SIXTH FRAMEWORK PROGRAMME
PRIORITY 2
INFORMATION SOCIETY TECHNOLOGIES

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London, UK

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Manchester, UK

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Scionics, Germany

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www.biotec.tu-dresden.de/sealife

Thomas Wächter  
BIOTEC, TU Dresden, Germany
Outline

- Introduction

- Tools developed at TU Dresden
  - GoPubMed, GoWeb, GoPatents
  - Ontology Editor
  - Ontology Generation

- SeaLife workflow in Molecular Biology
“A Semantic Grid Browser for the Life Sciences Applied to the Study of Infectious Diseases”

- **Semantic Grid Browsers** link the current Web to the emerging eScience infrastructure.

- **Semantic hyperlinks** dynamically link text through ontologies to services.
Applications / Use cases

- **Evidence-based Medicine**
  - National electronic Library of Infection (NeLI)
    - Clinician consults NeLI for trustworthy information on an infection
    - Finds site on hepatitis
    - SeaLife Browser identifies hepatitis as disease and interferon as a cytokine and immunologic factor
    - Browser offers to query Ensembl, Protein Databank, etc.

- **Ontology-based patent and literature mining**
  - Refine searches and look for e.g. interferon type I
  - Generalise and search for e.g. liver diseases

- **Molecular Biology**
  - Protein domain search (e.g. Scoppi)
  - Multiple sequence alignment (e.g. BLAST)
  - Retrieval of potential interaction partners (e.g. IntAct)
  - Gene expression databases (e.g. SAGE)
  - Image and developmental stages (e.g. EMAGE)
Work done at TU Dresden

- Semantic Indexing and information retrieval
  - GoPubMed
  - GoWeb
  - GoPatents

- Ontology Learning
  - Automatic term recognition
  - Definition extraction

- Ontology Editor
  - Integration of term and definition generation methods
    - Dresden services in OBOEdit, Manchester TerMine Protege
  - Web-based ontology editor
your PubMed search: "levamisole inhibitor"

long result list in PubMed

Andreas Doms and Michael Schroeder
GoPubMed: Exploring PubMed with the GeneOntology
Nucleic Acid Research, 33 (Web Server Issue):W783--W786, 2005
Semantic Indexing

Term extraction takes place…

tyrosine phosphorylation of STAT protein
GoPubMed indexes ...

... Gene Ontology terms and Medical Subject Headings
... gene and protein names
... disambiguated author names
... geographical locations

Gene Ontology

Molecular functions
Biological processes
Cellular components

tyrosine phosphorylation of STAT protein
„Semantic table of contents“
Question Answering
Which biological process is the protein Rab5 involved in and where it is located in the cell?
Molecular and cellular function of ALS2/alsin: Implication of membrane dynamics in neuronal development and degeneration.

ALS2 activates Rab5 small GTPase and involves in endosomal/membrane trafficking and fusions in the cells, and also promotes neurite outgrowth in neuronal cultures.

Specific Rab GTPase-activating proteins define the Shiga toxin and epidermal growth factor uptake pathways.

In contrast, RabGAP-5, a Rab5 GAP, was unique among the GAPs tested and reduced the uptake of EGF but not Shiga toxin.

GAPex-5 mediates ubiquitination, trafficking and degradation of epidermal growth factor receptor.

Rab6 has been shown to play an important role in the early stages of EGFR trafficking.

Human CIC-6 is a Late Endosomal Glycoprotein that Associates with
Which anatomical structure is affected by helicobacter pylori?
1: Helicobacter pylori infection, but not genetic polymorphism of CYP2E1, is highly prevalent in gastric cancer patients younger than 40 years.

BACKGROUND: Gastric cancers in young adults are thought to be associated with risk factors that include Helicobacter pylori infection and genetic polymorphism. The objective of this study was to elucidate the roles of these risk factors in patients younger than 40 years by analyzing clinicopathological data and H. pylori infection, and using molecular epidemiologic techniques. METHODS: Clinicopathological features, the presence of H. pylori infection, endoscopic characteristics of gastritis, genetic polymorphism of P4502E1 (CYP2E1), and family history of cancer in patients with gastric cancer treated surgically at Nippon Medical School Hospital from 1991 to 2004 were analyzed, based on our medical database. RESULTS: Gastric cancer in those younger than 40 years was characterized by a predominance of female patients with poorly differentiated adenocarcinoma who had undergone total gastrectomy with extended lymphadenectomy. H. pylori infection had a higher prevalence in patients with gastric cancer than in patients with normal endoscopic results or chronic gastritis, especially in those younger than 40 years (odds ratio, 13.7). Atrophic gastritis, nodular gastritis, and rugal hyperplastic gastritis were observed by endoscopy as H. pylori-associated gastritis. No difference in the incidence of either CYP2E1 genetic polymorphism or a family history of cancer was observed among different age groups. CONCLUSION: Gastric cancer in patients younger than 40 years is closely associated with H. pylori infection, but not with genetic characteristics. Eradication therapy for H. pylori and endoscopic examination of H. pylori-positive young adults may be anticipated to be adopted as a strategy for the prevention and/or early detection of cancer.
1: *Helicobacter pylori* infection, but not genetic polymorphism of CYP2E1, is highly prevalent in gastric cancer patients younger than 40 years.

BACKGROUND: Gastric cancers in young adults are thought to be associated with risk factors that include *Helicobacter pylori* infection and genetic polymorphism.


Infection with *Helicobacter pylori* is a strong and established risk factor of gastric cancer but is not a sufficient cause for its development.


*Helicobacter pylori* has been implicated in the pathogenesis of a number of digestive tract disorders, such as chronic active gastritis, peptic ulceration, gastric cancer, and mucosa-associated lymphoid tissue lymphoma.
Which diseases are associated with HIV?
1000 articles for query "HIV"

PubMed has found 211,797 citations for the query "HIV". The 1,000 latest documents were used by GoPubMed.

1: Pulmonary embolism in patients with acquired immunodeficiency syndrome presenting with clinical picture of Pneumocystis jiroveci pneumonia: Report of two cases.

No abstract text found for this article.

2: Acute demyelinating encephalomyelitis (ADEM) as initial presentation of primary HIV infection.

The authors report a patient with sexual exposure, clinical symptoms, MRI, virological and CSF findings suggestive of acute demyelinating encephalomyelitis (ADEM) as initial presentation of primary HIV infection.
Which are leading centers and scientists for liver transplantation?
1: Familial amyloid polyneuropathy associated with TTRSer50Arg mutation in two Iberian families presenting a novel single base change in the mutant gene.

Munoz-Quesada, M., Manzoun, J., Cogollo, T., Moreira, P., Vilaire-Ferrut, C., Sarasa, M.J.


We present two families, from Spain and Portugal, with familial amyloid polyneuropathy (FAP) associated with the mutation TTRSer50Arg. This mutation was first described in two Japanese patients from independent families and later in a French-Italian patient and a Vietnamese family. The two families presented here, are the first to be diagnosed with this mutation in the Iberian Peninsula. In the patients of both families, FAP was very aggressive as they rapidly developed multiple symptoms with progressive deterioration; we emphasize the presence of severe orthostatic hypotension in the Spanish proband which confined him to a wheelchair. This proband was the first patient with this mutation to have undergone liver transplantation and results were encouraging. The mutation was detected in four patients and one disease-free relative by DNA sequencing of exon 3 and induced mutation restriction analysis. The most outstanding feature was the single base transversion A to C in codon 50 (CGT instead of AGT), whereas in both Japanese patients and the French-Italian patient it was T to G (AGG instead of AGT). To our knowledge only six FAP mutations with more than one single nucleotide mutation for the same codon have been reported to date.
### Statistics for term **mesh#"Liver Transplantation"**

#### Top authors, journals, cities and countries

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Show more | less authors.

Show more | less journals.

**Thomas Wächter**
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58587 other authors

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**Thomas Wächter** 22
Which enzymes are inhibited by aspirin?
1: Effects of direct stenting on epicardial and myocardial perfusion in patients with acute ST segment elevation myocardial infarction.


Clinical exclusion criteria were as follows: clinical and electrocardiographic features of reperfusion, pulmonary oedema, cardiogenic shock, contraindications to coronary angiography, allergy to aspirin, ticlopidine, clopidogrel, heparin and stainless steel.

2: NSAIDs and Colorectal Cancer Risk: Do Administrative Data Support a Chemopreventive Effect?

Lamont EB et al., J Gen Intern Med ; 2007

Observational studies of the NSAID aspirin (ASA) suggest that it reduces invasive colorectal cancer (CRC) incidence, but because ASA use may also be a marker for healthy behaviors, these studies may be subject to selection bias.

3: Management outcomes of patients with type 2 diabetes: targeting the 10-year absolute risk of coronary heart disease.


Based on the 10-year absolute risk there was no difference between high- and low-risk groups, with regard to
35 articles for query "aspirin" relating to "Cyclooxygenase 2"

Pubmed has found 39,840 citations for the query "aspirin". The 1,000 latest documents were used by GoPubMed. Show 35 articles relate to the term "Cyclooxygenase 2". Require Exclude

Show statistics for term Cyclooxygenase 2

description: An inducibly-expressed subtype of prostaglandin-endoperoxide synthase. It plays an important role in many cellular processes and INFLAMMATION. It is the target of COX2 INHIBITORS.
synonyms: "Cyclo-oxygenase II" "COX-2 Prostaglandin Synthase" "Cyclo Oxygenase II" "Prostaglandin H Synthase-2" "COX 2 Prostaglandin Synthase" "Prostaglandin H Synthase 2" "PTGS2" "PGHS-2" "Cyclooxygenase-2"

wiki: "Cyclooxygenase-2"

Show statistics for these 35 articles.

Export to: Xml Rtf Endnote PlainText


METHODS: We estimated cyclooxygenase-2 (COX-2) expression by immunohistochemical assay of sections from paraffin-embedded colorectal-cancer specimens from two large cohorts of participants who provided data on aspirin use from a questionnaire every 2 years.

169: Cyclooxygenase Polymorphisms and Risk of Cardiovascular Events: The Atherosclerosis Risk in Communities (ARIC) Study
35 articles for query "aspirin" relating to "Cyclooxygenase 2"

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PMID: 17522398

METHODS: We estimated cyclooxygenase-2 (COX-2) expression by immunohistochemical assay of sections from paraffin-embedded colorectal-cancer specimens from two large cohorts of participants who provided data on aspirin use from a questionnaire every 2 years.
What is Paul Nurse working on?

Sir Paul M. Nurse

1/3 of the prize
United Kingdom

Imperial Cancer Research Fund
London, United Kingdom
b. 1949
Mitosis

Top authors, journals, cities and countries

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102981 other authors
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The new GoPubMed
Workflow in Molecular Biology.

Searching is now sorted!

term extraction/name disambiguation

HMMerThread functional prediction
RNA interference functional studies
pathway resource system integration
GO2Human anatomical integration

OMIM diseases links

18-09-2008

Thomas Wächter
Challenge: Agreement

- data types / concepts / naming schema
- workflow descriptions
- background knowledge / ontology / rules
Challenge: Agreement

I1: Ontology design
I2: Textmining and natural language processing
I3: Grid services
I4: Semantic Grid Browser
A1: Evidence-based medicine
A2: Literature and patent mining
A3: Molecular Biology
example I: disease link & anatomical link

1. The DeltaPbpA mutant derived from *Mycobacterium tuberculosis* H37Rv has an enhanced susceptibility to intracellular anti-microbial oxidative mechanisms, undergoes limited phagosome maturation and activates macrophages and dendritic cells.

*Cell Microbiol.*, 2008

*Mycobacterium tuberculosis* H37Rv (Mt) excludes phagocyte oxidase (phox) and inducible nitric oxide synthase (INOS) while preventing lysosomal fusion in macrophages (MPhis). The antigen 85A deficient (DeltaPbpA) mutant of Mt was vaccinogenic in mice and the mechanisms of attenuation were compared with MPhis infected with H37Rv and BCG. DeltaPbpA contained reduced amounts of trehalose 6, 6, dimycolate and induced minimal levels of SOCS-1 in MPhis. Blockade of oxidants enhanced the growth of DeltaPbpA in MPhis that correlated with increased colocalization with phox and INOS. Green fluorescent protein-expressing strains within MPhis or purified phagosomes were analyzed for endosomal trafficking with immunofluorescence and western blot. DeltaPbpA phagosomes were enriched for rab5, rab11, LAMP-1 and Hck suggesting enhanced fusion with early, recycling and late endosomes in MPhis compared to BCG or H37Rv. DeltaPbpA phagosomes were thus more mature than H37Rv or BCG although, they failed to acquire rab7 and CD63 preventing lysosomal fusion. Finally, DeltaPbpA infected MPhis and dendritic cells (DCs) showed an enhanced MHC-II and CD1d expression and primed immune T cells to release more IFN-gamma compared to those infected with BCG and H37Rv. DeltaPbpA was thus more immunogenic in MPhis and DCs because of an enhanced susceptibility to oxidants and increased maturation.
GO2Human
example I: disease link & anatomical link

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PMID: 19248628 Related Articles

**Mycobacterium tuberculosis H37Rv** (Mt) excludes phagocyte oxidase (phox) and inducible nitric oxide synthase (iNOS) while preventing lysosomal fusion in macrophages (MPhis). The antigen 85A deficient (DeltaFbpA) mutant of Mt was vaccinogenic in mice and the mechanisms of attenuation were compared with MPhis infected with H37Rv and BCG. DeltaFbpA contained reduced amounts of trehalose 6, 6, dimycolate and induced minimal levels of SOCS-1 in MPhis. Blockade of oxidants enhanced the growth of DeltaFbpA in MPhis that correlated with increased colocalization with phox and iNOS. Green fluorescent protein-expressing strains within MPhis or purified phagosomes were analyzed for endosomal trafficking with immunofluorescence and western blot. DeltaFbpA phagosomes were enriched for rab5, rab11, LAMP-1, and Hck suggesting enhanced fusion with early, recycling and late endosomes in MPhis compared to BCG or H37Rv. DeltaFbpA phagosomes were thus more mature than H37Rv or BCG although, they failed to acquire rab7 and CD63 preventing lysosomal fusion. Finally, DeltaFbpA infected MPhis and dendritic cells (DCs) showed an enhanced MHC-II and CD1d expression and primed immune T cells to release more IFN-gamma compared to those infected with BCG and H37Rv. DeltaFbpA was thus more immunogenic in MPhis and DCs because of an enhanced susceptibility to oxidants and increased maturation.

**SOCS-1**, Green fluorescent protein, Hck, BCG, DC, IFN-gamma, Immunogenic, antigen 85A, rab5, nitric oxide synthase, rab11, LAMP-1, MHC, CD1d, CD63, rab7

**Endosome**, Oxidants, Endosomes, Phagosome, Lysosomes, Nitric Oxide, OxiReductases, Nitric oxide synthase type II, Dendritic cells, Macrophages, Trehalase

**OMIM** Tuberculosis

**KEGG**: reductase

**RIDDLE**: SOCS-1, Green fluorescent protein, Hck, BCG, DC, IFN-gamma, Immunogenic, antigen 85A, rab5, nitric oxide synthase, rab11, LAMP-1, MHC, CD1d, CD63, rab7

**HMMer**: SOCS-1, Green fluorescent protein, Hck, BCG, DC, IFN-gamma, Immunogenic, antigen 85A, rab5, nitric oxide synthase, rab11, LAMP-1, MHC, CD1d, CD63, rab7

**Go2Human**: early endosome, endosome, intracellular, late endosome, positive regulation of dendritic membrane protein
example 1: disease link & anatomical link

MYCOBACTERIUM TUBERCULOSIS, SUSCEPTIBILITY TO

Alternative titles; symbols

MYCOBACTERIUM TUBERCULOSIS, PROTECTION AGAINST, INCLUDED

Gene map locus 19p13.3, 17q12-q12, 12q14, 11q23-q24, 6q23-q24, 2q37.1, 2q35

TEXT

A number sign (#) is used with this entry because many genes are involved, singly or in combination, in determining susceptibility to tuberculosis (TB). Case-control studies in areas of endemic TB pointed to variation in several genes contributing to TB risk, including HLA (see 142800), NRAMP1 (900266), vitamin D receptor (VDR; 601769), and mannose-binding protein (MBL2; 154343) (Mittos et al., 2003). Variation in the CD209 (604672) and MCP1 (CCL2; 153105) genes is also associated with TB susceptibility. TB susceptibility loci have been mapped to chromosome 2q35 (MTBS1; 607949), near NRAMP1, and to chromosome 8q12-q13 (MTBS2; 611946). X-linked susceptibility to TB has also been suggested (MTBSX; 300259). Protection against TB has been associated with a coding single-nucleotide polymorphism (SNP) in the TIRAP gene (606252.0001).

CLINICAL FEATURES

Price et al. (2001) detected a significantly higher concentration of MMP9 (120361) per leukocyte in cerebrospinal fluid from adult tuberculosis meningitis patients than in patients with bacterial or viral meningitis. In vitro studies indicated that viable bacilli were not required to stimulate MMP9 production. In contrast to the changes in MMP9 expression, MMP2 (120360) and tissue inhibitor of metalloproteinase-1 (TIMP1; 305370) were constitutively expressed, and the latter did not oppose the MMP9 activity. Elevated MMP9 activity was related to unconsciousness, confusion, focal neurologic damage, and death in the tuberculous meningitis patients.
example II: functional prediction & RNA interference

9: Tyr-phosphorylation signals translocate RIN3, the small GTPase Rab5-GEF, to early endocytic vesicles.

Yoshikawa M, Kaiho H, Sakurai K, Minoda T, Nakagawa S, Komai K, Kaida T.

Biochim Biophys Res Commun., 2006

The small GTPase Rab5 plays a key role in early endocytic pathway, and its activation requires guanine-nucleotide exchange factors (GEFs). Rab5-GEFs share a conserved VPS9 domain for the GEF action, and RIN3 containing additional domains, such as Src-homology 2, RIN-family homology (RH), and Ras-association (RA), was identified as a new Rab5-GEF. However, precise functions of the additional domains and the activation mechanism of RIN3 remain unknown. Here, we found tyrosine-phosphorylation signals are involved in the Rab5-GEF activation. Treatment of HeLa cells with pervanadate translocates RIN3 from cytosol to the Rab5-positive vesicles. This RIN3 translocation was applied to various mutants lacking each domain of RIN3. Our present results suggest that a Ras GTPase(s) activated by tyrosine-phosphorylation signals interacts with the inhibitory RA domain, resulting in an active conformation of RIN3 as a Rab5-GEF and that RIN-unique RH domain constitutes a Rab5-binding region for the progress of GEF action.

RIN3, Ras, Rab5, GTPase, VPS9, Src

Transport vesicles, HeLa cells, GTPase, Cytoplasm, Signal transduction, Monomeric GTP-Binding Proteins

PubChem: GTP, Phosphohydrolases, Monomeric GTP-Binding Proteins

KEGG: small monomeric GTPase

RIDDLE: RIN3, Ras, Rab5, GTPase, VPS9, Src

HMMP: RIN3, Ras, Rab5, GTPase, VPS9, Src

Go2human: GTPase activity, activation of Ras GTPase, cytoplasm, guanine-nucleotide exchange factor activity, positive regulation of Ras GTPase activity, regulation of Ras GTPase activity, signal transduction
**example II:** functional prediction & RNA interference

**Orthologs**
- **Rat**
- **Mouse**

**Related Ensembl**

**Related Proteins**
- **NCBI**
- **HPRD**

**Genome:** NCBI Human  
**Gene:** SRC  
**Transcripts:** NM_005417

**esiRNA** (length: 584) *(red basepairs indicate CAN repeats)*

```
CTGTCGGAGGGCTTCAACTCTCTGGACACCGTCCTCCC
CGCAGAGGGCGGCTCCTGGGGTCACTGACCACCTCC
TGTGGCCTCTCATAGTAAGCTGTGAGAGGCACGACGAC
CTGTCCTTTCCAAGAAAGGGAGGGCGCTACCAGATGTCAACA
ACACAGAGGGCGGTGGCGTCCTGCCAATCGTCGACGAC
AGGACAGACAGGGCGTCTCACCAGAATCACGTTGGCGCC
TCCGACTTCAATCCAGGCTAGAGCTGTGAATTGCGAAGA
TCACCAGACGGGAGTCAAGCGTTGCTGCTAATCGAGA
GAACCCCGAGAGGGGCTTCTCGTGCGAGAAAGTGAGACC
ACGAAGGCTGCTTCCATCGAGAAGGAGCTGTGAGG
ACGCCACAGGGGCCTCAAGTGGAAGCTACAAGATCGGCA
GCTGGGAGACGGCGGGCTTCTCATACTACCTCCGTGCCAAG
TTCAACAGCTCAGGACGCTGTGGGCTACTACTCGAAAC
AGGCGGAT
```

**Look for this esiRNA at**
- NCBI  
- Ensembl  
- UCSC

**Left primer**

```
CTGTCGGAGGGCTTCAACT
```

**Right primer**

```
ATCCGGCTGGTTGGAGTAGT
```

**Efficient siRNAs**

34.74%
example II: functional prediction & RNA interference

9: Tyr-phosphorylation signals translocate RIN3, the small GTPase Rab5-GEF, to early endocytic vesicles.

Yoshikawa M, Kaiho H, Sakurai K, Minoda T, Nakagawa S, Komai K, Kaiada T.

The small GTPase Rab5 plays a key role in early endocytic pathway, and its activation requires guanine-nucleotide exchange factors (GEFs). Rab5-GEFs share a conserved VPS9 domain for the GEF action, and RIN3 containing additional domains, such as Src-homology 2, RIN-family homology (RH), and Ras-association (RA), was identified as a new Rab5-GEF. However, precise functions of the additional domains and the activation mechanism of RIN3 remain unknown. Here, we found tyrosine-phosphorylation signals are involved in the Rab5-GEF activation. Treatment of HeLa cells with pervanadate translocates RIN3 from cytoplasm to the Rab5-positive vesicles. This RIN3 translocation was applied to various mutants lacking each domain of RIN3. Our present results suggest that a Ras GTPase(s) activated by tyrosine-phosphorylation signals interacts with the inhibitory RA domain, resulting in an active conformation of RIN3 as a Rab5-GEF and that RIN-unique RH domain constitutes a Rab5-binding region for the progress of GEF action.
example II: functional prediction & RNA interference

Provide remote domain information of all proteins within an organism based on 3D structure and Pfam-domains.
Example III: system integration

**Rab5** modulates aggregation and toxicity of mutant huntingtin through macroautophagy in cell and fly models of Huntington disease.

Huntington disease (HD) is caused by a polyglutamine-expansion mutation in huntingtin (HTT) that makes the protein toxic and aggregate-prone. The subcellular localisation of huntingtin and many of its interactors suggest a role in endocytosis, and recently it has been shown that huntingtin interacts indirectly with the early endosomal protein Rab5 through HAP40. Here we show that Rab5 inhibition enhanced polyglutamine toxicity, whereas Rab5 overexpression attenuated toxicity in our cell and fly models of HD. We tried to identify a mechanism for the Rab5 effects in our HD model systems, and our data suggest that Rab5 acts at an early stage of autophagosome formation in a macromolecular complex that contains beclin 1 (BECN1) and Vps34. Interestingly, chemical or genetic inhibition of endocytosis also impaired macroautophagy, and enhanced aggregation and toxicity of mutant huntingtin. However, in contrast to Rab5, inhibition of endocytosis by various means suppressed autophagosome-lysosome fusion (the final step in the macroautophagy pathway) similar to bafilomycin A1. Thus, Rab5, which has previously been thought to be exclusively involved in endocytosis, has a new role in macroautophagy. We have previously shown that macroautophagy is an important clearance route for several aggregate-prone proteins including mutant huntingtin. Thus, better understanding of Rab5-regulated autophagy might lead to rational therapeutic targets for HD and other protein-conformation diseases.
example III: system integration

Huntington's disease - Homo sapiens (human)

- KEGG PATHWAY
- KEGG BRITE
- KEGG DISEASE
- KEGG GENES

18-09-2008
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Submit as PubMed Query

View positive marked  View negative marked  View undecided

Export displayed terms

ranked by score

cholesterol  non-high-density lipoprotein  lipid  metabolic syndrome  high-density lipoprotein  low-density lipoprotein  risk  lipoprotein  triglyceride  (hs)-C-reactive protein  LDL  metabolic density

[Ch, CHO] cholesterol, Cholesterol
[HD] non-high-density lipoprotein
[L] Lipids, lipid, Lipid, lipids
[MS, MetS] metabolic syndrome, Metabolic Syndrome, metabolic syndromes, METABOLIC SYNDROME, Metabolic syndrome
[HDLS, HDL] high-density lipoprotein, High-density lipoprotein, High-density lipoproteins, high density lipoproteins, high density lipoprotein
[LDLs, LDL] low-density lipoprotein, Low density lipoprotein, low-density lipoproteins, low density lipoprotein, low density lipoproteins, Low Density Lipoprotein, low-density lipoproteins
[TG] Triglycerides, triglyceride, triglycerides
[CRP] CRP, (hs)-C-reactive protein
[LDLs, LDL] metabolic, Metabolic density
Web-based ontology editor
Thank you!

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TRANSiNSIGHT