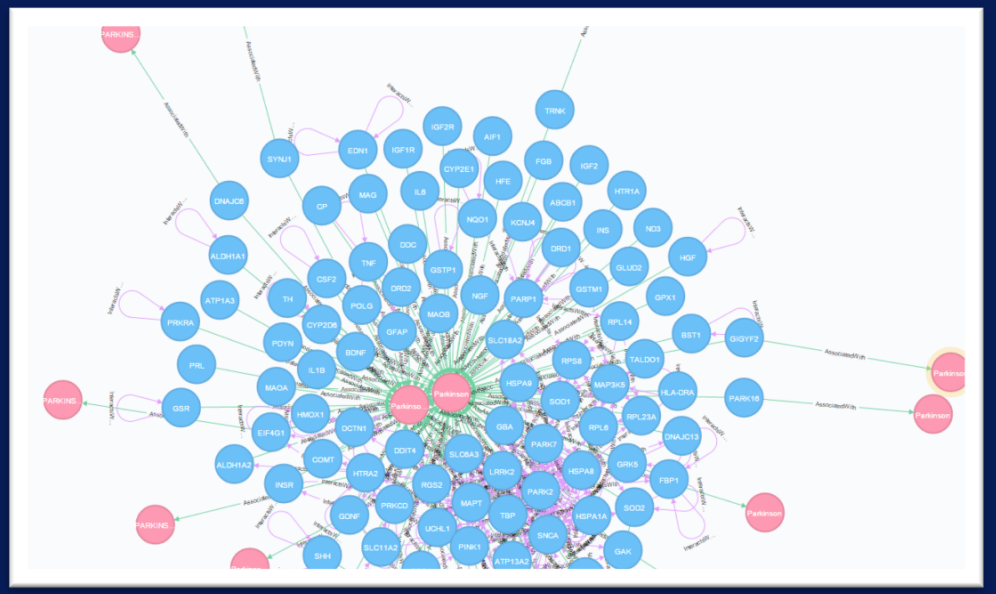
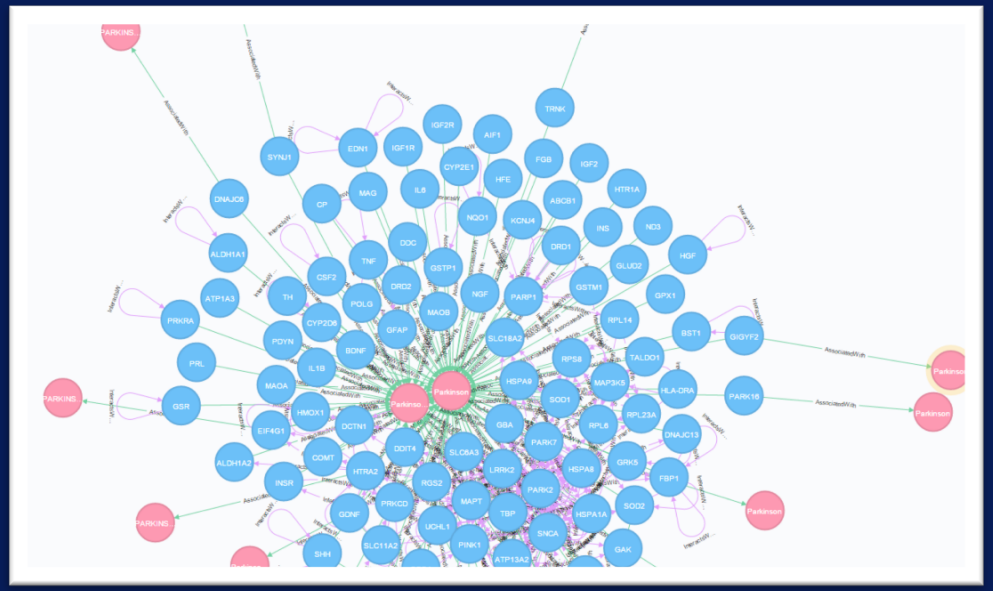

Why Graphs?
Example 2: Biology

Biological Entities Interact

- **Networks arising from**
  - Experimental observations
    - Gene-protein relationships
    - Gene-gene interactions
    - Cell-cell signaling
    - Gene-phenotype-disease relationships
  - Human Knowledge



Biological Entities Interact



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    - Anatomical knowledge

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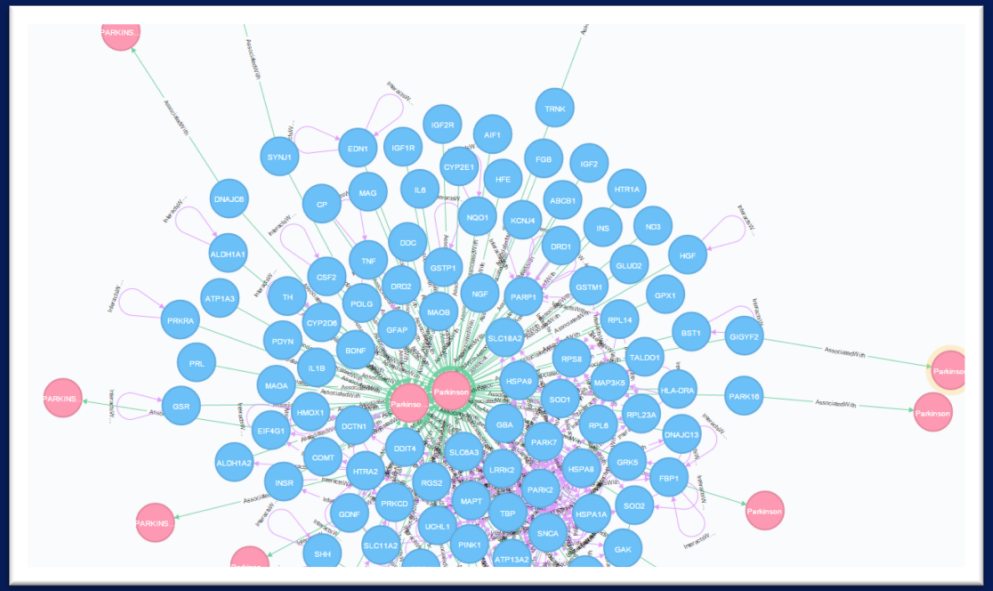

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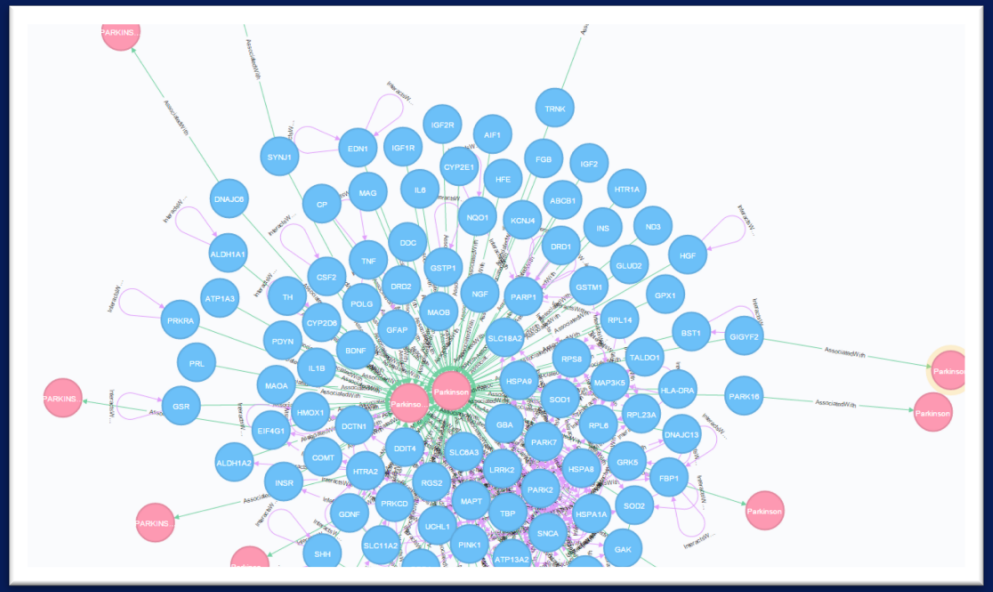
    - Anatomical knowledge
    - Taxonomy of the animal kingdom …

Computed Relations

- **Networks arising from**
  - Computational Techniques
    - Bioinformatics algorithms
    - Literature mining

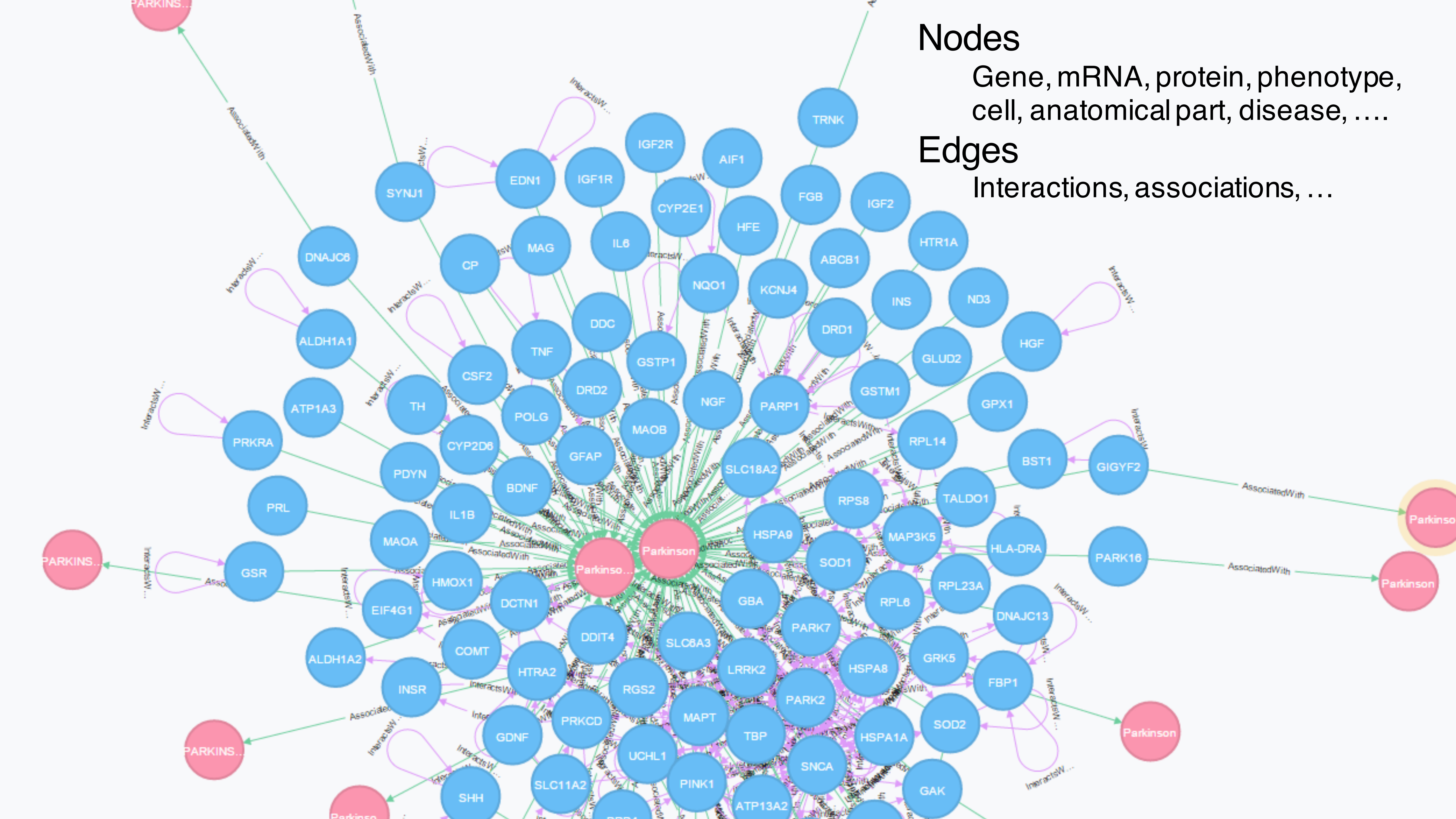


Nodes

Gene, mRNA, protein, phenotype, cell, anatomical part, disease, ….

Edges

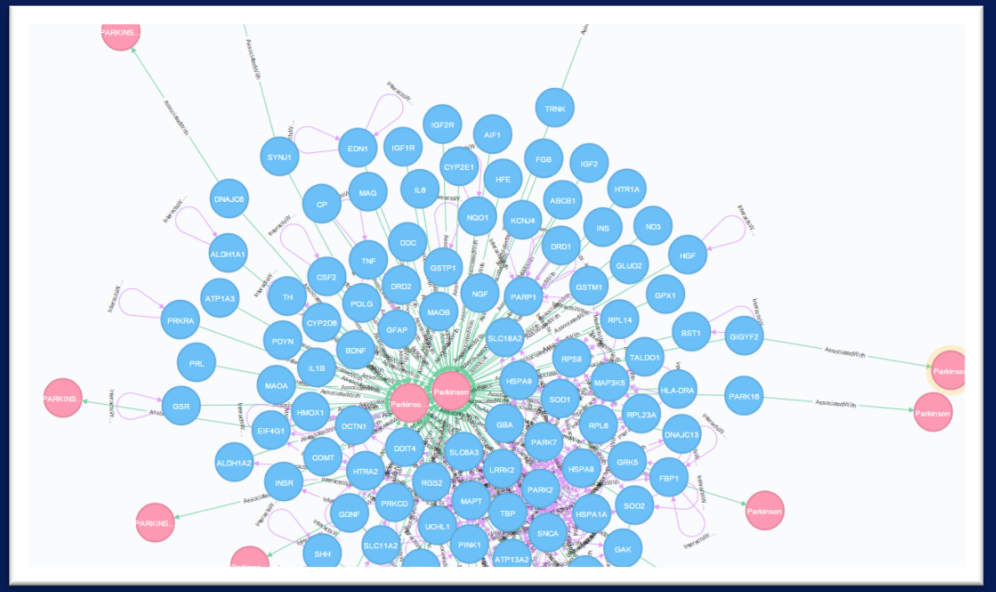
Interactions, associations, …



PARKINS...
TRNK
IGF2R
AIF1
EDN1
IGF1R
SYNJ1
CYP2E1
FGB
IGF2
HFE
MAG
IL6
CP
DNAJC6
NQO1
KCNJ4
ABCB1
HTR1A
INS
ND3
DRD1
ALDH1A1
DDC
TNF
GSTP1
GLUD2
HGF
CSF2
DRD2
NGF
PARP1
GSTM1
ATP1A3
TH
POLG
MAOB
GPX1
PRKRA
CYP2D6
GFAP
SLC18A2
RPL14
BST1
GIGYF2
PDYN
BDNF
RPS8
TALDO1
PRL
IL1B
HSPA9
MAP3K5
HLA-DRA
PARK16
Parkinson
MAOA
Parkinson
Parkinso...
SOD1
PARKINS...
GSR
HMOX1
DCTN1
GBA
RPL6
RPL23A
EIF4G1
PARK7
DNAJC13
DDIT4
SLC6A3
ALDH1A2
COMT
LRRK2
HSPA8
GRK5
HTRA2
FBP1
INSR
RGS2
PARK2
PRKCD
MAPT
TBP
HSPA1A
SOD2
PARKINS...
GDNF
UCHL1
SNCA
SHH
SLC11A2
PINK1
ATP13A2
GAK
AssociatedWith
InteractsW...

Data Integration

- Data sets must be assembled
- More data integration = larger data volume



Why Graphs?

- Discovering Unknown Relationships
  - Connecting the dots
    - Indirect associations between diseases
    - Exploratory analysis