
Proposal: Towards Apoptosis Ontology?

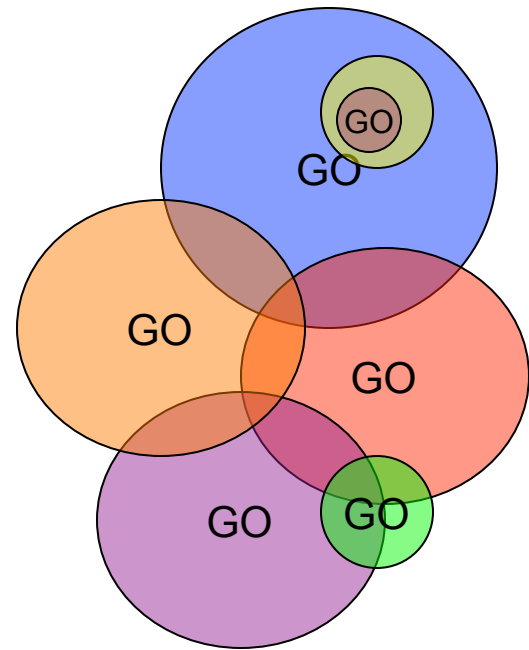
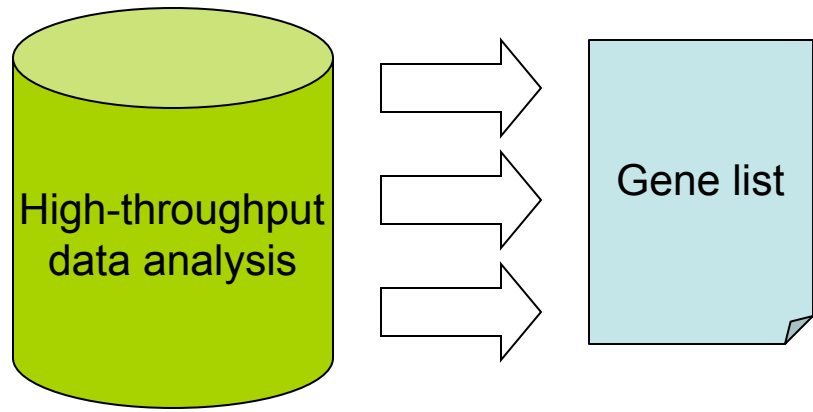
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“Computational Systems Biology of Cancer”

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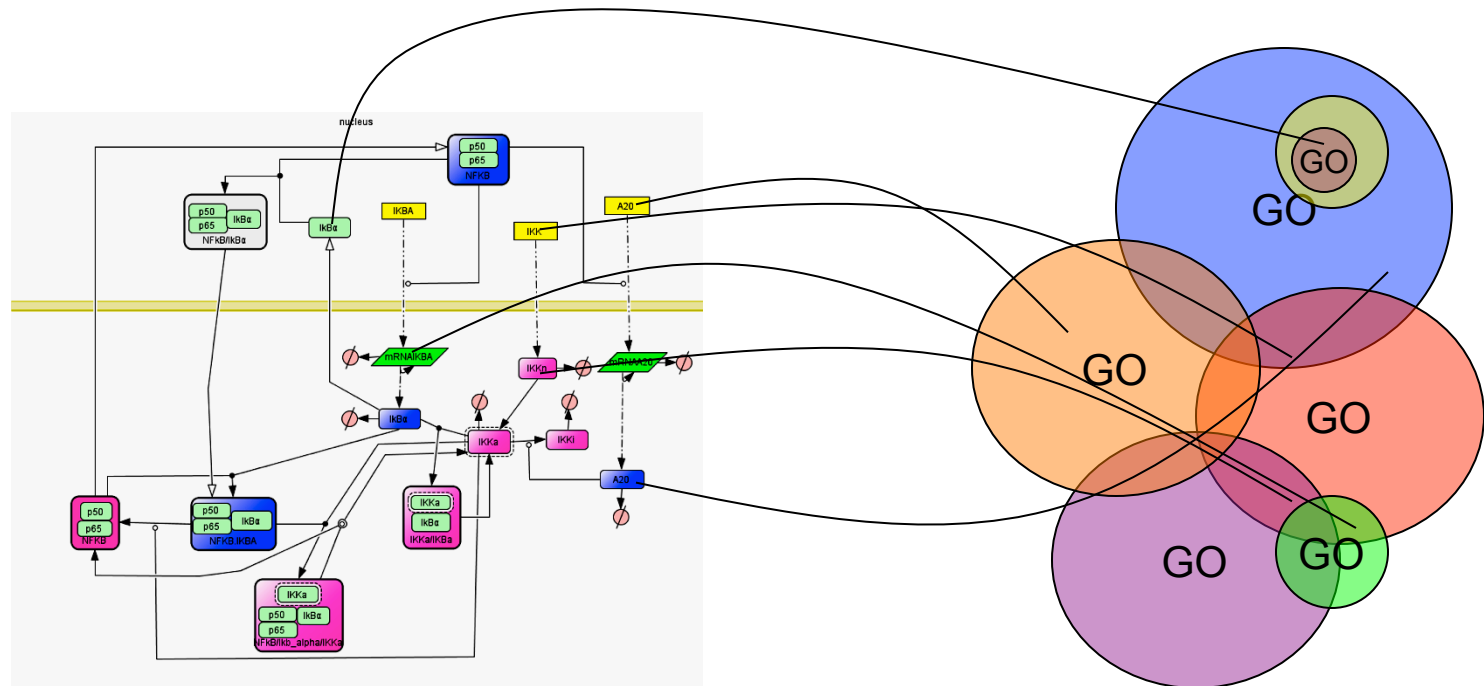
<http://bioinfo.curie.fr/sysbio>

Functional annotation of high-throughput data



Gene Ontology:
Set of terms and their relations +
Association of individual genes to terms

Annotation of mathematical models



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- Gene Ontology resource is an important and most used bridge between the world of biology and the world of bioinformatics/mathematical modeling
 - Question: how adequate cell death modalities are represented in GO (needed for all data analysis in APO-SYS)?

Gene Ontology resource for cell death

[-] I GO:0008219 : cell death [2802 gene products]

[+] I GO:0019835 : cytolysis [46 gene products]

[+] I GO:0070265 : necrotic cell death [12 gene products]

[+] R GO:0060548 : negative regulation of cell death [944 gene products]

[+] G GO:0010942 : positive regulation of cell death [950 gene products]

[+] I GO:0012501 : programmed cell death [2592 gene products]

[+] R GO:0010941 : regulation of cell death [1982 gene products]

[+] I GO:0070266 : necroptosis [0 gene products]

[+] R GO:0060547 : negative regulation of necrotic cell death [0 gene products]

[+] P GO:0070267 : oncosis [2 gene products]

[+] G GO:0010940 : positive regulation of necrotic cell death [5 gene products]

[+] R GO:0010939 : regulation of necrotic cell death [5 gene products]

FADD, FASL, TNF,
RIPK1, TMEM123

necroptosis	
Term information • Term lineage • External references • 0 gene product associations •	
Term Information	
Accession	GO:0070266
Ontology	biological process
Synonyms	exact: programmed necrotic cell death
Definition	A necrotic cell death process that results from the activation of endogenous cellular processes, such as signaling involving death domain receptors and Toll-like receptors. [source: GOC:mah, PMID:18846107]
Comment	None
Subset	None
Community	There have been 0 comments for this term. If you would like to view or participate in the community annotation, please continue to the GONUTS page .

Gene Ontology resource for cell death

GO:0012501 : programmed cell death [2592 gene products]

GO:0006915 : apoptosis [2324 gene products]

GO:0048102 : autophagic cell death [80 gene products]

GO:0070268 : cornification [0 gene products]

GO:0010623 : developmental programmed cell death [63 gene products]

GO:0034050 : host programmed cell death induced by symbiont [39 gene products]

GO:0010421 : hydrogen peroxide-mediated programmed cell death [4 gene products]

GO:0070270 : mitotic catastrophe [0 gene products]

GO:0043069 : negative regulation of programmed cell death [942 gene products]

GO:0043068 : positive regulation of programmed cell death [945 gene products]

GO:0070269 : pyroptosis [0 gene products]

GO:0043067 : regulation of programmed cell death [1977 gene products]

GO:0010343 : singlet oxygen-mediated programmed cell death [1 gene products]

GO:0052433 : modulation by organism of apoptosis in other organism during

GO:0043066 : negative regulation of apoptosis [907 gene products]

GO:0043065 : positive regulation of apoptosis [894 gene products]

GO:0043281 : regulation of caspase activity [204 gene products]

GO:0034350 : regulation of glial cell apoptosis [1 gene product]

GO:0070228 : regulation of lymphocyte apoptosis [24 gene products]

GO:0010660 : regulation of muscle cell apoptosis [15 gene products]

GO:0033032 : regulation of myeloid cell apoptosis [21 gene products]

GO:0043523 : regulation of neuron apoptosis [212 gene products]

GO:0045477 : regulation of nurse cell apoptosis [5 gene products]

GO:0006919 : activation of caspase activity [127 gene products]

GO:0008633 : activation of pro-apoptotic gene products [43 gene products]

GO:0043276 : anoikis [0 gene products]

GO:0070059 : apoptosis in response to endoplasmic reticulum stress [9 gene products]

GO:0060561 : apoptosis involved in morphogenesis [4 gene products]

GO:0008637 : apoptotic mitochondrial changes [75 gene products]

GO:0030262 : apoptotic nuclear changes [77 gene products]

GO:0006921 : cell structure disassembly during apoptosis [73 gene products]

GO:0034349 : glial cell apoptosis [1 gene product]

GO:0006925 : inflammatory cell apoptosis [5 gene products]

GO:0070227 : lymphocyte apoptosis [46 gene products]

GO:0010657 : muscle cell apoptosis [15 gene products]

GO:0033028 : myeloid cell apoptosis [26 gene products]

GO:0043066 : negative regulation of apoptosis [907 gene products]

GO:0051402 : neuron apoptosis [235 gene products]

GO:0045476 : nurse cell apoptosis [8 gene products]

GO:0001552 : ovarian follicle atresia [2 gene products]

GO:0043065 : positive regulation of apoptosis [894 gene products]

GO:0042981 : regulation of apoptosis [1885 gene products]

GO:0006927 : transformed cell apoptosis [12 gene products]

GO:0006926 : virus-infected cell apoptosis [8 gene products]

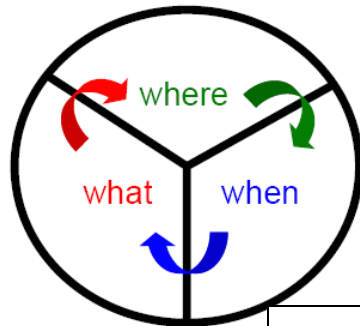
Gene Ontology resource

- Some limitations of GO:
 - Disease associated functions is out of the scope of GO
 - Molecular interactions are out of the scope of GO
 - Environment and expression are out of the scope of GO
 - GO only considers subsumption (is_a) and partonomic inclusion (part_of)

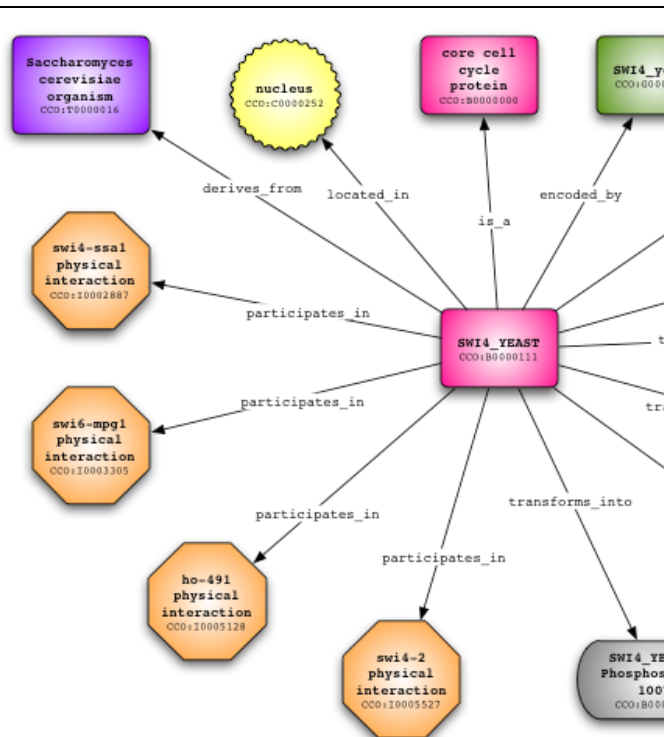
Cell Cycle Ontology (CCO) (FP6 project DIAMONDS)

<http://www.cellcycleontology.org>

Sample: “Cyclin B (*what*) is located in Cytoplasm (*where*) during Interphase (*when*)”



- What is a X-type **CDK**?
- What is Y-type **cyclin**?
- In what events is **CDK Z** involved?
- In what events does **Rb** participate?
- Which **CDKs** are involved in the endoreduplication process?



Software

Highly accessed

Open Access

The Cell Cycle Ontology: an application ontology for the representation and integrated analysis of the cell cycle process

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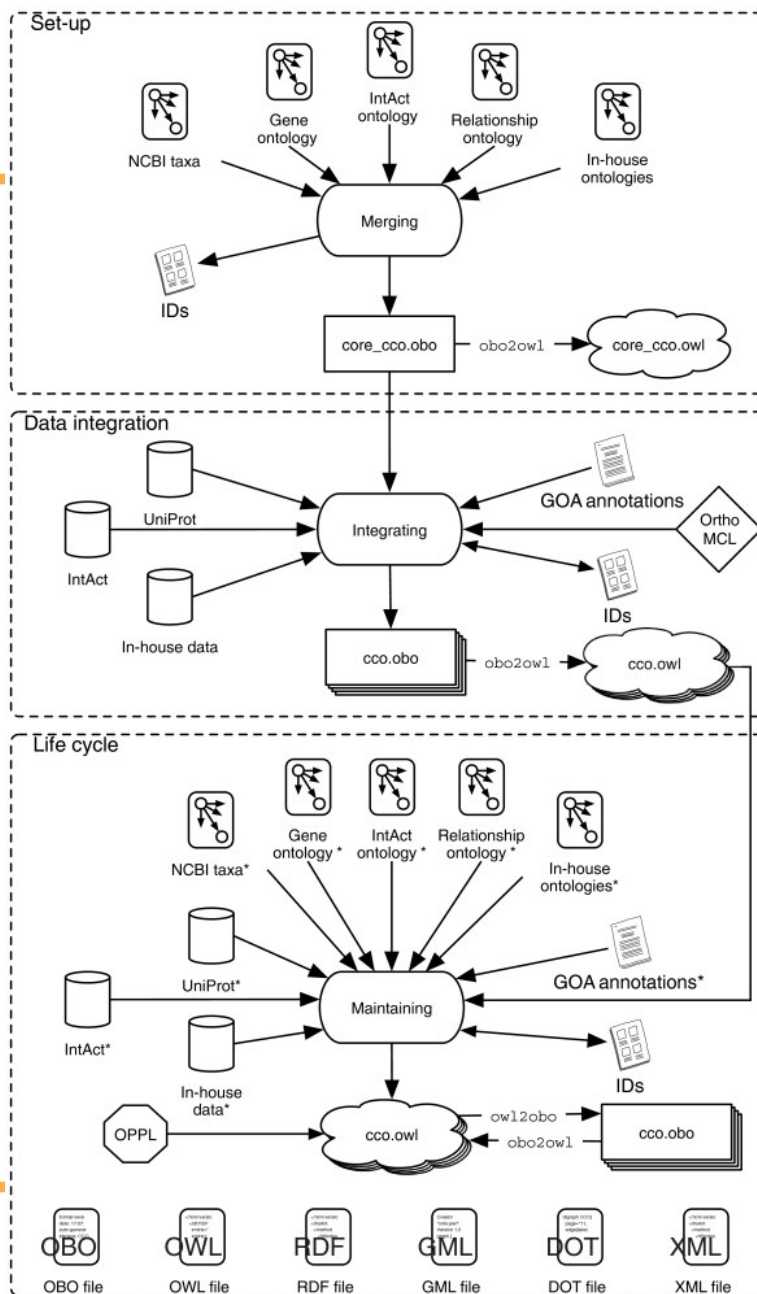
The electronic version of this article is the complete one and can be found online at: <http://genomebiology.com/2009/10/5/R58>

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From Antezana et al., 2009

Protégé software

biopax-level2.owl (http://www.biopax.org/release/biopax-level2.owl) - [C:\Data\BinomTest\Apoptosis.owl]

File Edit Ontologies Reasoner Tools Refactor Tabs View Window Help

Active Ontology Entities Classes Object Properties Data Properties Individuals OWL Viz DL Query

Individuals Individuals By Class

Individuals by class: BIM_BCL_xl_mitochondrial_outer_membrane_1

- complex (48)
 - Activated_BAX_mitochondrial_outer_membrane_1
 - Active_BAK_mitochondrial_outer_membrane_1
 - Active_Caspase_7_cytosol_1
 - Active_caspase_3_cytosol_1
 - Apaf_1_Cytochrome_C_cytosol_1
 - Apoptosome_cytosol_1
 - BAD_BCL_2_mitochondrial_outer_membrane_1
 - BAD_BCL_xl_mitochondrial_outer_membrane_1
 - BIM_BCL2_mitochondrial_outer_membrane_1
 - BIM_BCL_xl_mitochondrial_outer_membrane_1
 - BIM_sequestered_to_dynein_DLC1_plasma_membrane_1
 - BMF_sequestered_to_dynein_DLC2_plasma_membrane_1
 - Calcineurin_B_complex_cytosol_1
 - Caspase_8_dimer_cytosol_1
 - Cleaved_Caspase_9_cytosol_1
 - Cytochrome_C_Apaf_1_Procaspase_9_cytosol_1
 - DP_1_E2F1_complex_nucleoplasm_1
 - FASL_FAS_Receptor_Trimer_FADD_complex_plasma_membrane_1
 - FASL_FAS_Receptor_Trimer_FADD_pro_Caspase_10_plasma_membrane_1
 - FASL_FAS_Receptor_Trimer_FADD_pro_Caspase_8_DISC_plasma_membrane_1
 - FASL_FAS_Receptor_Trimer_plasma_membrane_1
 - FASL_FAS_Receptor_monomer_plasma_membrane_1
 - NOXA_BCL2_mitochondrial_outer_membrane_1
 - NOXA_BCL_xl_mitochondrial_outer_membrane_1
 - PUMA_Bcl_2_complex_mitochondrial_outer_membrane_1
 - PUMA_Bcl_XL_complex_mitochondrial_outer_membrane_1
 - SMAC_XIAP_Caspase_3_cytosol_1
 - SMAC_XIAP_Caspase_7_cytosol_1

Individual Annotations Individual Usage

Usage: BIM_BCL_xl_mitochondrial_outer_membrane_1

Show: ☒ this

Found 8 uses of BIM_BCL_xl_mitochondrial_outer_membrane_1

- BIM_BCL_xl_mitochondrial_outer_membrane_1
 - BIM_BCL_xl_mitochondrial_outer_membrane_1 PHYSICAL-ENTITY
- BIM_BCL_xl_mitochondrial_outer_membrane_1
 - BIM_BCL_xl_mitochondrial_outer_membrane_1 ORGANISM Homo sapiens
 - BIM_BCL_xl_mitochondrial_outer_membrane_1 types complex
 - BIM_BCL_xl_mitochondrial_outer_membrane_1 NAME "BIM:BCL_xl_mitochondrial_outer_membrane_1"
 - BIM_BCL_xl_mitochondrial_outer_membrane_1 COMPONENTS Apoptosis_regulator_Bcl_X5
 - BIM_BCL_xl_mitochondrial_outer_membrane_1 DATA-SOURCE ReactomeDataSource
 - BIM_BCL_xl_mitochondrial_outer_membrane_1 COMPONENTS BIM6
 - BIM_BCL_xl_mitochondrial_outer_membrane_1 SHORT-NAME "BIM:BCL-xl [mitochondrial outer membrane]"

Description: BIM_BCL_xl

Types

- complex

Same individuals

Different individuals

Property assertions: BIM_BCL_xl_mitochondrial_outer_membrane_1

Object property assertions

- ORGANISM Homo sapiens
- COMPONENTS Apoptosis_regulator_Bcl_X5
- DATA-SOURCE ReactomeDataSource
- COMPONENTS BIM6

Data property assertions

- NAME "BIM:BCL-xl [mitochondrial outer membrane]"

Conclusion (questions)

- Improve Gene Ontology 'cell death' branch using expertise from APO-SYS project?
- Develop 'APO-SYS approved' Ontology for genes and processes easily exploitable?
- Cell Cycle Ontology project from FP6 as a template?
- Using APO-SYS Intranet site for flexible and rapid collaborative effort?