7.11%	0.0063702	4.0749	0.002
ALS	1289662		6.6585%	0%	0	Undefined	0
PD	16510910		82.223%	65.416%	0.00073545	228.52	0

Table 17: 6 node network motifs - experiments

Characteristics /Diseases	ID	Adj	Frequency [Original]	Mean-Freq [Random]	Standard-Dev [Random]	Z-score	p- Value
FD	2199165980		17.05%	0.52725%	0.0028013	58.983	0
HD	2199165980		4.3023%	0.13759%	0.001358	30.669	0
LBD	2199165980		32.558%	0.20021%	0.0029245	110.64	0
Peroxisome	2199165980		2.9921%	0.010945%	0.00023051	129.33	0

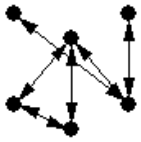
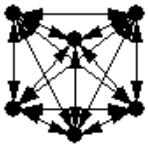
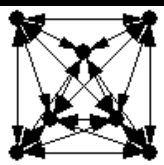
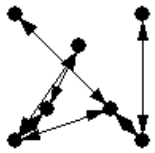
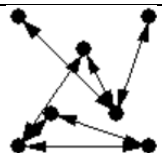
FD	2182388814		9.1004%	0.30933%	0.0017443	50.4	0
PD	34089189246		46.638%	0.053176%	3.5563e-005	13099	0

Table 18: 7 node network motifs – experiments

Characteristics /Diseases	**ID**	**Adj**	**Frequency [Original]**	**Mean-Freq [Random]**	**Standard-Dev [Random]**	**Z-score**	**p- Value**
PD	2803711532725574		27.784%	0.0042747%	4.025e-006	69019	0
FD	4538208111814		12.487%	0.20892%	0.0012093	101.53	0
LBD	4433224306288		28.475%	0.50436%	0.0010393	273.49	0