## **Data Model**

BioNetDB models biology data as a network of nodes and relations. Biology data comes from different formats and sources it comprises system biology data from Reactome, annotation data from CellBase and human genetic variations from healthcare centers' clinical data. BioNetDB relies on Neo4j graph database that allows users to access biological data using the Cypher query language (similar to SQL in relational databases).

The figure below shows BioNetDB nodes with their labels. for clarity, some labels have been shortened:

#### FAMILY CLINICAL DRUG RNA DNA COMPLEX PATHWAY REGULATION CATALYSIS REACTION CEL. LOCAT. DATA DNA SAMPLE XREF FILE target VARIANT CALL COMPON. OF PATHWAY NEX CONTROLLER CONTROLLED PRODUCT REACTANT TRANSCR MIRNA VARIANT TFBS PROTEIN CONSER REACTOME XREF KEYWOR

Shortened labes in the previous figure:

Shortened label	Node label
<sup>1</sup> POPUL. FREQUEN	POPULATION_FREQUENCY
<sup>2</sup> FUNCT. SCORE	FUNCTIONAL_SCORE
<sup>3</sup> TRAIT ASSOCIA.	TRAIT_ASSOCIATION
<sup>4</sup> CONSEQ. TYPE	CONSEQUENCE_TYPE
<sup>5</sup> PROTEIN VAR. ANNOT.	PROTEIN_VARIANT_ANNOTATION
<sup>6</sup> SUBST. SCORE	SUBSTITUTION_SCORE
<sup>7</sup> KEYWORD	PROTEIN_KEYWORD
<sup>8</sup> FEATURE	PROTEIN_FEATURE

# Modelling

This section lists the main nodes of the BioNetDB network data model and for each of them, its properties and relationships are shown.

#### Genes

Gene node properties:

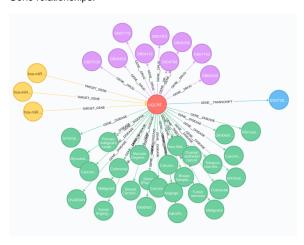
- uid
- id
- name
- chromosome
- start
- end
- strand
- biotype

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- description:source
- sourcestatus

#### Gene relationships:



## **Transcripts**

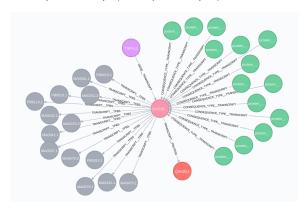
Transcript node properties:

- uid id

- namebiotype
- chromosome
- start
- end

- end
  strand
  proteinId
  genomicCodingEnd
  genomicCodingStart
  annotationFlags
  cdnaCodingEnd
  cdnaCodingStart
  cdsLength
  description
  status

Transcript relationships (transcript node in pink):



### **Proteins**

Protein node properties:

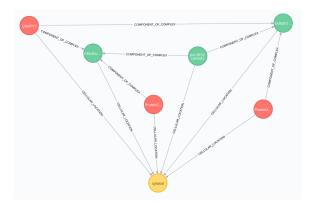
- uididname
- accession
- dataset

- evidenceproteinExistence

#### Protein relationships:



### **Protein complex**



### Variants

Variant node properties:

- uid id
- name
- chromosomestart

- endstrand
- type

- alternate reference alternativeNames

#### Variant relationships:



## Regulation

Regulation node properties:

- uididname

### Regulation relationships:



## Pathway

Pathway node properties:

- uididname

Pathway relationships (pathway nodes in yellow):

