

7_python

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1 Network data from OmniPath

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In this tutorial we show you how to query interactions from one of the many resources included in OmniPath, customize the data by interaction types, and further quality controls.

We'll start by importing libraries, first `omnipath`, and `pandas` for data wrangling.

```
[2]: import omnipath as op
import pandas as pd
```

OmniPath contains many resources we can choose to collate our desired network from. To browse the list available resources call the `op.interactions.AllInteractions.resources()` function.

```
[4]: op.interactions.AllInteractions.resources()
```

```
[4]: ('ABS',
      'ACSN',
      'ACSN_SignaLink3',
      'ARACNe-GTEx_DoRothEA',
      'ARN',
      'Adhesome',
      'AlzPathway',
      'BEL-Large-Corpus_ProtMapper',
      'Baccin2019',
      'BioGRID',
      'BioGRID_ICELLNET',
      'CA1',
      'CancerCellMap',
      'CellPhoneDB',
      'CellPhoneDB_ICELLNET',
      'DEPOD',
      'DIP',
      'DOMINO',
      'DeathDomain',
      'Dinarelllo2013_ICELLNET',
      'DoRothEA',
```

'DoRothEA-reviews_DoRothEA',
'ELM',
'EMBRACE',
'ENCODE-distal',
'ENCODE-proximal',
'ENCODE_tf-mirna',
'FANTOM4_DoRothEA',
'Fantom5_LRdb',
'GO-lig-rec_ICELLNET',
'Guide2Pharma',
'Guide2Pharma_CellPhoneDB',
'Guide2Pharma_ICELLNET',
'Guide2Pharma_LRdb',
'HOCOMOCO_DoRothEA',
'HPMR',
'HPMR_ICELLNET',
'HPMR_LRdb',
'HPRD',
'HPRD-phos',
'HPRD_KEA',
'HPRD_LRdb',
'HPRD_MIMP',
'HTRIdb',
'HTRIdb_DoRothEA',
'HuRI',
'I2D_CellPhoneDB',
'ICELLNET',
'IMEx_CellPhoneDB',
'InnateDB',
'InnateDB-All_CellPhoneDB',
'InnateDB_CellPhoneDB',
'InnateDB_ICELLNET',
'InnateDB_SignalLink3',
'IntAct',
'IntAct_CellPhoneDB',
'IntAct_DoRothEA',
'JASPAR_DoRothEA',
'KEA',
'KEGG-MEDICUS',
'Kinexus_KEA',
'Kirouac2010',
'Kirouac2010_ICELLNET',
'LMPID',
'LRdb',
'Li2012',
'Lit-BM-17',
'LncRNADisease',

'MIMP',
'MINT_CellPhoneDB',
'MPPI',
'Macrophage',
'Macrophage_ICELLNET',
'MatrixDB',
'MatrixDB_CellPhoneDB',
'NCI-PID_ProtMapper',
'NFIREgulomeDB_DoRothEA',
'NRF2ome',
'NetPath',
'NetworkKIN_KEA',
'ORegAnno',
'ORegAnno_DoRothEA',
'PAZAR',
'PAZAR_DoRothEA',
'PhosphoNetworks',
'PhosphoPoint',
'PhosphoSite',
'PhosphoSite_KEA',
'PhosphoSite_MIMP',
'PhosphoSite_ProtMapper',
'PhosphoSite_noref',
'ProtMapper',
'REACH_ProtMapper',
'RLIMS-P_ProtMapper',
'Ramilowski2015',
'Ramilowski2015_Baccin2019',
'Ramilowski2015_ICELLNET',
'ReMap_DoRothEA',
'Reactome_ICELLNET',
'Reactome_LRdb',
'Reactome_ProtMapper',
'Reactome_SignaLink3',
'RegNetwork_DoRothEA',
'SIGNOR',
'SIGNOR_ICELLNET',
'SIGNOR_ProtMapper',
'SPIKE',
'SPIKE_ICELLNET',
'STRING_ICELLNET',
'SignaLink3',
'SignaLink3_ICELLNET',
'Sparser_ProtMapper',
'TCRcuration_SignaLink3',
'TFactS_DoRothEA',
'TFe_DoRothEA',

```
'TRED_DoRothEA',
'TRIP',
'TRRD_DoRothEA',
'TRRUST_DoRothEA',
'TransmiR',
'UniProt_CellPhoneDB',
'UniProt_LRdb',
'Wang',
'dbPTM',
'iPTMnet',
'iTALK',
'lncrnadb',
'miR2Disease',
'miRDeathDB',
'miRTarBase',
'miRecords',
'ncRDeathDB',
'phosphoELM',
'phosphoELM_KEA',
'phosphoELM_MIMP')
```

OmniPath can serve multiple kinds of interactions, based on the quality of the interactors or the interactions themselves:

- `post_translational` i.e. physical interactions of proteins, protein-protein interactions (or PPIs)
- `transcriptional` i.e. gene regulatory interactions
- `post_transcriptional` i.e. miRNA-mRNA interactions
- `mirna_transcriptional` i.e. transcriptional regulation of miRNA genes

In the following code blocks we are going to query all of them, and show the URLs these queries generate, through which the data is also accessible, through a browser.

First, let's take a look at PPI interactions.

URL: <https://omnipathdb.org/interactions?genesymbols=yes&datasets=omnipath,pathwayextra,kinaseextra,ligre>

By default, this query returns data from the `omnipath` dataset, which means literature curated activity flow (directed, signed interactions in most cases, curation effort).

```
[20]: interactions = op.interactions.PostTranslational.get()
interactions
#
#RecursionError: maximum recursion depth exceeded
```

```
-----
RecursionError                                Traceback (most recent call last)
<ipython-input-20-69bc68e6b6bc> in <module>
----> 1 interactions = op.interactions.PostTranslational.get()
      2 interactions
```

```

3 #
4 #RecursionError: maximum recursion depth exceeded

~/miniconda3/lib/python3.7/site-packages/omnipath/_core/requests/_utils.py in
↳ wrapper(wrapped, _instance, args, kwargs)
    102     @wrapt.decorator(adapter=wrapt.adapter_factory(argspec_factory))
    103     def wrapper(wrapped, _instance, args, kwargs):
--> 104         return wrapped(*args, **kwargs)
    105
    106     if hasattr(clazz, "get") and not hasattr(clazz.get, "__wrapped__"):

~/miniconda3/lib/python3.7/site-packages/omnipath/_core/requests/interactions/
↳ _interactions.py in get(cls, exclude, **kwargs)
    432         %(get.returns)s
    433         """
--> 434         return cls(exclude=exclude).get(**kwargs)
    435
    436

... last 2 frames repeated, from the frame below ...

~/miniconda3/lib/python3.7/site-packages/omnipath/_core/requests/_utils.py in
↳ wrapper(wrapped, _instance, args, kwargs)
    102     @wrapt.decorator(adapter=wrapt.adapter_factory(argspec_factory))
    103     def wrapper(wrapped, _instance, args, kwargs):
--> 104         return wrapped(*args, **kwargs)
    105
    106     if hasattr(clazz, "get") and not hasattr(clazz.get, "__wrapped__"):

RecursionError: maximum recursion depth exceeded

```

We can include interactions without explicit literature references as well, by including the extra datasets `pathwayextra`, `kinaseextra`, or `ligreextra`.

To get just one of these extra sets, one can call the specific function for it:

URL <https://omnipathdb.org/interactions?genesymbols=yes&datasets=pathwayextra&organisms=9606&fields=>

```
[24]: interactions_pathwayextra = op.interactions.PathwayExtra.get()
interactions_pathwayextra
```

```
[24]:
```

	source	target \
0	P48995	Q13255
1	Q13255	P48995
2	P20591	Q9Y210
3	O60500	Q9Y210
4	Q13976	Q9Y210
...

41812		P52789		Q07812
41813		O15264		Q96BA8
41814	COMPLEX:P49023_Q05397_Q13418		COMPLEX:O43707_P18206_Q9Y4G6	
41815	COMPLEX:P29466_Q96P20_Q9ULZ3			P01584
41816		Q02750		O15264

	is_directed	is_stimulation	is_inhibition	consensus_direction	\
0	True	False	True	False	
1	True	True	False	True	
2	True	True	False	True	
3	True	True	False	True	
4	True	False	True	True	
...	
41812	True	False	True	True	
41813	True	True	False	True	
41814	True	True	False	True	
41815	True	True	False	True	
41816	True	True	False	False	

	consensus_stimulation	consensus_inhibition	dip_url	curation_effort	\
0	False	False	None	0	
1	True	False	None	1	
2	True	False	None	3	
3	True	False	None	2	
4	False	True	None	5	
...	
41812	False	True	None	0	
41813	True	False	None	0	
41814	True	False	None	0	
41815	True	False	None	0	
41816	False	False	None	0	

	references	\
0	NaN	
1	TRIP:14614461	
2	HPRD:15757897;Lit-BM-17:15757897;TRIP:15757897	
3	TRIP:15924139;TRIP:22155451	
4	PhosphoSite:19961855;PhosphoSite:23645677;Prot...	
...	...	
41812	NaN	
41813	NaN	
41814	NaN	
41815	NaN	
41816	NaN	

	sources	\
0	Wang	

```

1                                TRIP
2                                HPRD;Lit-BM-17;TRIP;Wang
3                                TRIP;Wang
4                                MIMP;PhosphoSite;PhosphoSite_MIMP;PhosphoSite_...
...
41812                            KEGG-MEDICUS
41813                            KEGG-MEDICUS
41814                            KEGG-MEDICUS
41815                            KEGG-MEDICUS
41816                            KEGG-MEDICUS

```

```

                                references_stripped n_references n_sources \
0                                None                None                1
1                                14614461           1                    1
2                                15757897           1                    4
3                                15924139;22155451       2                    2
4                                18617565;19961855;21402151;23645677;24740790 5                    9
...
41812                            None                None                1
41813                            None                None                1
41814                            None                None                1
41815                            None                None                1
41816                            None                None                1

```

```

n_primary_sources
0                    1
1                    1
2                    4
3                    2
4                    4
...
41812                1
41813                1
41814                1
41815                1
41816                1

```

[41817 rows x 16 columns]

```

[26]: interactions_pathwayextra_citations = interactions_pathwayextra[
interactions_pathwayextra['curation_effort'] >= 7
]
interactions_pathwayextra_citations

```

```

[26]: source target is_directed is_stimulation is_inhibition \
7      P12931 Q8NER1      True          True          False
14     P49137 Q16539      True          True          False

```

15	Q16539	P49137	True	True	False
16	O60674	P19235	True	True	False
17	P19235	O60674	True	True	False
...
40511	Q16665	P17948	True	True	False
40573	P27540	Q15672	True	True	False
40743	Q9UJX5	O95997	True	True	True
41009	Q9UJU2	O43623	True	True	False
41050	P49841	Q00534	True	False	True

	consensus_direction	consensus_stimulation	consensus_inhibition	\
7	True	True	False	
14	False	False	False	
15	True	True	False	
16	True	True	False	
17	False	False	False	
...	
40511	True	True	False	
40573	True	True	False	
40743	True	True	False	
41009	True	True	False	
41050	True	False	True	

	dip_url	curation_effort	\
7	None	8	
14	None	24	
15	None	60	
16	None	19	
17	None	8	
...	
40511	None	15	
40573	None	21	
40743	None	19	
41009	None	19	
41050	None	13	

	references	\
7	PhosphoSite:16319926;ProtMapper:16319926;ProtM...	
14	BioGRID:17395714;ELM:23047924;ELM:25255283;HPR...	
15	ACSN:11274345;ACSN:12738796;ACSN:15187187;ACSN...	
16	BioGRID:8343951;HPRD-phos:12441334;HPRD:117795...	
17	BioGRID:8343951;HPRD:11779507;HPRD:12441334;HP...	
...	...	
40511	ACSN:10403805;ACSN:11528470;ACSN:11566883;ACSN...	
40573	ACSN:10403805;ACSN:11566883;ACSN:12080085;ACSN...	
40743	ACSN:10477750;ACSN:11402067;ACSN:11535616;ACSN...	
41009	ACSN:11955436;ACSN:11967263;ACSN:12051714;ACSN...	

41050 ACSN:10385618;ACSN:10486203;ACSN:11124803;ACSN...

```

sources \
7      MIMP;NCI-PID_ProtMapper;PhosphoSite;PhosphoSit...
14     BioGRID;ELM;HPRD;InnateDB;IntAct;Lit-BM-17;Pho...
15     ACSN;BEL-Large-Corpus_ProtMapper;BioGRID;CA1;E...
16     BEL-Large-Corpus_ProtMapper;BioGRID;HPRD;HPRD-...
17     BioGRID;HPRD;Signalink3;Wang
...
40511  ACSN;Wang
40573  ACSN;Wang
40743  ACSN;Wang
41009  ACSN;Wang
41050  ACSN;Wang
```

```

references_stripped n_references \
7      15084474;16319926;17582331;24717323;25970319;3...      6
14     10581204;10922375;11042204;17255097;17395714;2...      18
15     10581204;10922375;11042204;11274345;11551945;1...      34
16     10579919;10660611;11443118;11779507;12027890;1...      12
17     11779507;12441334;18160720;23331499;8343951          5
...
40511  10403805;11528470;11566883;12080085;12829734;1...      15
40573  10403805;11566883;12080085;12829734;13130303;1...      21
40743  10477750;11402067;11535616;12640463;15024386;1...      19
41009  11955436;11967263;12051714;12490555;14623871;1...      19
41050  10385618;10486203;11124803;11152665;12459251;1...      13
```

```

n_sources  n_primary_sources
7          10                5
14         8                 8
15        35                23
16        20                12
17         4                 4
...
40511     2                  2
40573     2                  2
40743     2                  2
41009     2                  2
41050     2                  2
```

[3426 rows x 16 columns]

We can use these properties to further specify our queries, for example on curation effort. The `curation_effort` value we filtered our query on shows the unique database - citation pairs, i.e. how many times was an interaction described in a paper and mentioned in a database.

To get all PPI interactions call `interactions.AllInteractions`. By default only directed inter-

actions are included, but we can include a flag to import undirected interactions as well.

URL: <https://omnipathdb.org/interactions?genesymbols=yes&fields=sources,references&datasets=omnipath,path>

```
[35]: op.interactions.AllInteractions.get(directed = False, organism = 'human')
```

```
HBox(children=(HTML(value=''), FloatProgress(value=1.0, bar_style='info',  
↳ layout=Layout(width='20px'), max=1.0...
```

```
/Users/olbeim/miniconda3/lib/python3.7/site-  
packages/omnipath/_core/requests/interactions/_interactions.py:377:  
DtypeWarning: Columns (8) have mixed types.Specify dtype option on import or set  
low_memory=False.
```

```
return cls(include, exclude=exclude)._get(**kwargs)
```

```
[35]:
```

	source	target	is_directed	is_stimulation	is_inhibition	\
0	P0DP24	P48995	True	False	True	
1	Q03135	P48995	True	True	False	
2	P14416	P48995	True	True	False	
3	Q02790	P48995	True	False	True	
4	P48995	Q86YM7	False	False	False	
...	
176859	UCA1	P49715	True	False	False	
176860	UCA1	Q16665	True	False	False	
176861	URH	Q9NYL2	True	False	False	
176862	Xist	P26358	True	False	False	
176863	Xist	Q01860	True	False	False	

	consensus_direction	consensus_stimulation	consensus_inhibition	\
0	True	False	True	
1	True	True	False	
2	True	True	False	
3	True	False	True	
4	False	False	False	
...	
176859	False	False	False	
176860	False	False	False	
176861	False	False	False	
176862	False	False	False	
176863	False	False	False	

	dip_url	curation_effort	\
0	None	3	
1	http://dip.doe-mbi.ucla.edu/dip/DIPview.cgi?IK...	13	
2	None	1	
3	None	3	
4	None	4	

...
176859	None	1
176860	None	1
176861	None	1
176862	None	1
176863	None	1

	references \
0	TRIP:11290752;TRIP:11983166;TRIP:12601176
1	DIP:19897728;HPRD:12732636;IntAct:19897728;Lit...
2	TRIP:18261457
3	TRIP:15199065;TRIP:19945390;TRIP:23228564
4	HPRD:14505576;TRIP:14505576;TRIP:16905188;TRIP...

...	...
176859	ncRDeathDB:24648007
176860	ncRDeathDB:24737584
176861	ncRDeathDB:25013376
176862	ncRDeathDB:8769643
176863	ncRDeathDB:24945968

	sources	type \
0	TRIP	post_translational
1	DIP;HPRD;IntAct;Lit-BM-17;TRIP	post_translational
2	TRIP	post_translational
3	TRIP	post_translational
4	HPRD;TRIP	post_translational

...
176859	ncRDeathDB	lncrna_post_transcriptional
176860	ncRDeathDB	lncrna_post_transcriptional
176861	ncRDeathDB	lncrna_post_transcriptional
176862	ncRDeathDB	lncrna_post_transcriptional
176863	ncRDeathDB	lncrna_post_transcriptional

	references_stripped	n_references \
0	11290752;11983166;12601176	3
1	10980191;12732636;14551243;16822931;18430726;1...	8
2	18261457	1
3	15199065;19945390;23228564	3
4	14505576;16905188;22506990	3

...
176859	24648007	1
176860	24737584	1
176861	25013376	1
176862	8769643	1
176863	24945968	1

n_sources n_primary_sources

```

0          1          1
1          5          5
2          1          1
3          1          1
4          2          2
...
176859    ...      ...      1
176860    1          1
176861    1          1
176862    1          1
176863    1          1

```

[176864 rows x 17 columns]

The other interaction types have their own built-in functions as well. This query accesses interactions from DoRothEA, from confidence levels A to D, from highest to lowest. It is set to pull out A and B by default, but naturally we can extend it.

URL: https://omnipathdb.org/interactions?genesymbols=yes&fields=sources,references&datasets=dorothea,tf_ta

```
[38]: op.interactions.Transcriptional.get(dorothea_levels = ["A","B","C"], organism =
      ↪ 'human')
```

```
HBox(children=(HTML(value=''), FloatProgress(value=1.0, bar_style='info',
      ↪ layout=Layout(width='20px'), max=1.0...
```

```
[38]:
      source target is_directed is_stimulation \
0      Q9H2P0 Q6VMQ6      True      False
1      Q9H2P0 Q13627      True      False
2      Q9H2P0 Q9UKI8      True      False
3      Q9H2P0 Q5VZL5      True      False
4      P35869 Q53QZ3      True      False
...
90135      COMPLEX:P15336 P12004      True      True
90136 COMPLEX:P01106_Q92993_Q9Y4A5 P30279      True      True
90137      COMPLEX:000268_Q8TEY5 Q9UBK2      True      True
90138      Q14934 P35354      True      True
90139      COMPLEX:P03372_Q15596 P08727      True      True

      is_inhibition consensus_direction consensus_stimulation \
0      False      False      False
1      False      False      False
2      False      False      False
3      False      False      False
4      False      False      False
...
90135      False      True      True
```

90136	False	True	True
90137	False	True	True
90138	False	True	True
90139	False	True	True

	consensus_inhibition	dip_url	curation_effort	references	\
0	False	None	0	NaN	
1	False	None	0	NaN	
2	False	None	0	NaN	
3	False	None	0	NaN	
4	False	None	0	NaN	
...	
90135	False	None	0	NaN	
90136	False	None	0	NaN	
90137	False	None	0	NaN	
90138	False	None	0	NaN	
90139	False	None	0	NaN	

	sources	references_stripped	n_references	\
0	ARACNe-GTEx_DoRothEA;ReMap_DoRothEA	None	None	
1	ARACNe-GTEx_DoRothEA;ReMap_DoRothEA	None	None	
2	ARACNe-GTEx_DoRothEA;ReMap_DoRothEA	None	None	
3	ARACNe-GTEx_DoRothEA;ReMap_DoRothEA	None	None	
4	ARACNe-GTEx_DoRothEA;ReMap_DoRothEA	None	None	
...	
90135	KEGG-MEDICUS	None	None	
90136	KEGG-MEDICUS	None	None	
90137	KEGG-MEDICUS	None	None	
90138	KEGG-MEDICUS	None	None	
90139	KEGG-MEDICUS	None	None	

	n_sources	n_primary_sources
0	2	0
1	2	0
2	2	0
3	2	0
4	2	0
...
90135	1	1
90136	1	1
90137	1	1
90138	1	1
90139	1	1

[90140 rows x 16 columns]

To access `post_transcriptional` and `mirna_transcriptional` interactions, we can utilise their respective functions, or call the corresponding URLs:

- miRNA - mRNA <https://omnipathdb.org/interactions?genesymbols=yes&datasets=mirnatarget&organisms=9606>
- TF - miRNA: https://omnipathdb.org/interactions?genesymbols=yes&datasets=tf_mirna&organisms=9606

```
[39]: op.interactions.TFmiRNA.get()
```

```
HBox(children=(HTML(value=''), FloatProgress(value=1.0, bar_style='info',
↳ layout=Layout(width='20px'), max=1.0...
```

```
[39]:
```

	source	target	is_directed	is_stimulation	is_inhibition	\
0	Q9UKV8	MIMAT0000646	True	False	True	
1	Q9UKV8	MIMAT0004658	True	False	True	
2	P35869	MIMAT0004672	True	True	False	
3	P35869	MIMAT0000680	True	True	False	
4	P35869	MIMAT0004594	True	True	False	
...	
4974	Q15545	MIMAT0000075	True	False	False	
4975	O60216	MIMAT0005867	True	False	False	
4976	P23511	MIMAT0003308	True	False	False	
4977	P15408	MIMAT0005867	True	False	False	
4978	Q12824	MIMAT0004491	True	False	False	

	consensus_direction	consensus_stimulation	consensus_inhibition	\
0	True	False	True	
1	True	False	True	
2	True	True	False	
3	True	True	False	
4	True	True	False	
...	
4974	False	False	False	
4975	False	False	False	
4976	False	False	False	
4977	False	False	False	
4978	False	False	False	

	dip_url	curation_effort	references	\
0	None	1	TransmiR:24263100	
1	None	1	TransmiR:24263100	
2	None	1	TransmiR:24798859	
3	None	1	TransmiR:24798859	
4	None	2	TransmiR:25617893;TransmiR:26377202	
...	
4974	None	0	NaN	
4975	None	0	NaN	
4976	None	0	NaN	
4977	None	0	NaN	
4978	None	0	NaN	

	sources	references_stripped	n_references	n_sources	\
0	TransmiR	24263100	1	1	
1	TransmiR	24263100	1	1	
2	TransmiR	24798859	1	1	
3	TransmiR	24798859	1	1	
4	TransmiR	25617893;26377202	2	1	
...	
4974	ENCODE_tf-mirna	None	None	1	
4975	ENCODE_tf-mirna	None	None	1	
4976	ENCODE_tf-mirna	None	None	1	
4977	ENCODE_tf-mirna	None	None	1	
4978	ENCODE_tf-mirna	None	None	1	

	n_primary_sources
0	1
1	1
2	1
3	1
4	1
...	...
4974	0
4975	0
4976	0
4977	0
4978	0

[4979 rows x 16 columns]

```
[40]: op.interactions.miRNA.get()
```

```
HBox(children=(HTML(value=''), FloatProgress(value=1.0, bar_style='info',
↪ layout=Layout(width='20px'), max=1.0...
```

```
[40]:
```

	source	target	is_directed	is_stimulation	is_inhibition	\
0	MIMAT0000062	P01116	True	False	False	
1	MIMAT0000062	P52926	True	False	False	
2	MIMAT0000062	P10415	True	False	False	
3	MIMAT0000062	P01106	True	False	False	
4	MIMAT0000062	P30304	True	False	False	
...	
8273	MIMAT0000617	Q13526	True	False	False	
8274	MIMAT0000451	Q9NSE2	True	False	False	
8275	MIMAT0000416	Q12797	True	False	False	
8276	MIMAT0000449	Q96LI5	True	False	False	
8277	MIMAT0000256	Q14746	True	False	False	

	consensus_direction	consensus_stimulation	consensus_inhibition	\
0	False	False	False	
1	False	False	False	
2	False	False	False	
3	False	False	False	
4	False	False	False	
...	
8273	False	False	False	
8274	False	False	False	
8275	False	False	False	
8276	False	False	False	
8277	False	False	False	

	dip_url	curation_effort	\
0	None	5	
1	None	9	
2	None	0	
3	None	2	
4	None	0	
...	
8273	None	1	
8274	None	1	
8275	None	1	
8276	None	1	
8277	None	1	

	references	\
0	miRTarBase:15766527;miRTarBase:16651716;miRTar...	
1	miRTarBase:17322030;miRTarBase:17600087;miRTar...	
2	NaN	
3	miRTarBase:16651716;miRTarBase:20033209	
4	NaN	
...	...	
8273	miRTarBase:24786790	
8274	miRTarBase:23723424	
8275	miRTarBase:23723006	
8276	miRTarBase:23591815	
8277	miRTarBase:25444904	

	sources	\
0	miR2Disease;miRTarBase;miRecords;ncRDeathDB	
1	miR2Disease;miRTarBase;miRecords;ncRDeathDB	
2	miR2Disease	
3	miR2Disease;miRTarBase	
4	miR2Disease	
...	...	


```

8273          miRTarBase
8274          miRTarBase
8275          miRTarBase
8276          miRTarBase
8277          miRTarBase

          references_stripped n_references \
0          15766527;16651716;20033209;24092860          4
1    17322030;17554199;17600087;18083101;18413822;1...          8
2          None          None
3          16651716;20033209          2
4          None          None
...          ...          ...
8273          24786790          1
8274          23723424          1
8275          23723006          1
8276          23591815          1
8277          25444904          1

          n_sources  n_primary_sources
0          4          4
1          4          4
2          1          1
3          2          2
4          1          1
...          ...          ...
8273          1          1
8274          1          1
8275          1          1
8276          1          1
8277          1          1

```

[8278 rows x 16 columns]

In this tutorial we learned:

- The various interaction types in `OmniPath`
- The differences between the encoded interaction types
- How to access and query these interaction types