

GRAPH STATS	RPGeNet v1		RPGeNet v2 — All Sets					BioGRID Only		STRING Only		PPaxe Only	
	Skeleton	WholeGrap	Skeleton	Level1	Level2	Level3	WholeGrap	Skeleton	WholeGrap	Skeleton	WholeGrap	Skeleton	WholeGrap
Total #Nodes	1 294	22 372	4 018	17 851	18 512	18 527	18 542	3 057	15 205	2 555	13 325	762	3 146
Isolated Nodes	7	7	16	15	15	15	15	71	70	56	56	93	84
Adjacent Drivers	103 of 110		260 of 276	261 of 276				205 of 276	206 of 276	220 of 276		183 of 276	192 of 276
Total #Edges	5 883	752 062	35 528	932 340	1217 902	1 218 017	1 218 032	23 480	623 601	20 791	629 271	3 654	13 584
Mutual [A⇌B]	1 082	319 928	9 601	462 988	604 652	604 707	604 713	6 243	307 422	6 422	314 629	1 554	6 760
Assymetric [A→B]	3 719	106 907	16 326	5 074	5 931	5 931	5 931	10 994	6 138	7 947	0	546	0
Self-loop [A→A]	0	5 299	0	1 290	2 667	2 672	2 675	0	2 619	0	13	0	64
Total Non-Redundant	4 801	432 134	25 927	469 352	613 250	613 310	613 319	17 237	316 179	14 369	314 642	2 100	6 824
Graph Density	0.0035	0.0015	0.0022	0.0029	0.0036	0.0035	0.0035	0.0025	0.0027	0.0032	0.0035	0.0063	0.0014
Avg. Clustering	0.0433	0.1445	0.0613	0.1449	0.2331	0.2331	0.2331	0.0448	0.0737	0.1508	0.5512	0.0959	0.0580
Graph Diameter	10	9	8	6	7	8	8	8	7	9	10	13	13
Graph Reciprocity	0.3678	0.8568	0.5405	0.9946	0.9951	0.9951	0.9951	0.5318	0.9901	0.6178	1.0000	0.8506	1.0000
Avg. Degree	9.0927	67.2324	17.6844	104.458	131.5797	131.4856	131.3809	15.3615	82.0258	16.2748	94.4497	9.5906	8.6357
Avg. Closeness	0.0969	0.0185	0.052	0.0529	0.0529	0.0529	0.0295	0.0128	0.0116	0.0165	0.0052	0.0093	0.0024
Betweenness	3	32 888.11	10	33	34	35	35 044.91	7	28 684.70	6	31 567.57	1 635.56	7 714.01
Avg. Edge Betw.	1	1 480.75	1 629.48	980.37	812.19	814.28	814.27	1	1 064.77	1	942.69	463.38	2 354.06
Avg. Coreness	4.7751	39.8983	9.1309	54.8258	77.0557	77.0063	76.9456	7.9326	42.0278	8.7366	67.3668	5.1273	4.6300
Avg. Eccentricity	6.7272	4.5465	5.6904	4.5666	4.9552	5.8732	5.8691	5.5741	5.1786	6.2693	6.6453	6.8307	7.9259
Avg. Path Length	4.1559	2.9473	3.6155	2.8810	2.8969	2.9000	2.9000	3.5936	2.9143	3.8110	3.4375	3.7888	4.1479

Supplementary Table 1.- Topology of the RPGeNet interactions graph.

This table shows the total number of nodes (genes/proteins, where adjacent nodes can be calculated by subtracting *isolated* from *total nodes*) and edges (interactions, including counts by the type of relation between pairs of adjacent nodes: mutual-, asymmetric- and self-interactions), for every level of the RPGeNet database graph (see “RPGeNet v2 All Sets” block). For comparison purposes, graph stats are provided for the previous RPGeNet v1 version, as well as those for the interaction networks that can be produced separately from each of the evidence sources (blocks named as “BioGRID Only”, “STRING Only”, and “PPaxe Only”, respectively). Most of the *isolated nodes* correspond to drivers without interaction evidences from the selected sources, and those numbers complement the values from the *adjacent drivers* row. Graph statistics were described in depth on Newman *et al* [1]. In br: *graph density* is the ratio between edges and the total number of possible vertices (nodes); *average clustering coefficient* (or the tendency of nodes to cluster together) is a measure of how complete the neighborhood of a node is, over all the nodes of the network; *diameter* is the maximum distance between two nodes; *reciprocity* is the; *average degree* is the average number of edges per node; *closeness* is the average length of shortest path between a node and every other node in the network; *betweenness* is a measure of the number of times a node is found within the shortest paths between two other nodes; *coreness* defines the shell index of the vertices of a network; *eccentricity* is the maximum of the shortest distances of a node with respect all other nodes in the graph; finally, *average path length* is a measure of the average distance between two nodes. Graph stats produced with `python-igraph` library (v0.7.0, see further details at <https://igraph.org/python/>).

		Skeleton	Level1	Level2	Level3	WholeGraph
GRAPH SUMMARY	Total UNIQUE NODES	4 018	17 851	18 512	18 527	18 542
	Adjacent Nodes	4 002	17 836	18 497	18 512	18 527
	Isolated Nodes	16	15	15	15	15
	NODES by Source					
	BioGRID	3 677	14 831	15 132	15 136	15 139
	STRING	3 580	12 864	13 253	13 263	13 269
	PPaxe	1 407	3 016	3 054	3 056	3 062
	TOTAL	8 664	30 711	31 439	31 455	31 470
	<i>Nodes Source "redundancy"</i>	215.63%	172.04%	169.83%	169.78%	169.72%
	Total DIRECTED EDGES	35 528	932 340	1 217 902	1 218 017	1 218 032
	Mutual [A⇌B]	9 601	462 988	604 652	604 707	604 713
	Assymetric [A→B]	16 326	5 074	5 931	5 931	5 931
	Self-loop [A→A]	0	1 290	2 667	2 672	2 675
	Total Non-Redundant	25 927	469 352	613 250	613 310	613 319
	<i>Directed Edges "redundancy"</i>	137.03%	198.64%	198.60%	198.60%	198.60%
	EDGES by Source					
	BioGRID all	22 914	518 478	623 643	623 656	623 659
	<i>BioGRID only</i>	21 334	483 667	579 207	579 220	579 220
	STRING all	12 563	440 111	629 167	629 265	629 271
	<i>STRING only</i>	10 599	402 920	582 094	582 190	582 190
PPaxe all	2 277	12 282	13 572	13 578	13 584	
<i>PPaxe only</i>	1 534	8 049	8 984	8 988	8 988	
TOTAL	37 754	970 871	1 266 382	1 266 499	1 266 514	
<i>Edges Source "redundancy"</i>	145.62%	206.85%	206.50%	206.50%	206.50%	
EVIDENCE SUMMARY	TOTAL EVIDENCES	75 447	2 371 305	3 209 677	3 209 856	3 209 871
	By Class					
	Genetic evidences	257	6 018	7 062	7 063	7 063
	<i>Avg. evids x directed edge</i>	0.007	0.006	0.006	0.006	0.006
	Physical evidences	70 561	2 342 154	3 177 567	3 177 739	3 177 748
	<i>Avg. evids x directed edge</i>	1.986	2.512	2.609	2.609	2.609
	Unknown evids (PPaxe)	4 629	23 133	25 048	25 054	25 060
	<i>Avg. evids x directed edge</i>	0.130	0.025	0.021	0.021	0.021
	By Source					
	BioGRID	31 726	705 485	842 798	842 815	842 818
	<i>Physical interactions</i>	31 469	699 467	835 736	835 752	835 755
	<i>Genetic Interactions</i>	257	6 018	7 062	7 063	7 063
	<i>Avg. evids x directed edge</i>	0.893	0.757	0.692	0.692	0.692
STRING	39 092	1 642 687	2 341 831	2 341 987	2 341 993	
<i>Avg. evids x directed edge</i>	1.100	1.762	1.923	1.923	1.923	
PPaxe	4 629	23 133	25 048	25 054	25 060	
<i>Avg. evids x directed edge</i>	0.130	0.025	0.021	0.021	0.021	
EDGES with STRING SCORE	With any STRING score	12 563	440 111	629 167	629 265	629 271
	With "experimental" score	2 696	75 075	109 191	109 231	109 235
	With "database" score	9 112	371 666	541 032	541 082	541 084
	With "text-mining" score	8 803	248 133	345 610	345 682	345 686
	With "co-expression" score	2 227	107 246	157 974	158 008	158 010
	With "neighborhood" score	0	0	0	0	0
	With gene-"fusion" score	16	1 136	2 384	2 384	2 384
	With "co-occurrence" score	124	6 320	8 749	8 755	8 757

Supplementary Table 2.- Source origin and redundancy of evidences for RPGeNet core network interactions.

First block accounts for the number of nodes and edges supported by each input source at each graph level of the core network. Second block provides information about distinct evidences used to weight the interactions. Number of interactions on the core network with STRING scores is provided on the last block to complement evidences (also shown in the interaction information pop-up cards like the one shown in Figure 5 right panel). RPGeNet models interactions as directed edges between nodes, and thus, represents undirected interactions between genes as two separate interactions. The "Total Interactions" column shows the total number of edges stored in the database (without taking into account the number of evidences), counting reciprocal interactions twice (A→B is different from B→A). The "Non-redundant Interactions" column refers to the number of interactions in RPGeNet independently of the direction, and thus, the pair A→B and B→A is only counted once. The Non-redundant interactions count criteria is equivalent to the one used by the BioGRID database (https://wiki.thebiogrid.org/doku.php/build_3.5.171).

	Skeleton		WholeGraph	
	Total # Nodes	Total # Edges	Total # Nodes	Total # Edges
Run Together (RPGeNet v2)	4 018	35 528	18 542	1 218 032
Overlapping Sets	4 767	46 610	18 539	1 217 974
BioGRID only	2 031	22 757	4 956	579 165
STRING only	1 389	19 650	2 598	582 196
PPaxe only	136	2 994	113	8 994
BioGRID \cap STRING	585	549	7 839	43 029
BioGRID \cap PPaxe	45	68	145	544
STRING \cap PPaxe	185	486	623	3 183
BioGRID \cap STRING \cap PPaxe	396	106	2 265	863
Total from BioGRID	3 057	23 480	15 205	623 601
Total from STRING	2 555	20 791	13 325	629 271
Total from PPaxe	762	3 654	3 146	13 584

Supplementary Table 3.- Interaction sources overlap against the RPGeNet skeleton and wholegraph networks.

To provide an estimate of the overlap for the evidences gathered from each source, this table shows the intersection of total number of nodes and edges for the skeleton and wholegraph networks produced when the RPGeNet pipeline is run over each of the interactions sources separately. First row has the totals for the whole network that is produced when combining all the sources when running the full pipeline to create the graph levels integrated on the RPGeNet v2 database, already shown on the previous Supplementary Tables. See also Supplementary Table 4 for further details about edges defined from the analysis of each separate interaction sources.

Edges Summary					
	Total Directed	Mutual [A⇌B]	Assymetric [A→B]	Self-loop [A→A]	Total Non-Redundant
BioGRID					
Skeleton	23 480	6 243	10 994	0	17 237
WholeGraph	623 601	307 422	6 138	2 619	316 179
STRING					
Skeleton	20 791	6 422	7 947	0	14 369
WholeGraph	629 271	314 629	0	13	314 642
PPaxe					
Skeleton	3 654	1 554	546	0	2 100
WholeGraph	13 584	6 760	0	64	6 824
RPGeNet v2 Core Network					
Skeleton	35 528	9 601	16 326	0	25 927
WholeGraph	1 218 032	604 713	5 931	2 675	613 319

Supplementary Table 4.- Edges classification for the standalone pipeline analyses over each separate interaction sources versus RPGeNet core network.

The “Total Interactions” column shows the total number of edges stored in the database (without taking into account the number of evidences), counting reciprocal interactions twice ($A \rightarrow B$ is different from $B \rightarrow A$). The “Non-redundant Interactions” column refers to the number of interactions in RPGeNet independently of the direction, and thus, the pair $A \rightarrow B$ and $B \rightarrow A$ is only counted once. Further details on all graph levels for the RPGeNet core network are provided on Supplementary Table 2.

Driver Genes	Predicted Interactions	Putative Interactors
<i>DTHD1</i> *	10	<i>AIPL1, CHD3, CNGB1, IFI27, MACC1, PID1, SH3BP4, UNC5A, UNC5C, UNC5CL</i>
<i>IMPG2</i> *	10	<i>C2orf71, C8orf37, EYS, FAM161A, PRCD, TMEM252, TTC8, TULP1, ZNF408, ZNF513</i>
<i>KCNJ13</i> *	10	<i>COL11A1, COL4A3, EDNRB, GJA5, IGSF11, KCNE3, KCNK5, KCNN4, KCNQ1, PNP</i>
<i>MIR204</i>	0	-
<i>MT-TH</i>	0	-
<i>MT-TL1</i>	0	-
<i>MT-TP</i>	0	-
<i>PLA2G5</i>	10	<i>ALOX5, ENSG00000168970, PLA2G15, PLA2G16, PLA2G4D, PLA2G7, PLD1, PLA2G4A, PTGS1, PTGS2</i>
<i>PRCD</i> *	10	<i>C2orf71, CERKL, CNGB1, FRMD6, IMPG2, PDE6A, PDE6B, RPE65, SLC4A3, ZNF513</i>
<i>RAX2</i>	10	<i>AKTIP, C8orf37, CRX, DPRX, FIZ1, GUCA1A, LEUTX, NRL, PITPNM3, PLAC9</i>
<i>RDH12</i>	10	<i>RBP1, RBP2, RBP5, RETSAT, ALDH1A1, ALDH1A2, LRAT, AOX1, CYP26A1, BCO1</i>
<i>SLC7A14</i> *	10	<i>ANKS4B, CAPN9, EIF5A2, GART, MFSD9, NMNAT2, RASD2, RPL22L1, SLC15A5, SLCO1B7</i>
<i>SRD5A3</i>	10	<i>SRD5A1, AKR1C1, AKR1C2, AKR1C3, AKR1D1, DOLK, HSD3B2, HSD17B3, HSD17B6, CYP17A1</i>
<i>TRNT1</i>	10	<i>ACOT13, ELAC1, ELAC2, FARS2, LARS2, PNPT1, TRIT1, TRMT10C, YARS, YARS2</i>
<i>TPPA</i>	10	<i>ATCAY, BNIP2, CYP4F2, EIF3K, FXN, PRUNE2, SLC6A11, SRR, RRS1, TRIM37</i>
<i>C1QTNF5 (CTPR5)</i>	4	<i>PATE4, TNFAIP8L1, ENSG00000235718, ENSG00000259159</i>

Supplementary Table 5.- Predicted interactions for unconnected drivers genes on R_PGeNet core network.

Driver genes can be unconnected to the core interactions whole-network graph because there are no known experimentally validated interactions that link them to the rest of nodes from the whole-network graph. Number of predicted interactions and putative interactors were retrieved from *STRING* database. The predicted interactions were not included into the whole core network on this release. Bottom row shows a driver gene, *C1QTNF5* (formerly identified as *CTPR5*), which is aggregated by the protocol to the growing graph at level 1 expansion yet it only has a validated interaction to itself from that point to the whole-graph. From seven unconnected driver genes of the R_PGeNet previous version (2), five are still listed on this table—those marked with * —, while the updated interaction evidences made possible to connect the other two (*HGSNAT* and *PCARE*, the latter formerly identified as *C2ORF71*).

Non-Driver Genes	Predicted Interactions	Putative Interactors
<i>DEFB106A</i>	10	<i>DEFB103A, DEFB103B, DEFB104A, DEFB104B, DEFB105A, DEFB105B, DEFB106B, DEFB107A, DEFB107B, DEFB108B</i>
<i>DEFB106B</i>	10	<i>DEFB103A, DEFB103B, DEFB104A, DEFB104B, DEFB105A, DEFB105B, DEFB106A, DEFB107A, DEFB107B, DEFB108B</i>
<i>DFNB32</i>	0	-
<i>DFNA37</i>	0	-
<i>MFSD2A</i>	10	<i>CDC5L, ERVFRD-1, KIAA1919, MFSD5, MFSD10, MFSD11, SLC25A33, SVOP, SVOPL, SYSP2L</i>
<i>MFSD2B</i>	10	<i>AP1S3, C9orf66, C16orf59, C16orf70, DDRGK1, EXOC3L4, MYLK3, RFX4, SAMD14, SUSP1</i>
<i>PDSS1</i>	10	<i>COQ2, COQ6, COQ9, DHDDS, FDPS, FDFT1, FNTA, FNTB, GGPS1, PDSS2</i>
<i>PDSS2</i>	10	<i>COQ2, COQ6, COQ9, DHDDS, FDPS, FDFT1, FNTA, FNTB, GGPS1, PDSS1</i>
<i>SLC22A7</i>	10	<i>ABCB11, ABCG2, ENSG00000257046, SLC10A1, SLC22A8, SLC01A2, SLC01B1, SLC01B3, SLC02B1, UCK2</i>
<i>SLC22A10</i>	10	<i>OR5AR1, OR10X1, SLC7A13, SLC28A1, SLC35G4P, SLC01A2, SLC01B7, SLC03A1, SLC04A1, SLC04C,</i>
<i>ADGRL4 (ELTD1)</i>	10	<i>CLEC14A, EMCN, GSTO1, KNG1, LGALS8, MYCT1, NAA10, NEUROD6, PHACTR1, ZNF366</i>
<i>SLC24A2</i>	10	<i>CNGA3, CRKL, GUCA1C, HHIP, KCNIP1, MAP3K4, RCVRN, SLC6A1, SH3GL2, TRIM4</i>
<i>TMEM196</i>	10	<i>BTBD17, CDCA7L, DNAH11, ITGB8, MACC1, RAPGEF5, SP4, TMEM63C, TMEM184C, TMEM207</i>

Supplementary Table 6.- Predicted interactions for “unconnected” non-driver genes on RPGeNet core network.

Non-driver genes can be unconnected to the core interactions whole-network graph because there are no known experimentally validated interactions that link them from the whole-graph network level to the rest of nodes at any level of the RPGeNet core network. Number of predicted interactions and putative interactors were retrieved from STRING database. The predicted interactions were not included into the whole core network on this release. The last three genes have self-interactions, while the others are connected only among them in pairs at the whole-graph level (as for instance, *DEFB106A* and *DEFB106B*).