



Next generation semantic support technology

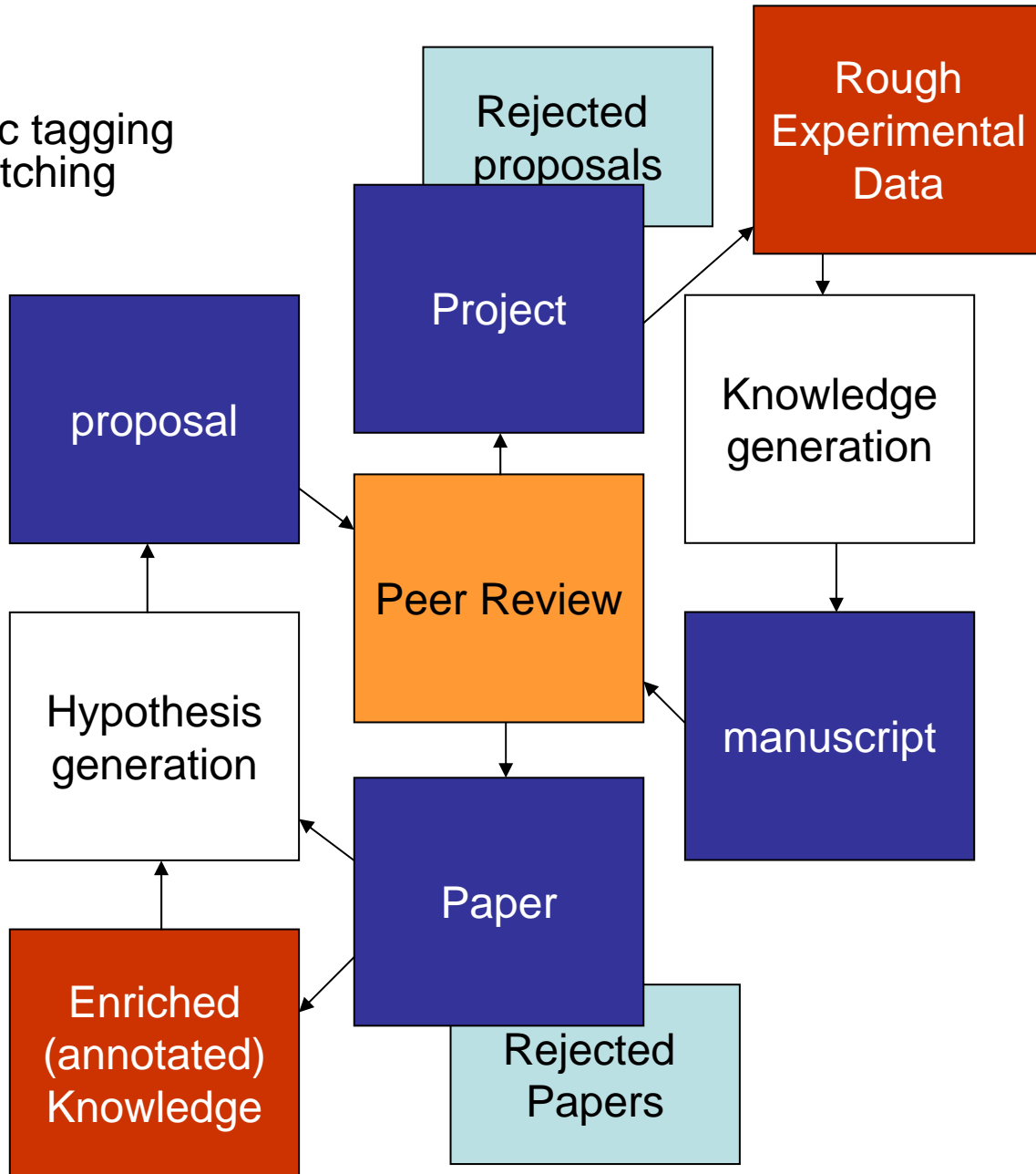
NIH symposium: **Knowledge in Service to Health:**

Leveraging Knowledge for Modern Science Management

Barend Mons

Management of Science (work flow)

- = Text-semantic tagging
- = Semantic matching

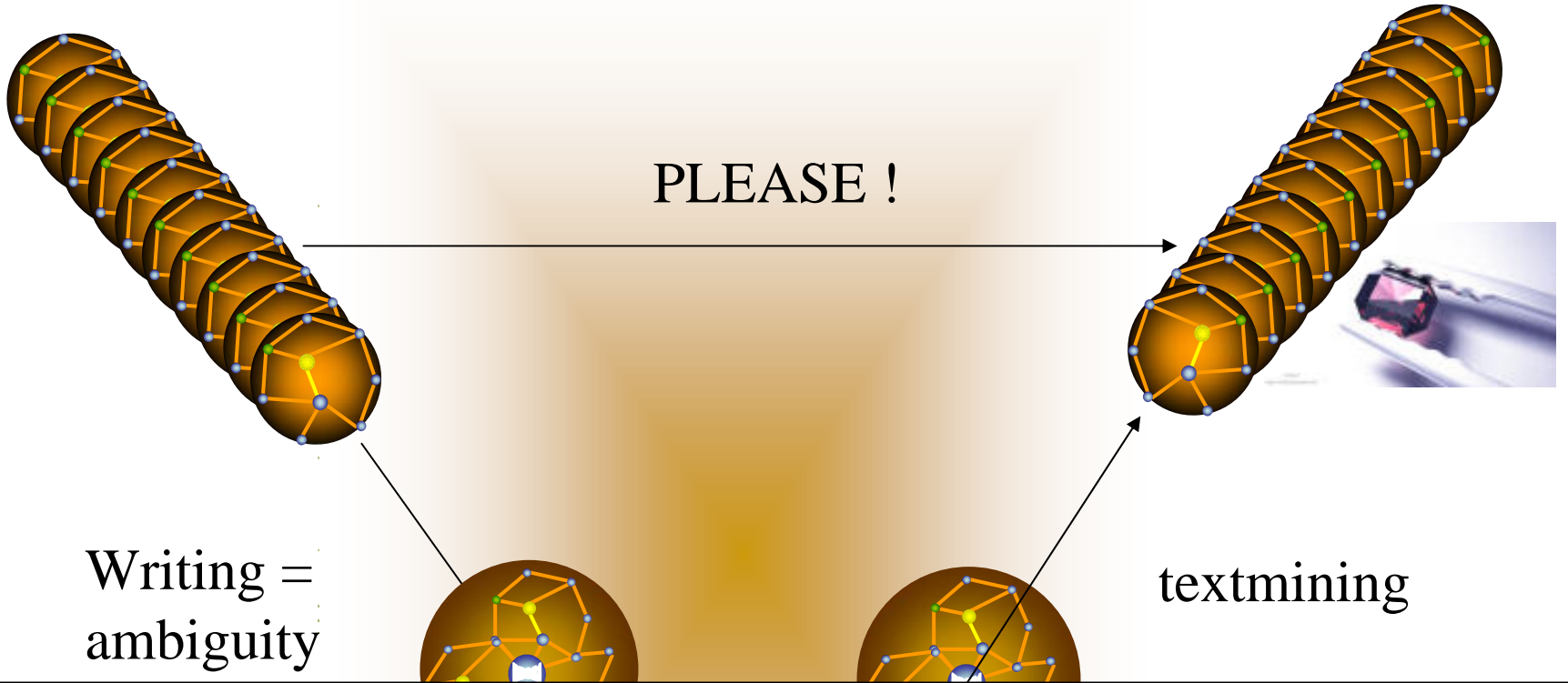


Too much to read: major trends foreseen:

- From Reading to Consulting
- From Reading to Meta Analysis
- From Writing to Knowledge Representations

Future (hope)

PLEASE !



Writing =
ambiguity

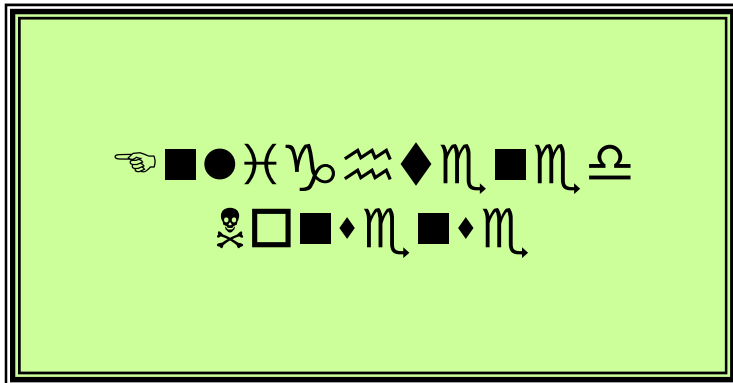
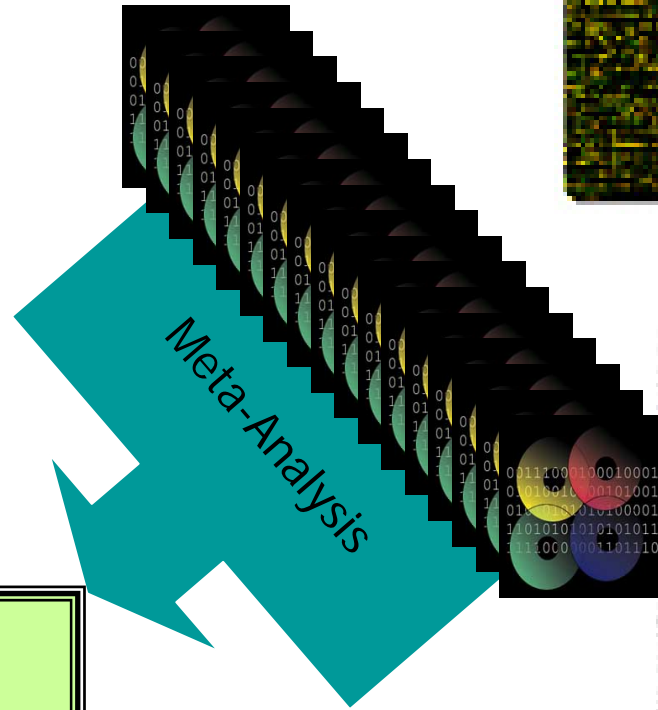
textmining

Papyrust

What is needed

- Disambiguate Text and tag/link concepts
- Meta-analyse information at concept level
- Provide meta-analysed information
- Support Information Based Knowledge Discovery (especially new associations)

META-ANALYSIS



Word Based is NOT good enough

TERM	Pubmed	ScholarGoogle	Concept Based
Bovine Spongiform E	2073	5,640	1673
Mad cow disease	1676	3,160	1682
CD154	2479	4,390	2812
CD40L	2771	20,800	2849
TNFSF5	2273	116	2751
EBV	12357	80,500	8154
Epstein Barr virus	20761	99,000	8154
Human Herpes virus 4	15025	78,400	8154

Tag-As-You-Type, Tag-As-You-Like

The screenshot displays the 'Thesaurus Enricher' application window. The interface is divided into several sections:

- General | Thesaurus:** Contains fields for 'Log in information', 'Server' (//bios3.mi.fgg.eur.nl/BioSemantics), 'User name' (BarendMons), and 'Full name' (Barend Mons).
- Project:** Fields for 'Project' (Malaria), 'Leader' (Barend Mons), 'Thesaurus' (UMLS2003AC), and 'Description' (Project to enrich the default MESH2002_GeneList_v2.0.6 thesaurus for missing malaria concepts).
- Font size:** Set to 25, with an 'Apply' button.
- Leader actions:** A 'Release thesaurus' button.
- Document:** A field showing the current document as 'e-boost regimens, including a 12-.txt'.

The main text area contains a paragraph with several terms highlighted in various colors (green, red, blue, purple) to indicate their association with specific concepts in the thesaurus. The highlighted text reads:

Phase 1 evaluation of 3 highly immunogenic prime-boost regimens, including a 12-month reboosting vaccination, for malaria vaccination in Gambian men.

Successful vaccination against intracellular pathogens, including liver-stage Plasmodium falciparum, will require induction of strong antigen-specific T lymphocyte responses. The multiple epitope (ME)-thrombospondin-related adhesion protein (TRAP) construct includes CD8(+) and CD4(+) T cell epitopes from pre-erythrocytic P. falciparum antigens fused in-frame to the entire pre-erythrocytic antigen TRAP. Three carriers for this construct--plasmid DNA and 2 recombinant nonreplicating poxviruses (modified vaccinia virus Ankara [MVA] and fowlpox strain 9 [FP9])--were administered at 3-week intervals in a heterologous prime-boost combination to 29 Gambian men aged 18-45 years. Doses of DNA ME-TRAP, MVA ME-TRAP, and FP9 ME-TRAP were 2 mg and 1.5x10(8) and 1x10(8) plaque-forming units, respectively. DNA ME-TRAP was injected intramuscularly; MVA ME-TRAP and FP9 ME-TRAP were injected intradermally. There were no clinically relevant laboratory abnormalities and no severe or serious adverse events related to vaccination. DNA/MVA and FP9/MVA regimens were the most potent inducers of circulating effector T cells seen to date in sub-Saharan Africa. Twelve months after the final vaccination, a single booster vaccination expanded the effector T cell pool to a similar or higher magnitude than that after the primary vaccinations. These results highlight optimized combination regimens with general relevance to the development of vaccines targeting intracellular pathogens.

Below the text, the 'Concept information | Legend' section provides details for the highlighted term 'thrombospondin-related adhesive protein':

- thrombospondin-related adhesive protein**
- TRAP, a malaria antigen
- Associated semantic types**
- Immunologic Factor:*
A biologically active substance whose activities affect or play a role in the functioning of the immune system.

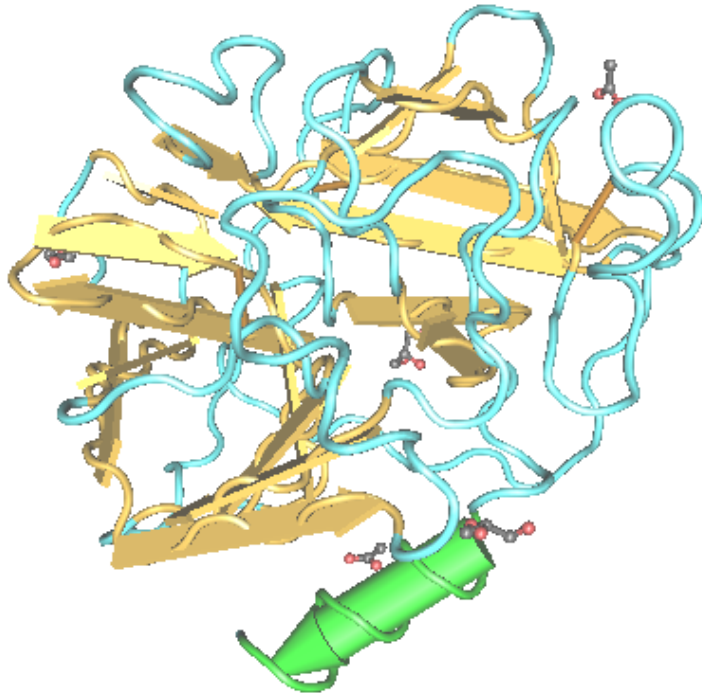


Ambiguity 1: Synonyms

Name and origin of the protein	
Protein name	Annexin A5
Synonyms	Annexin V Lipocortin V Endonexin II Calphobindin I CBP-I Placental anticoagulant protein I PAP-I PP4 Thromboplastin inhibitor Vascular anticoagulant-alpha VAC-alpha Anchorin CII
Gene name	ANXA5 or ANX5 or ENX2 or PP4
From	Homo sapiens (Human) [TaxID: 9606]
Taxonomy	Eukaryota ; Metazoa ; Chordata ; Craniata ; Vertebrata ; Euteleostomi ; Mammalia ; Eutheria ; Primates ; Catarrhini ; Hominidae ; Homo .

Relatively straightforward: Thesaurus

Ambiguity 2: Homonyms



PSA

Prostate **S**pecific **A**ntigen

PSoriatic **A**rthritis

alpha-2,8-**P**oly**S**ialic **A**cid

Poly**S**ubstance **A**buse

Picryl **S**ulfonic **A**cid

Polymeric **S**ilicic **A**cid

Partial **S**ensory **A**gnosia

Poultry **S**cience **A**ssociation

Not so easy: context needed

But...we have nomenclature committees now.....

DEFB4

defensin, beta 4

SAP1, HBD-2, DEFB-2, DEFB102, DEFB2

ELK4

ELK4, ETS-domain protein (SRF accessory protein 1)

SAP1

PSAP

proposin (variant Gaucher disease and variant metachromatic leukodystrophy)

SAP1, GLBA

Junk ?

or

Jewels ?

292 genes > 1 million papers

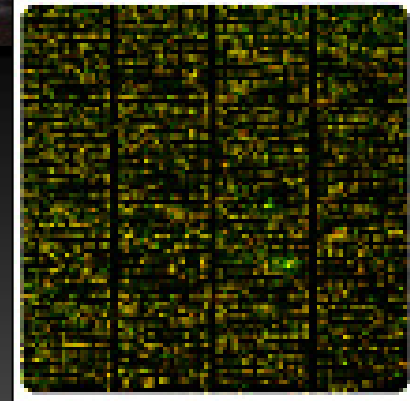
115 genes have a homonym problem (40 %)

- **Dbp**

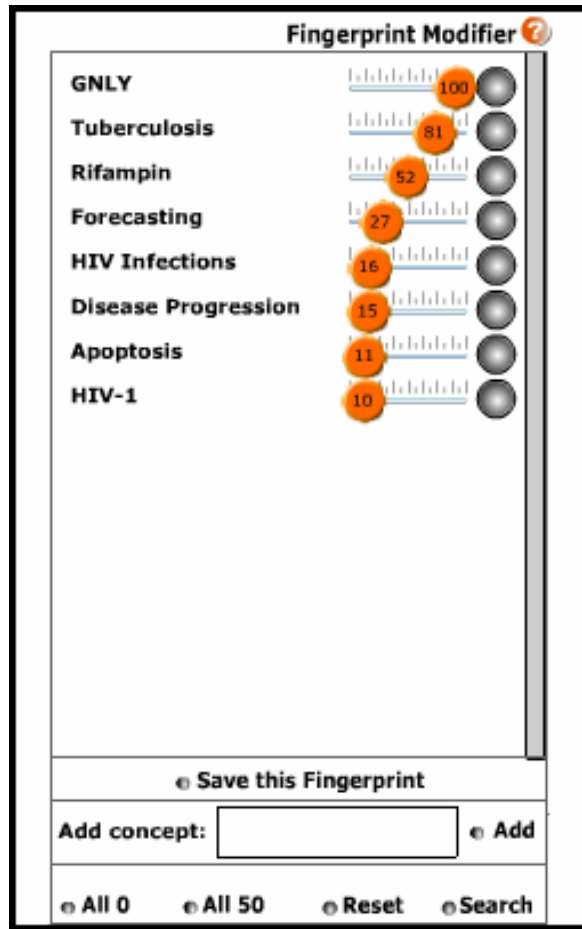
- D site albumin promoter binding protein
- PubMed: 1015 hits, including <diastolic blood pressure>
- After disambiguation: 124 relevant hits

- **Prp**

- proliferin related protein
- 2971 hits <platelet rich plasma>, <prion protein>
- Relevant hits: 7
- After disambiguation: 60.000 papers (<< 10 % is relevant)



Fingerprints (CFP's)



C19881 0.99

C92992 0.67

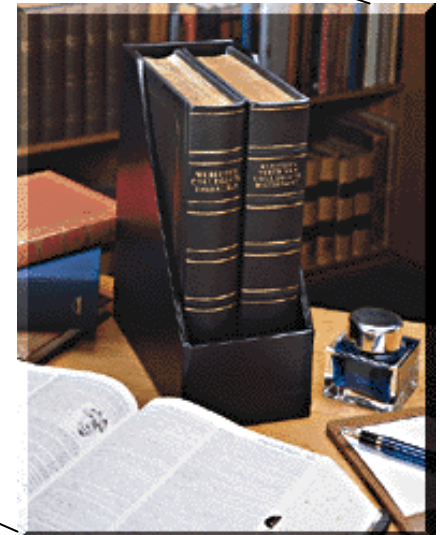
C02002 0.66

C99229 0.44

C00392 0.33

C93939 0.21

consolidated knowledge



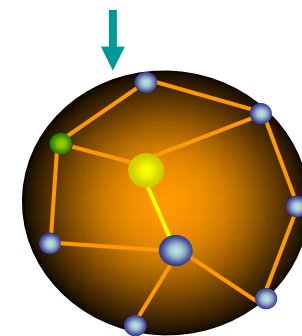
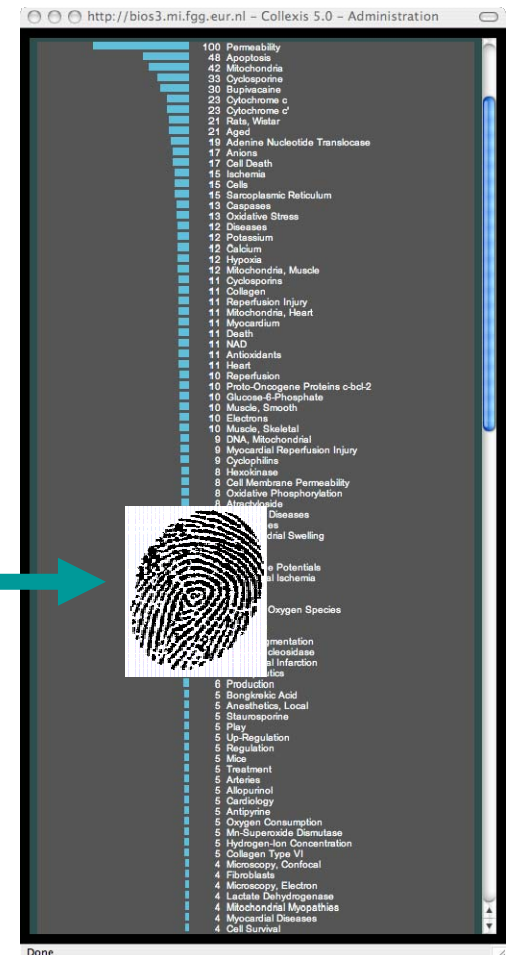
File Edit View Go Bookmarks Tools Help

Text analysis for the following text:

If a title such as: 'Epidemiological considerations of **BSE**' is typed, the system is unlikely to be able to decide whether the author meant **Breast Self Examination** or **Bovine Spongiform Encephalopathy**. If no further context follows, the author could be prompted to resolve the ambiguity. However, if someone decides that he likes **EBV** more than **Human Herpesvirus 4**, or she prefers **CD154** over **TNFSF5**, the author should not be forced to change that in the text

The following **concepts** from the 'MeshGenes_1.5UK' thesaurus have been found in this text. Their relevance has been corrected for their occurrence in the whole document collection (inverse document frequency).

- **Encephalopathy, Bovine Spongiform** with relevance **1.00** and concept number **C0085209**
 - ◊ based on **BSE** at position **58** in the text
 - ◊ based on **bovine** at position **178** in the text
 - ◊ based on **spongiform** at position **185** in the text
 - ◊ based on **encephalopathy**, at position **196** in the text
- **CD40 Ligand** with relevance **0.79** and concept number **C0167627**
 - ◊ based on **CD154** at position **399** in the text
 - ◊ based on **TNFSF5** at position **410** in the text
- **Breast Self-Examination** with relevance **0.56** and concept number **C0085105**
 - ◊ based on **BSE** at position **58** in the text
 - ◊ based on **breast** at position **151** in the text
 - ◊ based on **self** at position **158** in the text
 - ◊ based on **examination** at position **163** in the text
- **Herpesvirus 4, Human** with relevance **0.52** and concept number **C0014644**
 - ◊ based on **EBV** at position **349** in the text
 - ◊ based on **human** at position **363** in the text
 - ◊ based on **herpesvirus** at position **369** in the text
 - ◊ based on **4** at position **381** in the text



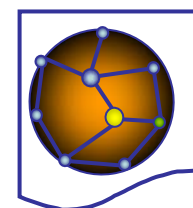
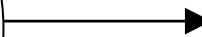
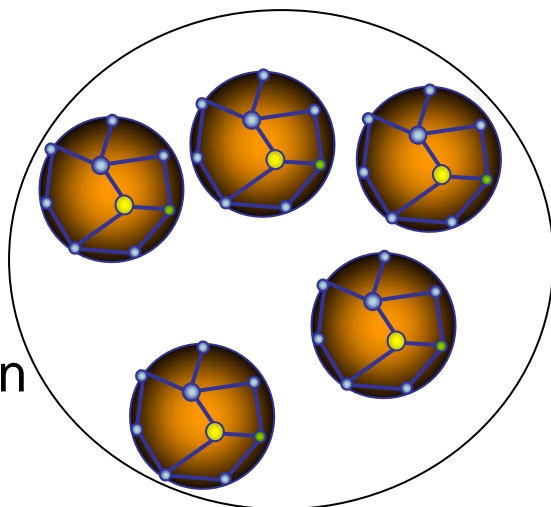
The **Knowlet**

- **Contextual annotation of web pages for interactive browsing**, van Mulligen E, Diwersy M, Schijvenaars B, Weeber M, van der Eijk CC, Jelier R, Schuemie M, Kors J, Mons B, **Medinfo 2004**, 11:94-8
- **Which gene did you mean?**, Mons B, **BMC Bioinformatics 2005** Jun 7, 6:142

Creating Reference Knowlets

PSA

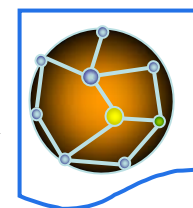
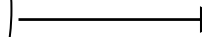
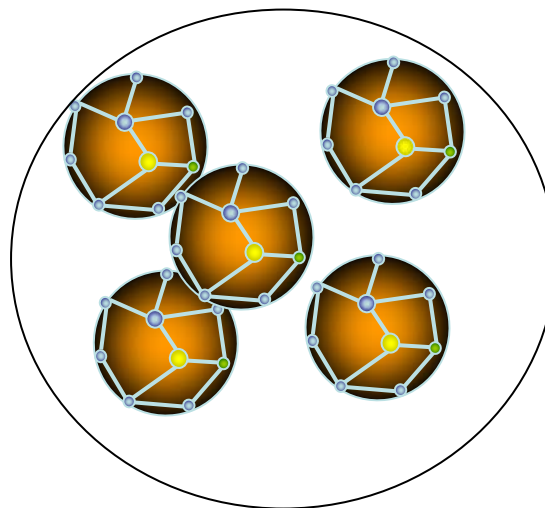
Prostate Specific Antigen



Reference
Knowlet

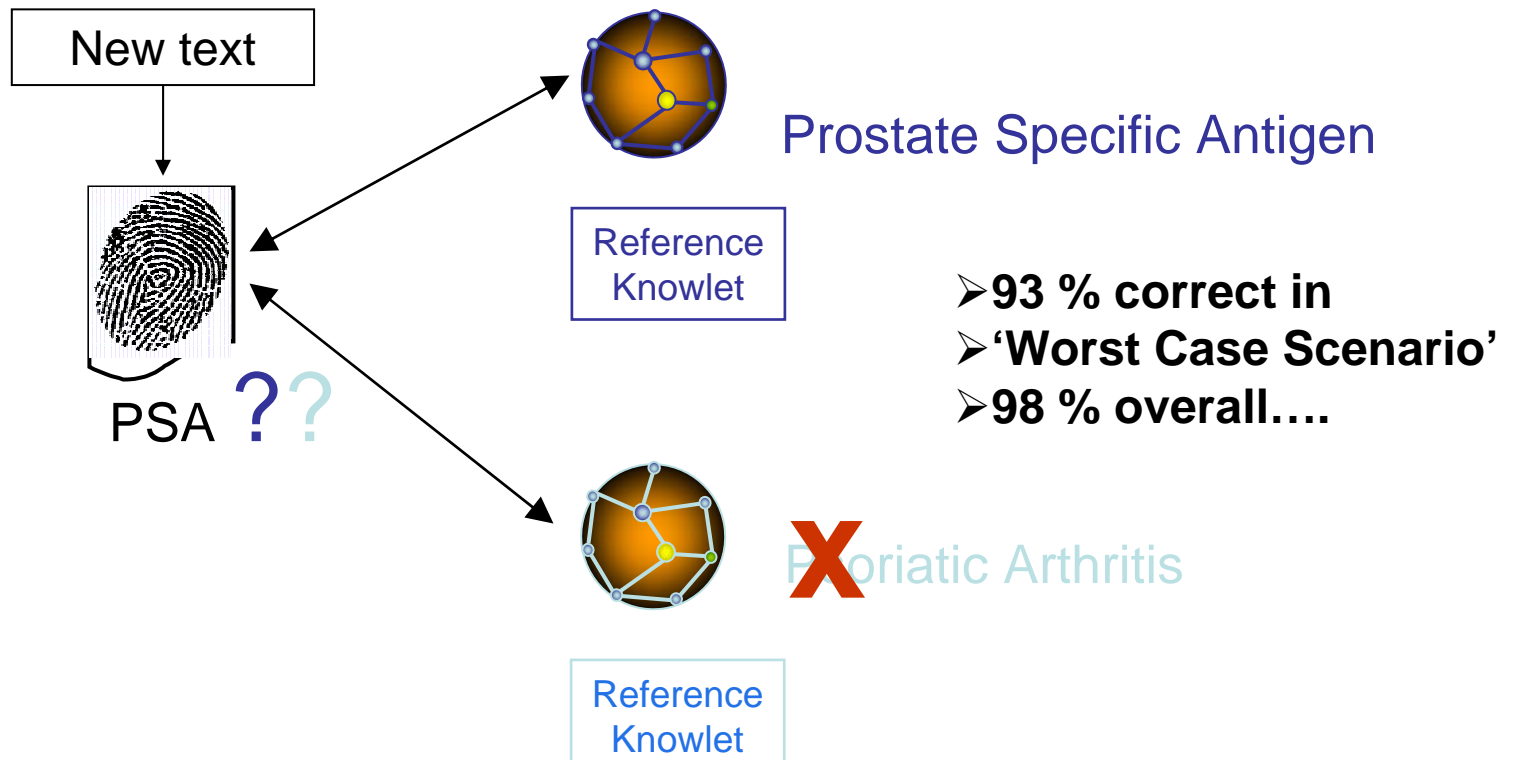
PSA

Psoriatic Arthritis



Reference
Knowlet

Context matching

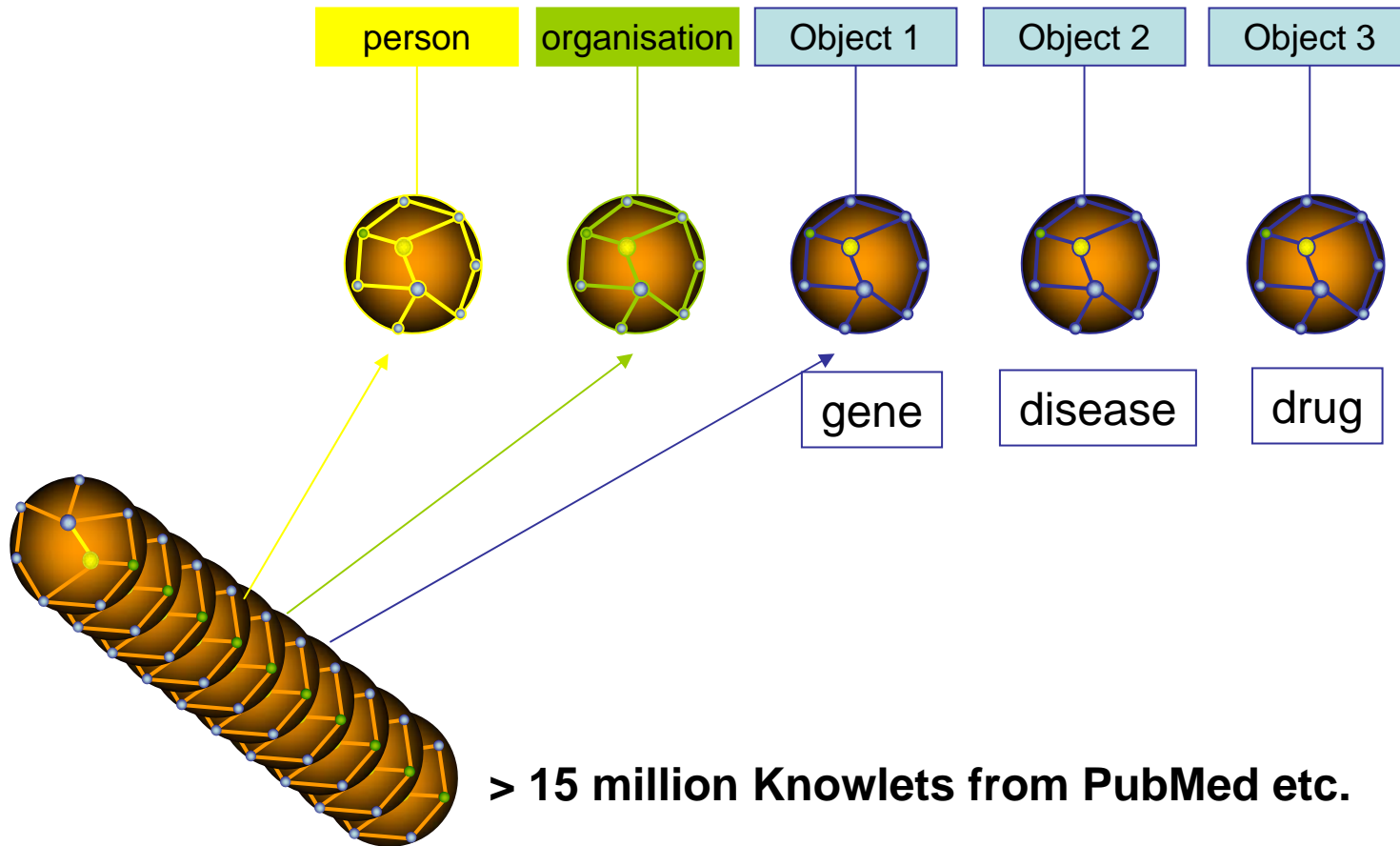


• **Thesaurus-based disambiguation of gene symbols.** Schijvenaars BJ, Mons B, Weeber M, Schuemie MJ, van Mulligen EM, Wain HM, Kors JA

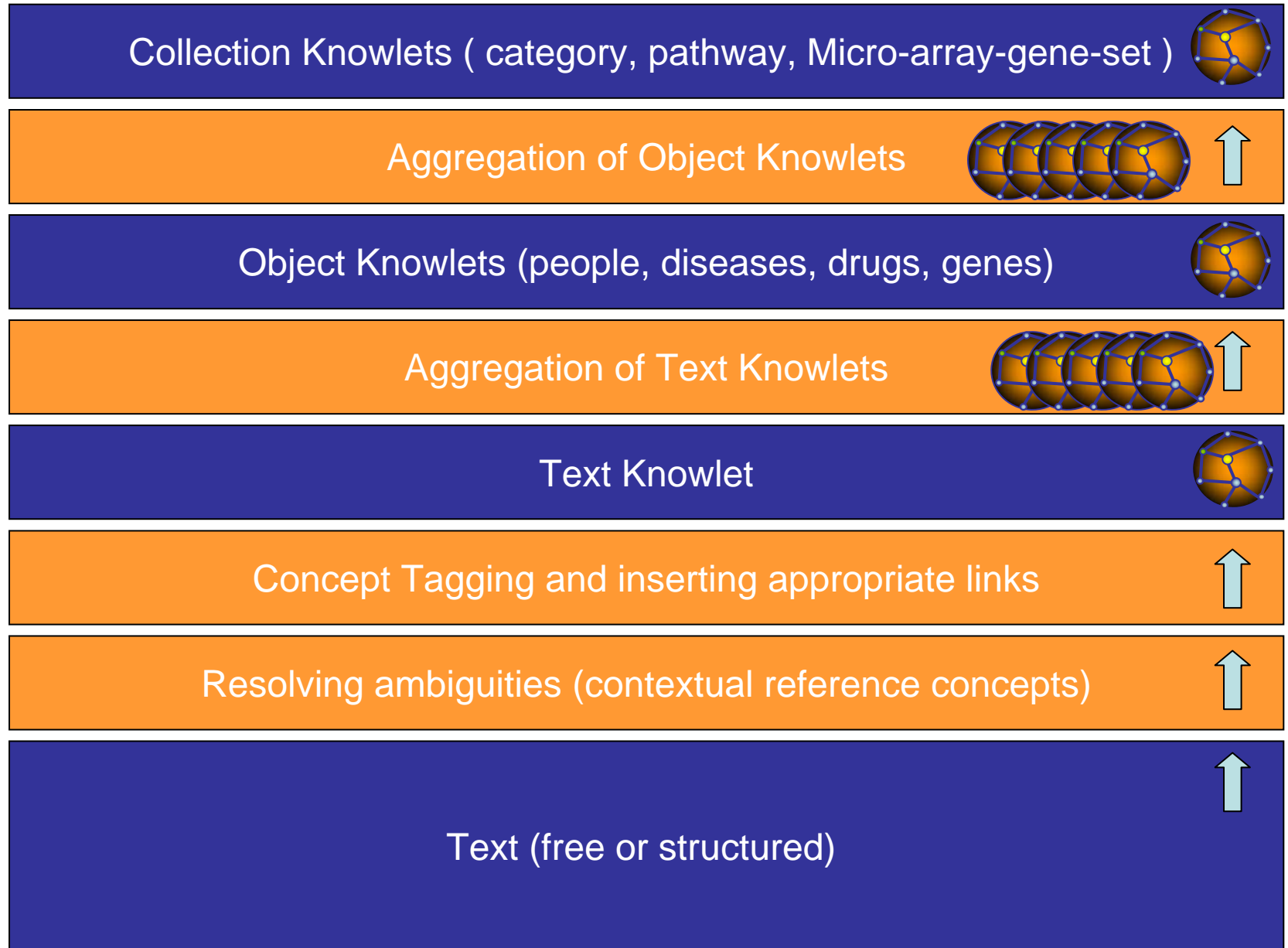
BMC Bioinformatics 2005 Jun 16, 6:149

• **Word sense disambiguation in the biomedical domain: an overview.** Schuemie MJ, Kors JA, Mons B, **Journal of Computational Biology 2005** Jun, 12:554-65

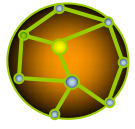
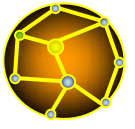
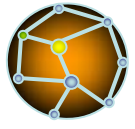
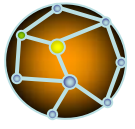
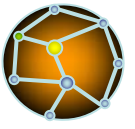
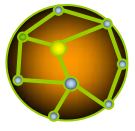
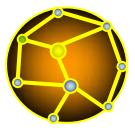
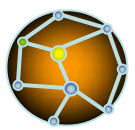
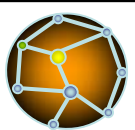
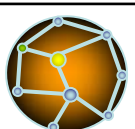
Building an association matrix of large data sources



Basic methodology: Concept Tagging, creation and systematic aggregation of Knowlets



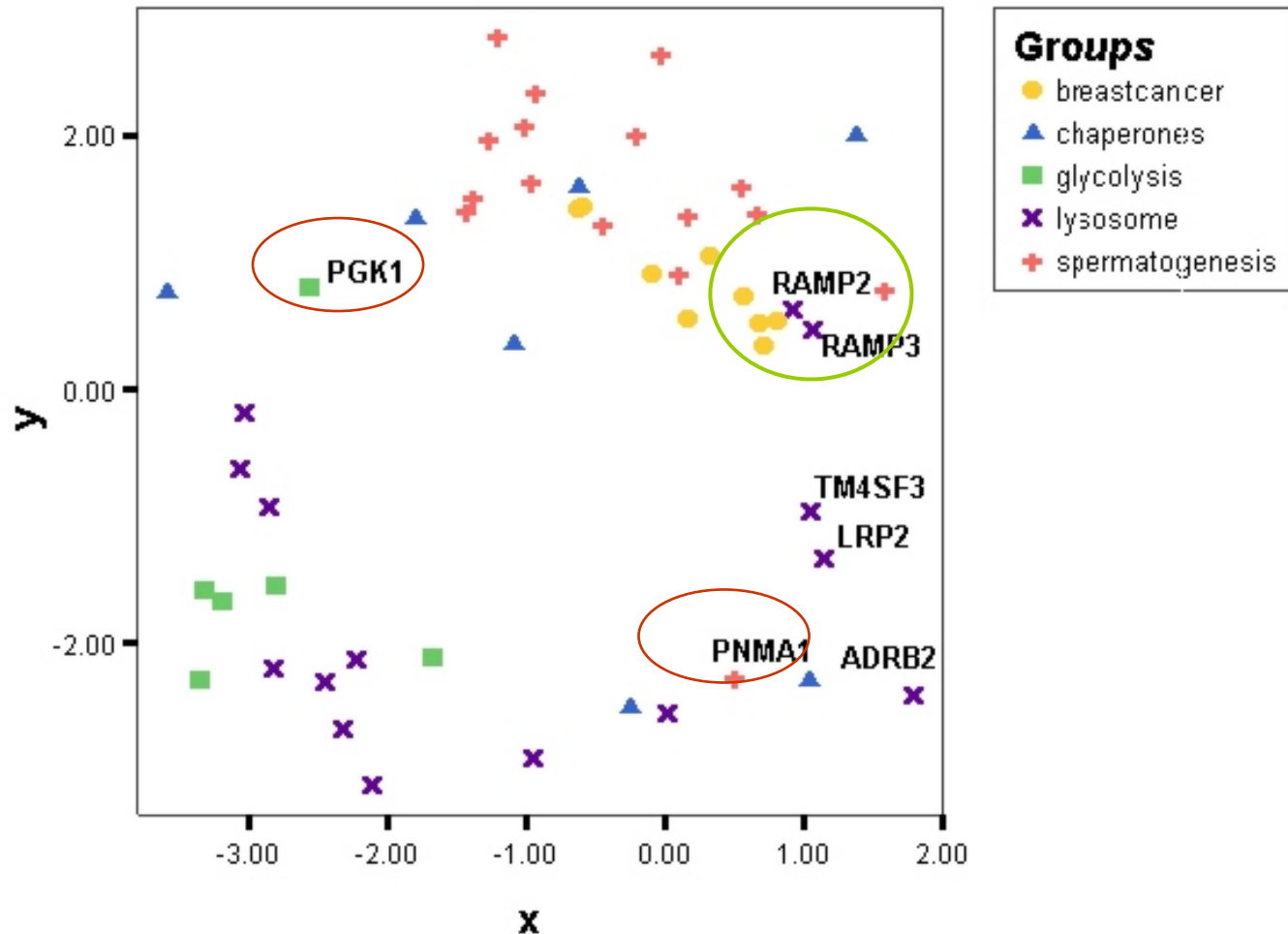
A matrix of associative distances

						
	1					
	0.16	1				
	0.30	0.03	1			
	0.28	0.35	0.20	1		
	0.188	0.004	0.15	0.13	1	

meta-analysis

Hierarchical
Clustering
ACS
MDS
Etc.

Meta-analysis 1: ACS



• **Constructing an Associative Concept Space for Literature-based Discovery**, van der Eijk CC, van Mulligen EM, Kors JA, Mons B, van den Berg J

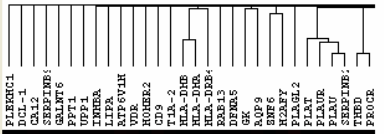
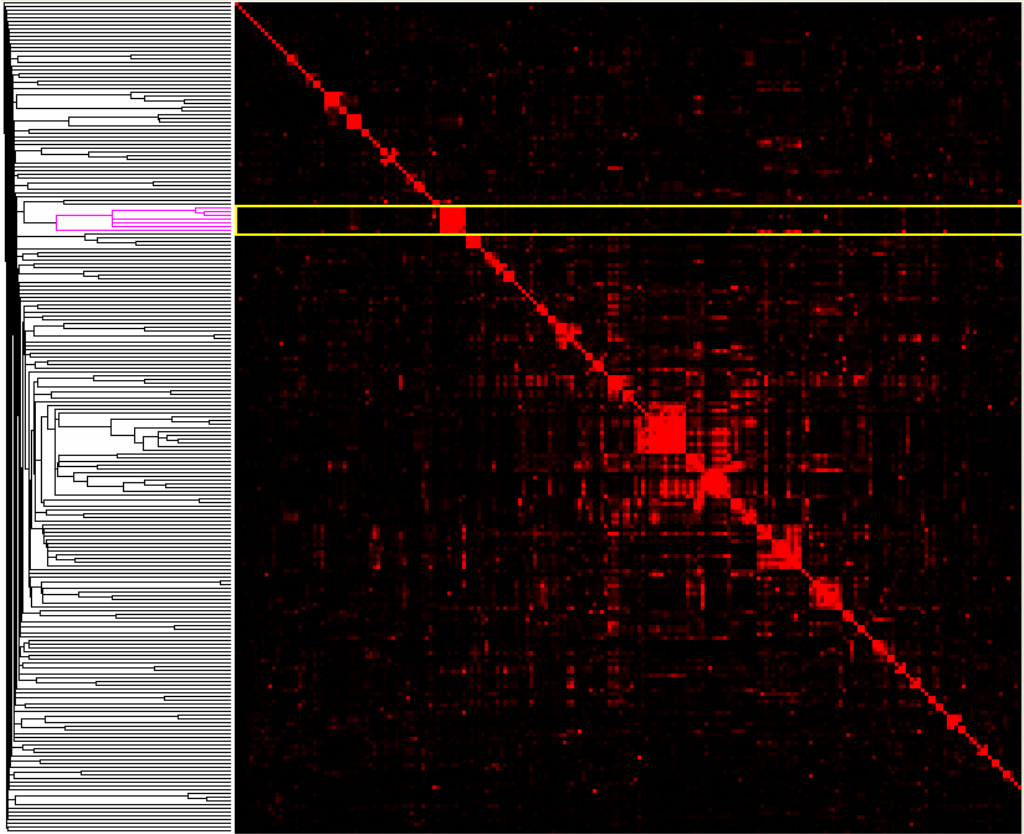
Journal of the American Society for Information Science and Technology 2004, 55(5): 436-444

• **Co-occurrence based meta-analysis of scientific texts: retrieving biological relationships between genes.** Jelier R, Jenster G, Dorssers LC, van der Eijk CC,

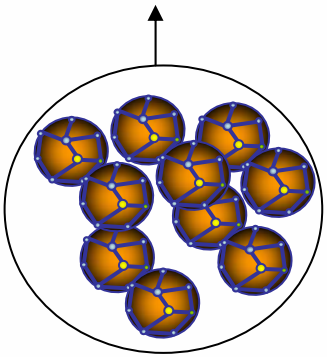
van Mulligen EM, Mons B, Kors JA *Bioinformatics* 2005 May 1, 21:2049-58

Meta Analysis 2: Hierarchical Clustering

Tree View --- CurrentNode NODE66X --- Correlation 0.22784423828125
File Setting Find Help



```
10094601|HT1E
10094671|HT1L
10094621|HT1G
10094611|HT1F
10094681|HT1X
10030251|HT2L
10090291|HTF1
```



1: 2: 3:

Annotation

Cosine (avg): Cutoff P-value:
 Extended Information Random (p) % above FE test

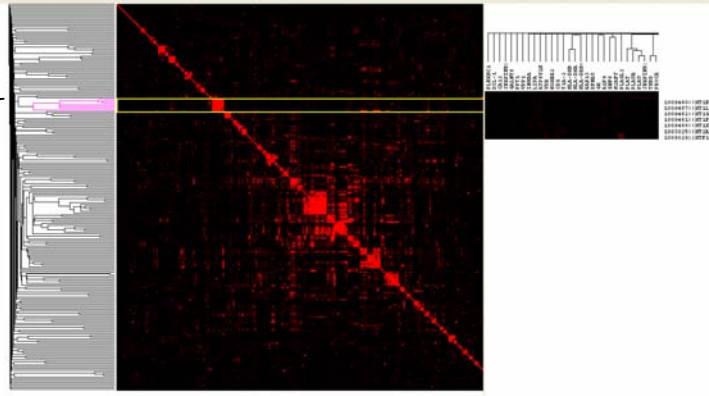
Concept names

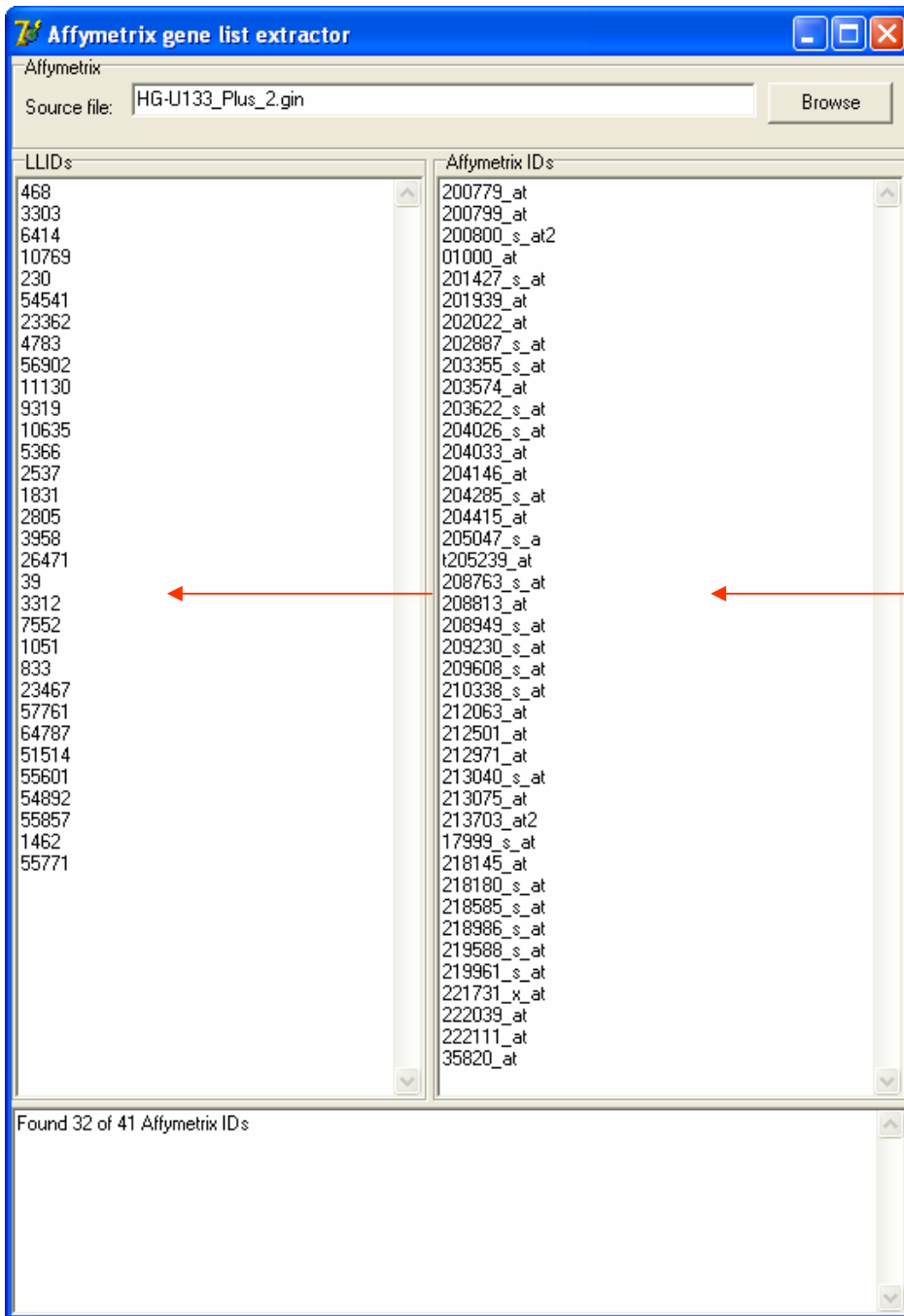
Name	Feature
MYDD1	
MTF1	
NFKBIA	
NEFH	
NCF4	
MT2A	
MT1F	
MT1E	
MSCP	
MT1X	
MT1L	
MT1G	
PTX3	
TNFRSF1B	
TNFAIP6	
TLR2	
TOM1	
TNIP1	
TNFRSF6B	
THBD	
TGFA	
T1A-2	
SOD2	
TGM2	
TGIF	
TGFBI	
TRAF1	
VEGF	
VDR	
VCL	
ZNF6	
WTAP	
WNT5A	
UPP1	
TXN	
TREM2	
TREM1	
UGCG	
UCP2	
TXNIP	
SOCS3	
SERPINA1	
SDC4	
SARS	
SGNE1	
SERPINB9	
SERPINB2	
SAMSN1	
RGS1	
RAB31	
RAB13	
RTP801	
RTN1	
RGS16	
SLAMF1	
SLC04A1	
SLC7A8	
SLC7A7	

Annotation:

Concept	Weight	p F-exact	'relative risk'	95%CI
Metallothionein	35.49	0.00015	5.66154	2.75-11.70
MT1E	17.77	0.00102	19.71430	5.13-75.70
MT1G	15.27	0.00012	20.44440	6.34-65.90
MT1L	10.76	0.00000	184.00000	20.60-1.64E0
MT2A	4.71	0.00001	6.30137	3.30-12.00
Zinc	3.56	0.00002	3.87640	2.33-6.46
MT1S	2.71	0.00000	11.87100	5.52-25.50
Cadmium	2.49	0.00002	6.57143	3.31-13.00
Protein Isoforms	1.91	0.00641	1.46454	1.12-1.92
MT1K	1.80	0.00000	184.00000	20.60-1.64E0
Zinc Acetate	0.55	0.00102	19.71430	5.13-75.70
Anions	0.46	0.01663	2.24390	1.21-4.17
Metals, Heavy	0.40	0.00024	6.19231	2.84-13.50
Copper	0.36	0.00457	3.57778	1.68-7.63
Metallothionein A	0.29	0.00178	8.76190	3.03-25.30
Monocytes	0.27	0.00000	5.05263	3.87-6.60
MT3	0.27	0.00095	5.75000	2.49-13.30
Metals	0.12	0.01381	2.44970	1.27-4.73
Tissues	0.11	0.00043	1.58724	1.25-2.02
Metallothionein II	0.08	0.00074	11.50000	3.88-34.10
Chromosomes, Human, Pair 16	0.08	0.42862	1.12982	0.54-2.36
Carcinoma, Transitional Cell	0.08	0.42633	1.39394	0.34-5.66
Liver	0.07	0.00000	1.87472	1.48-2.38
PYGL	0.07	0.00000	1.86767	1.47-2.37
Kidney Tubules, Proximal	0.06	0.05051	2.31933	1.03-5.21
Metallothionein I	0.06	0.00561	6.13333	2.18-17.30
SLC30A1	0.05	0.00129	9.68421	3.32-28.20
Arsenites	0.04	0.00294	4.52459	1.98-10.40
Oxidative Stress	0.03	0.00018	2.94400	1.81-4.79
Glycophorin A	0.02	0.09386	2.38961	0.88-6.47
Sodium Compounds	0.02	0.02104	5.52000	1.68-18.10
GYPA	0.02	0.11066	2.24390	0.83-6.07

Heat Map: CurrentNode: H2001_64X - Correlation 0.27184472828125





200779_at
200799_at
200800_s_at2
01000_at
201427_s_at
201939_at
202022_at
202887_s_at
203355_s_at
203574_at
203622_s_at
204026_s_at
204033_at
204146_at
204285_s_at
204415_at
205047_s_a
t205239_at
208763_s_at
208813_at
208949_s_at
209230_s_at
209608_s_at
210338_s_at
212063_at
212501_at
212971_at
213040_s_at
213075_at
213703_at2
17999_s_at
218145_at
218180_s_at
218585_s_at
218986_s_at
219588_s_at
219961_s_at
221731_x_at
222039_at
222111_at
35820_at

Q-norm

TextBLAST

powered by
Collexis®[Home](#)[Docs](#)[Contact](#)

Please select one or more gene(s):

Q-norm

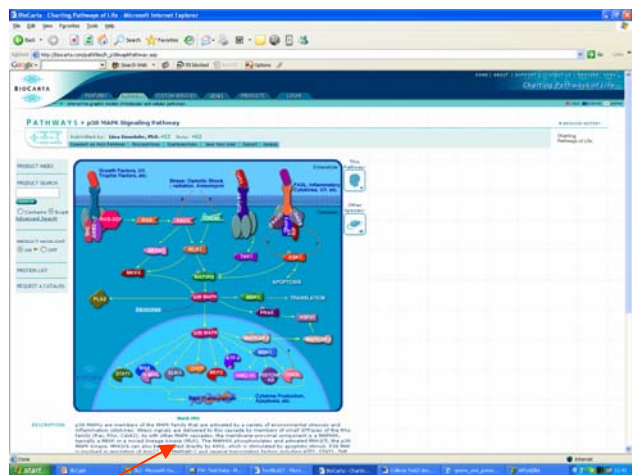
- RAMP (Hs)
- ZWINT / ZW10 interactor (Hs)
- HSPA8 / heat shock 70kDa protein 8 (Hs)
- RAD51AP1 / RAD51 associated protein 1 (Hs)
- ACAT2 / acetyl-Coenzyme A acetyltransferase 2 (acetoacetyl Coenzyme A thiolase) (Hs)
- FLJ11029 (Hs)
- ALDOC / aldolase C, fructose-bisphosphate (Hs)
- CEBPB / CCAAT/enhancer binding protein (C/EBP), beta (Hs)
- TRIP13 / thyroid hormone receptor interactor 13 (Hs)
- HSPA1A / heat shock 70kDa protein 1A (Hs)
- EPS8L2 / EPS8-like 2 (Hs)
- CSPG2 / chondroitin sulfate proteoglycan 2 (versican) (Hs)
- SEPP1 / selenoprotein P, plasma, 1 (Hs)
- MTB (Hs)
- ATF4 / activating transcription factor 4 (tax-responsive enhancer element B67) (Hs)
- FLJ20035 (Hs)
- DDI4 / DNA-damage-inducible transcript 4 (Hs)
- C20orf19 / chromosome 20 open reading frame 19 (Hs)
- NPTXR / neuronal pentraxin receptor (Hs)
- PLK2 / polo-like kinase 2 (Drosophila) (Hs)
- GOT1 / glutamic-oxaloacetic transaminase 1, soluble (aspartate aminotransferase 1) (Hs)
- LOC56902 (Hs)
- G1P3 / interferon, alpha-inducible protein (clone IFI-6-16) (Hs)
- CARS / cysteinyl-tRNA synthetase (Hs)
- TSC22D3 / TSC22 domain family 3 (Hs)
- TRIB3 / tribbles homolog 3 (Drosophila) (Hs)
- LGALS3 / lectin, galactoside-binding, soluble, 3 (galectin 3) (Hs)
- NFIL3 / nuclear factor, interleukin 3 regulated (Hs)
- PMAIP1 / phorbol-12-myristate-13-acetate-induced protein 1 (Hs)
- P8 (Hs)
- PSD3 / pleckstrin and Sec7 domain containing 3 (Hs)
- ZNF6 / zinc finger protein 6 (CMPX1) (Hs)

PLK2 / polo-like kinase 2 (Drosophila) (Hs)
 GOT1 / glutamic-oxaloacetic transaminase 1, soluble (aspartate aminotransferase 1) (Hs)
 LOC56902 (Hs)
 G1P3 / interferon, alpha-inducible protein (clone IFI-6-16) (Hs)
 CARS / cysteinyl-HRNA synthetase (Hs)
 TSC22D3 / TSC22 domain family 3 (Hs)
 TRIB3 / tribbles homolog 3 (Drosophila) (Hs)
 LGALS3 / lectin, galactoside-binding, soluble, 3 (galectin 3) (Hs)
 NFIL3 / nuclear factor, interleukin 3 regulated (Hs)
 PMAIP1 / phorbol-12-myristate-13-acetate-induced protein 1 (Hs)
 P8 (Hs)
 PSD3 / pleckstrin and Sec7 domain containing 3 (Hs)
 ZNF6 / zinc finger protein 6 (CMPX1) (Hs)

1 - 25

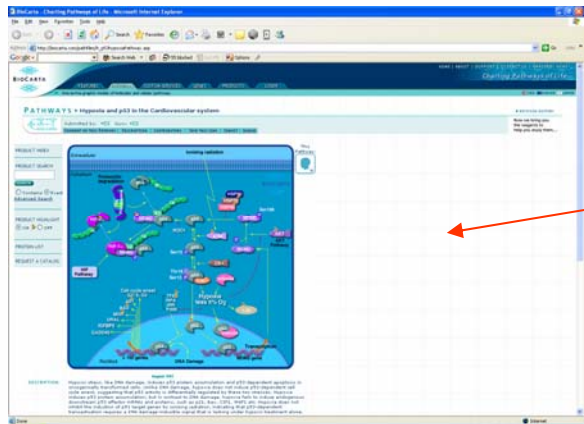
Diseases

- 1.00 Genomic Instability
- 0.99 Sequence Deletion
- 0.79 Chromosomal Instability
- 0.63 Neoplasm Metastasis
- 0.57 Glucose Intolerance
- 0.56 Cell Transformation, Neoplastic
- 0.53 Colonic Neoplasms
- 0.52 Neoplasm Invasiveness
- 0.50 Anoxia
- 0.50 Inflammation
- 0.48 Insulin Resistance
- 0.43 Diabetes Mellitus, Type 2
- 0.43 Adenocarcinoma
- 0.42 Neovascularization, Pathologic
- 0.42 Overnutrition
- 0.42 Carcinoma
- 0.36 Neoplasms
- 0.36 Mastocytoma
- 0.35 Lung Neoplasms
- 0.35 Liver Neoplasms, Experimental
- 0.34 DNA Damage
- 0.34 Carcinoma, Hepatocellular
- 0.32 Hyperinsulinism
- 0.32 Translocation, Genetic
- 0.32 Ovarian Neoplasms



1 - 25

Pathways



- 1.00 Hypoxia and p53 in the Cardiovascular system
- 0.79 p38 MAPK Signaling Pathway
- 0.67 Chaperones modulate interferon Signaling Pathway
- 0.64 AKT Signaling Pathway
- 0.59 MAPKinase Signaling Pathway
- 0.54 Hypoxia-Inducible Factor in the Cardiovascular System
- 0.50 Low-density lipoprotein (LDL) pathway during atherogenesis
- 0.48 Malate-aspartate shuttle
- 0.46 Dendritic cells in regulating TH1 and TH2 Development
- 0.46 PTEN dependent cell cycle arrest and apoptosis
- 0.45 Mechanism of Gene Regulation by Peroxisome Proliferators via PPAR(α)
- 0.43 Stress Induction of HSP Regulation
- 0.43 Glycolysis Pathway
- 0.43 Cell Cycle: G2/M Checkpoint
- 0.40 Overview of telomerase protein component gene hTert Transcriptional Regulation
- 0.37 p53 Signaling Pathway
- 0.37 Human Cytomegalovirus and Map Kinase Pathways
- 0.37 Inhibition of Cellular Proliferation by Gleevec
- 0.35 Visceral Fat Deposits and the Metabolic Syndrome
- 0.34 Erk1/Erk2 Mank Signaling pathway

Database: LocusLink

ID1; ID2; ...: 30 51312 6515 10938

Not found: 34; 51606; 54434; 6515; 10938

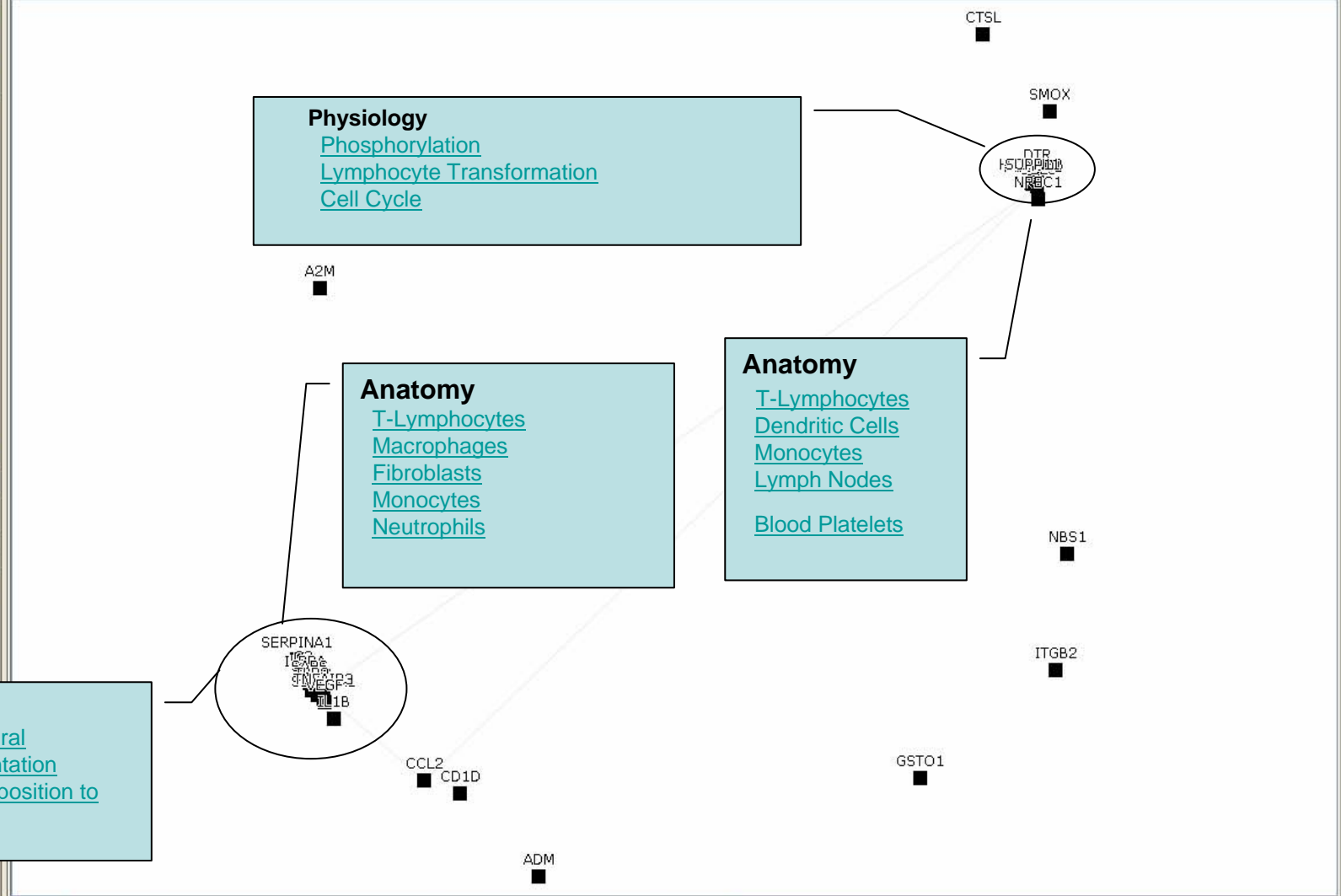
A2M
ADM
ANPEP
ANPEP
ATP2C1
C3
CCL2
CCL3
CCR7
CD1C
CD1D
CD36
CD9
CNK
CTSL
CXCL2
DTR
GSTO1
HLA-DMA

List Search Internet databases

Seeds Viewer

Selected seed concepts (46)

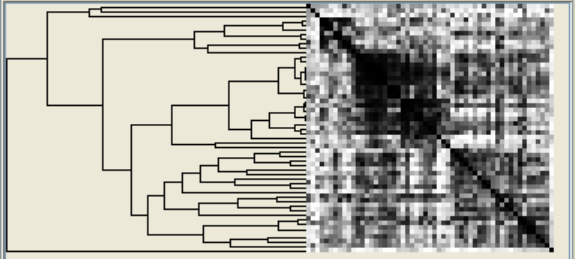
A2M
ADM
ANPEP
ANPEP
ATP2C1
C3
CCL2
CCL3
CCR7
CD1C
CD1D
CD36
CD9
CNK
CTSL
CXCL2
DTR
GSTO1
HLA-DMA
HLA-DMB
IL1A
IL1B
IL1RN
IL2RA



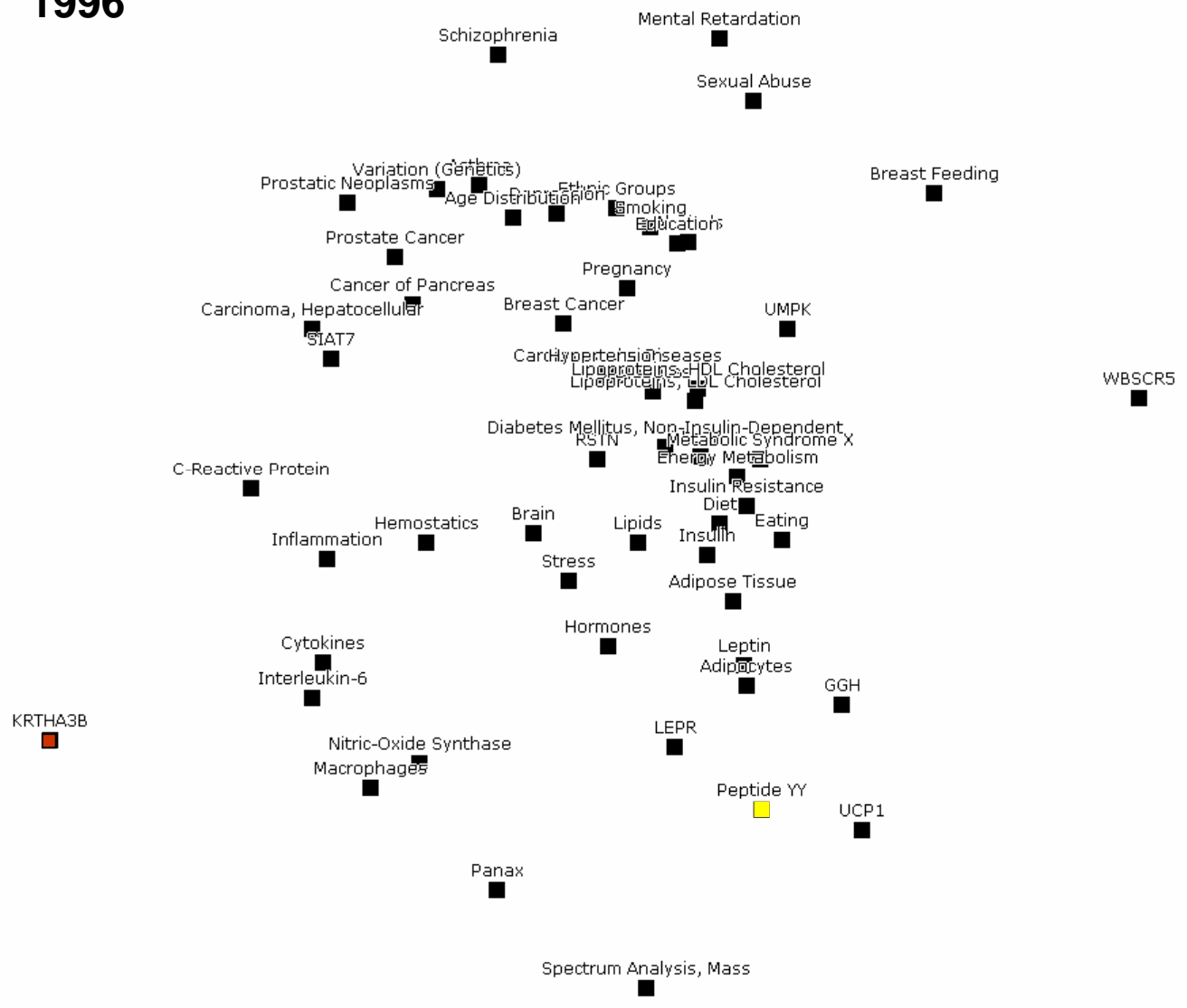
Legend

Undefined	Devices	Objects	Procedures
Activities & Behaviors	Disorders	Occupations	
Anatomy	Genes & Molecular Sequences	Organizations	
Chemicals & Drugs	Geographic Areas	Phenomena	
Concepts & Ideas	Living Beings	Physiology	

From	To	Distance
Panax	Panax	0
Panax	Cytokines	168
Panax	Cardiovascular Diseases	183
Panax	Peptide YY	192
Panax	C-Reactive Protein	232
Panax	Breast Feeding	222
Panax	Breast Cancer	72
Panax	Brain	72
Panax	Metabolic Syndrome X	200
Panax	Variation (Genetics)	203
Panax	Asthma	233
Panax	Stress	60
Panax	Spectrum Analysis, M...	156
Panax	Prostate Cancer	235
Panax	Smoking	234
Panax	Schizophrenia	218
Panax	Cancer of Pancreas	242
Panax	Prostatic Neoplasms	233
Panax	Pregnancy	228
Panax	Leptin	177
Panax	Obesity	199
Panax	Sexual Abuse	231
Panax	Mental Retardation	230
Panax	Macrophages	46
Panax	Lipoproteins, LDL Cho...	135
Panax	Lipoproteins, HDL Ch...	137
Panax	Lipids	54
Panax	Interleukin-6	172
Panax	Insulin Resistance	189
Panax	Insulin	164
Panax	Inflammation	192
Panax	Adipocytes	156



1996



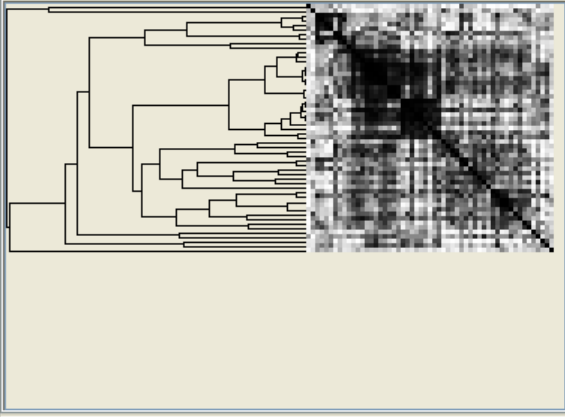
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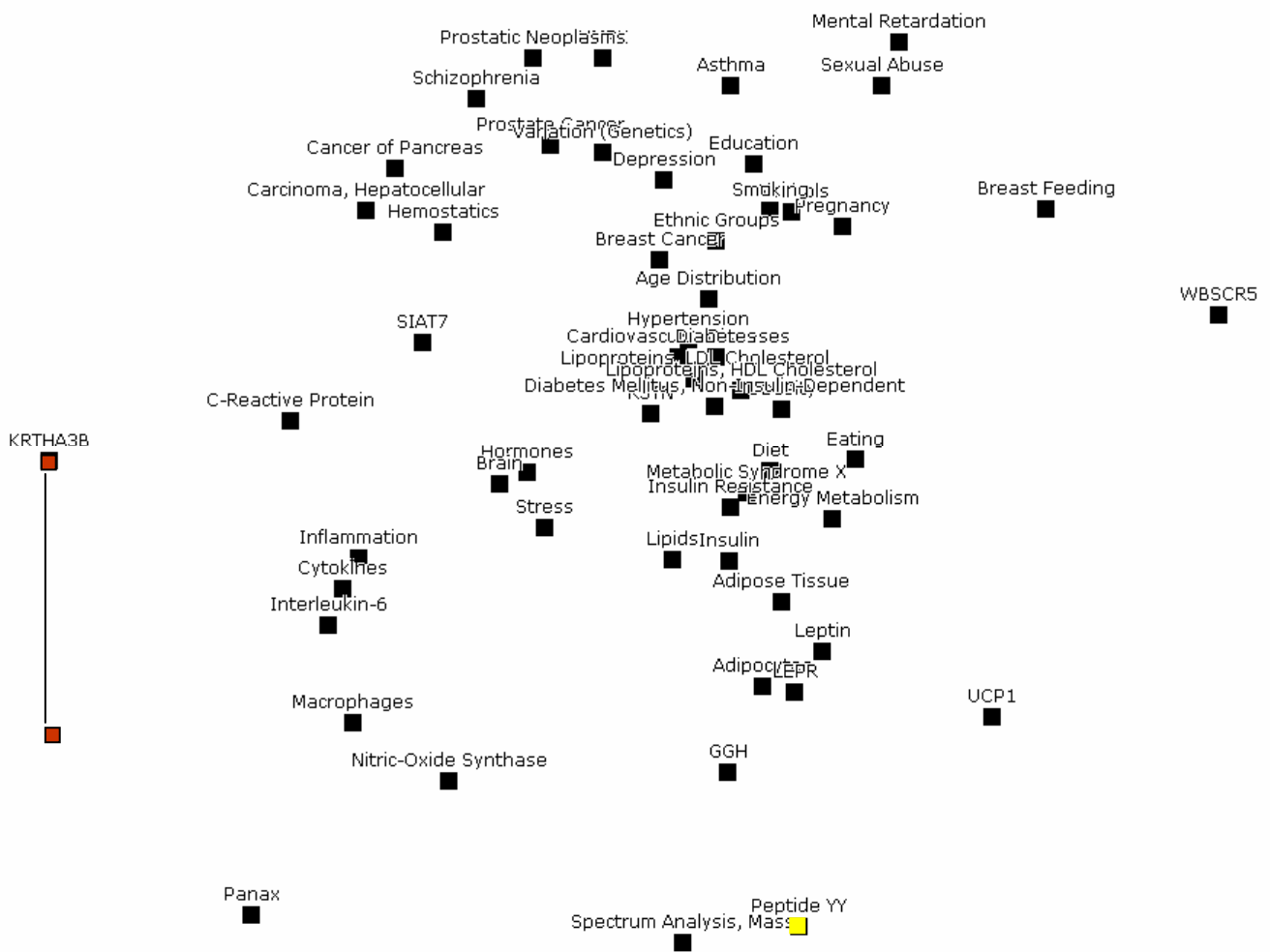
Explorer Distances "1997" Seed concepts

From	To	Distance
Panax	Panax	0
Panax	Cytokines	198
Panax	Cardiovascular Diseases	246
Panax	Peptide YY	233
Panax	C-Reactive Protein	240
Panax	Breast Feeding	254
Panax	Breast Cancer	253
Panax	Brain	75
Panax	Metabolic Syndrome X	207
Panax	Variation (Genetics)	241
Panax	Asthma	238
Panax	Stress	194
Panax	Spectrum Analysis, M...	244
Panax	Prostate Cancer	253
Panax	Smoking	248
Panax	Schizophrenia	195
Panax	Cancer of Pancreas	255
Panax	Prostatic Neoplasms	253
Panax	Pregnancy	250
Panax	Leptin	208
Panax	Obesity	230
Panax	Sexual Abuse	248
Panax	Mental Retardation	254
Panax	Macrophages	180
Panax	Lipoproteins, LDL Cho...	241
Panax	Lipoproteins, HDL Ch...	236
Panax	Lipids	218
Panax	Interleukin-6	199
Panax	Insulin Resistance	208
Panax	Insulin	223
Panax	Inflammation	172
Panax	Adipocytes	203



Viewer

1997



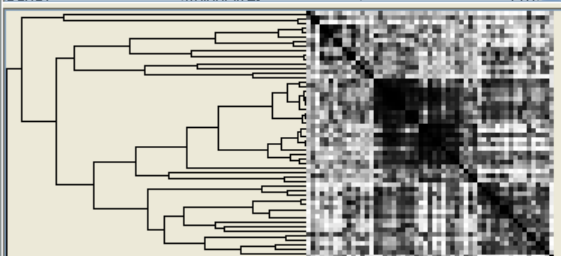
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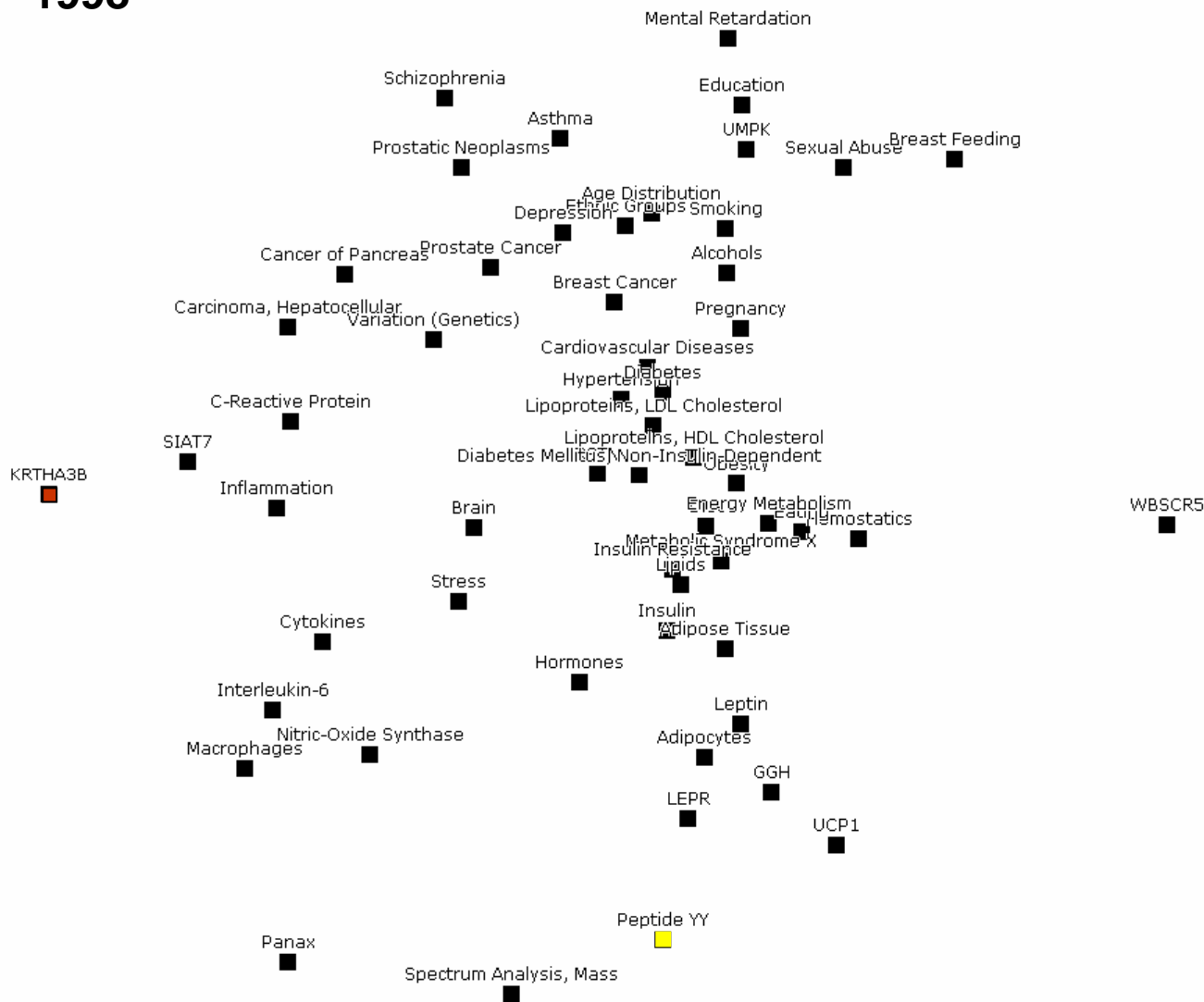
Explorer Distances "1998" Seed concepts

From	To	Distance
Panax	Panax	0
Panax	Cytokines	211
Panax	Cardiovascular Diseases	201
Panax	Peptide YY	177
Panax	C-Reactive Protein	240
Panax	Breast Feeding	254
Panax	Breast Cancer	228
Panax	Brain	66
Panax	Metabolic Syndrome X	196
Panax	Variation (Genetics)	225
Panax	Asthma	243
Panax	Stress	76
Panax	Spectrum Analysis, M...	160
Panax	Prostate Cancer	234
Panax	Smoking	236
Panax	Schizophrenia	237
Panax	Cancer of Pancreas	223
Panax	Prostatic Neoplasms	253
Panax	Pregnancy	222
Panax	Leptin	188
Panax	Obesity	215
Panax	Sexual Abuse	250
Panax	Mental Retardation	250
Panax	Macrophages	158
Panax	Lipoproteins, LDL Cho...	194
Panax	Lipoproteins, HDL Ch...	164
Panax	Lipids	188
Panax	Interleukin-6	193
Panax	Insulin Resistance	199
Panax	Insulin	194
Panax	Inflammation	199
Panax	Adipocytes	170



Viewer

1998



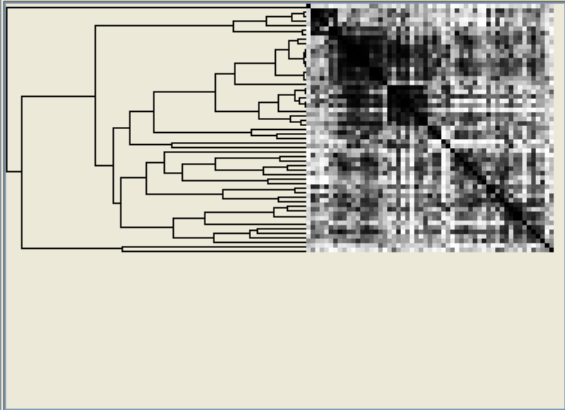
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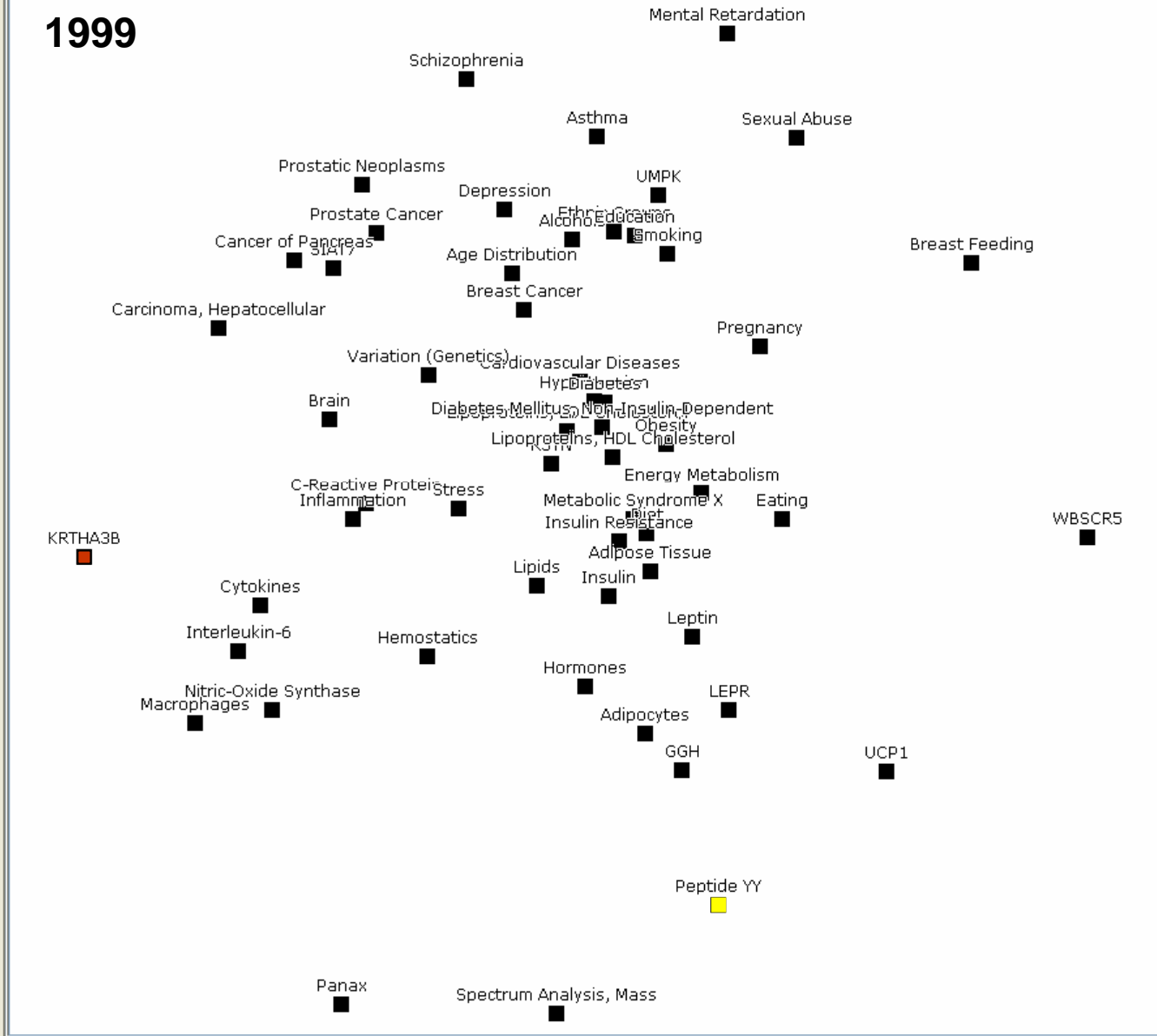


Explorer Distances "1999" Seed concepts

From	To	Distance
Panax	Panax	0
Panax	Cytokines	214
Panax	Cardiovascular Diseases	233
Panax	Peptide YY	244
Panax	C-Reactive Protein	247
Panax	Breast Feeding	255
Panax	Breast Cancer	236
Panax	Brain	220
Panax	Metabolic Syndrome X	196
Panax	Variation (Genetics)	247
Panax	Asthma	250
Panax	Stress	212
Panax	Spectrum Analysis, M...	193
Panax	Prostate Cancer	217
Panax	Smoking	199
Panax	Schizophrenia	246
Panax	Cancer of Pancreas	195
Panax	Prostatic Neoplasms	213
Panax	Pregnancy	244
Panax	Leptin	201
Panax	Obesity	200
Panax	Sexual Abuse	253
Panax	Mental Retardation	254
Panax	Macrophages	225
Panax	Lipoproteins, LDL Cho...	117
Panax	Lipoproteins, HDL Ch...	123
Panax	Lipids	190
Panax	Interleukin-6	221
Panax	Insulin Resistance	221
Panax	Insulin	224
Panax	Inflammation	234
Panax	Adipocytes	230



Viewer



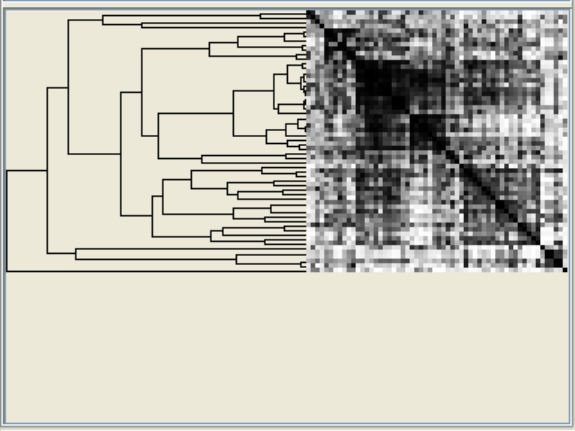
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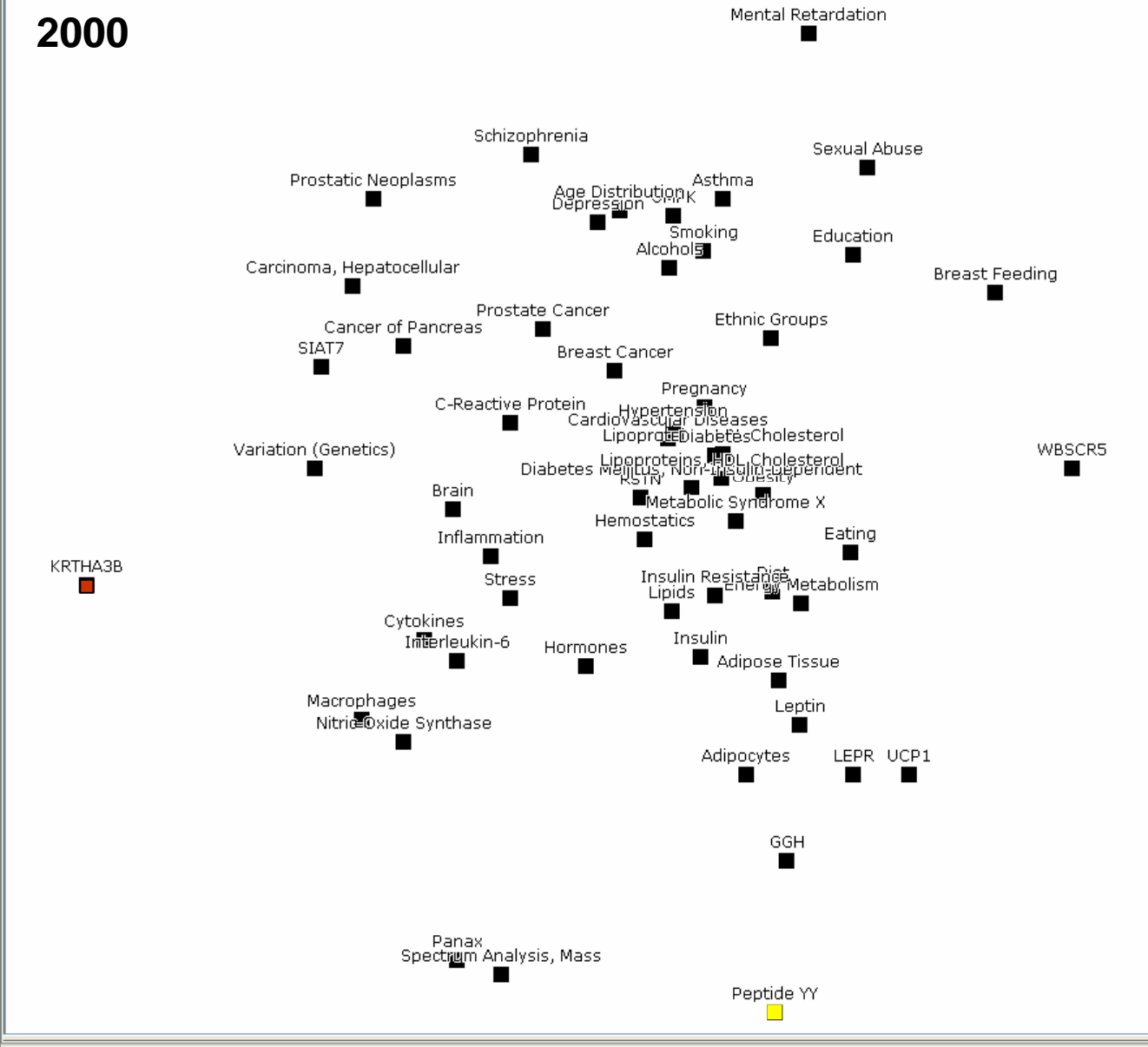
Explorer Distances "2000" Seed concepts

From	To	Distance
Panax	Panax	0
Panax	Cytokines	141
Panax	Cardiovascular Diseases	222
Panax	Peptide YY	229
Panax	C-Reactive Protein	249
Panax	Breast Feeding	251
Panax	Breast Cancer	235
Panax	Brain	188
Panax	Metabolic Syndrome X	155
Panax	Variation (Genetics)	201
Panax	Asthma	242
Panax	Stress	163
Panax	Spectrum Analysis, M...	33
Panax	Prostate Cancer	222
Panax	Smoking	229
Panax	Schizophrenia	248
Panax	Cancer of Pancreas	207
Panax	Prostatic Neoplasms	239
Panax	Pregnancy	238
Panax	Leptin	161
Panax	Obesity	197
Panax	Sexual Abuse	252
Panax	Mental Retardation	254
Panax	Macrophages	49
Panax	Lipoproteins, LDL Cho...	231
Panax	Lipoproteins, HDL Ch...	230
Panax	Lipids	180
Panax	Interleukin-6	164
Panax	Insulin Resistance	88
Panax	Insulin	62
Panax	Inflammation	192

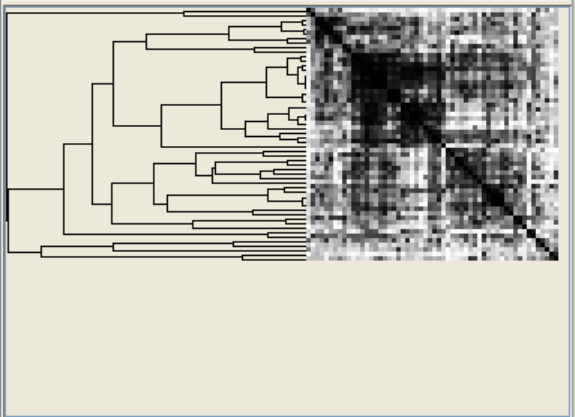


Viewer

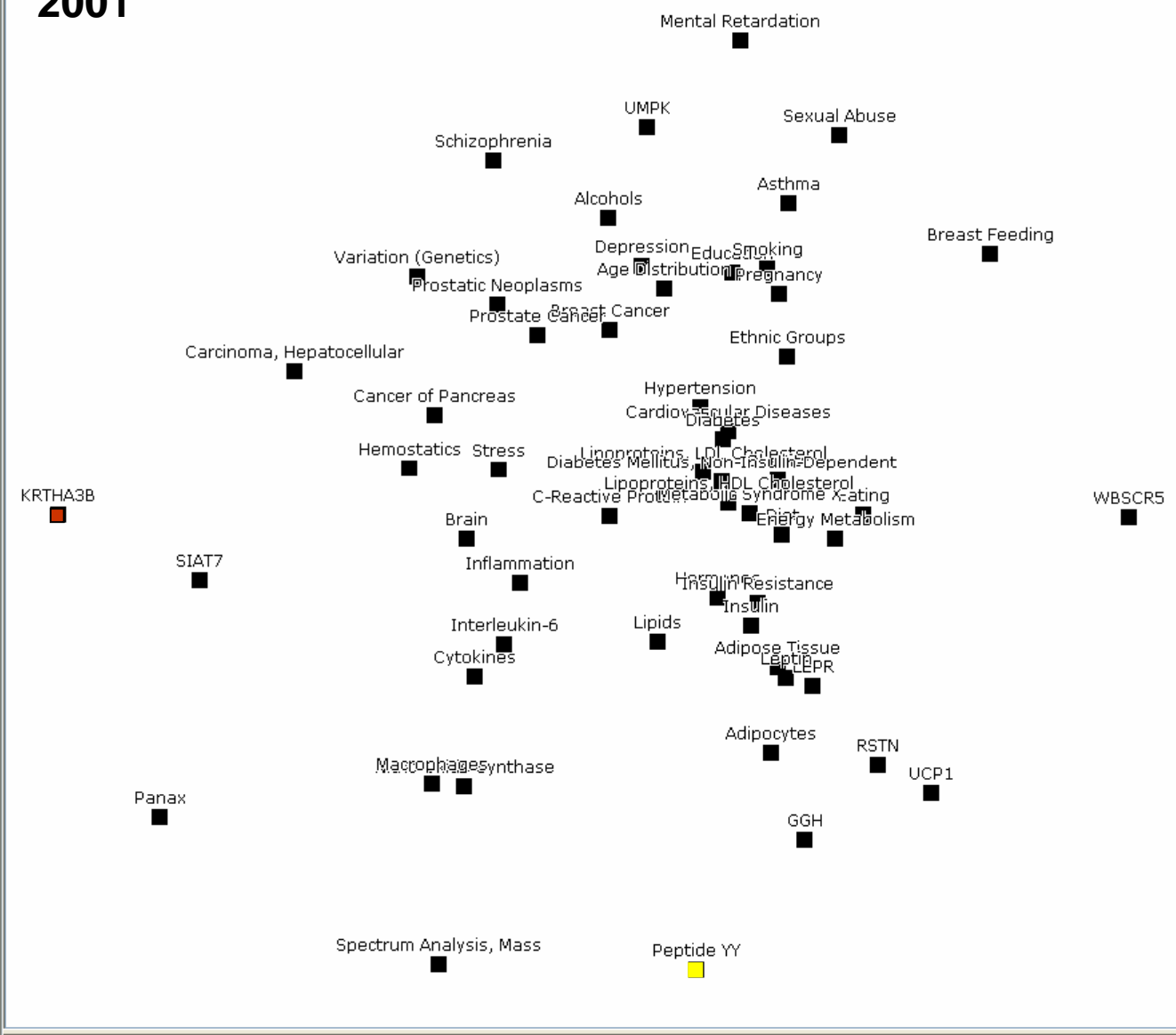
2000



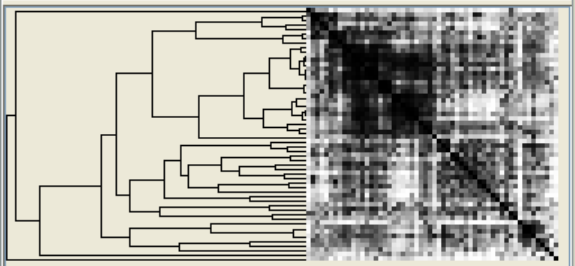
From	To	Distance
Panax	Panax	0
Panax	Cytokines	195
Panax	Cardiovascular Diseases	247
Panax	Peptide YY	207
Panax	C-Reactive Protein	213
Panax	Breast Feeding	247
Panax	Breast Cancer	223
Panax	Brain	200
Panax	Metabolic Syndrome X	250
Panax	Variation (Genetics)	87
Panax	Asthma	248
Panax	Stress	227
Panax	Spectrum Analysis, M...	121
Panax	Prostate Cancer	208
Panax	Smoking	244
Panax	Schizophrenia	226
Panax	Cancer of Pancreas	226
Panax	Prostatic Neoplasms	209
Panax	Pregnancy	252
Panax	Leptin	236
Panax	Obesity	241
Panax	Sexual Abuse	237
Panax	Mental Retardation	255
Panax	Macrophages	165
Panax	Lipoproteins, LDL Cho...	239
Panax	Lipoproteins, HDL Ch...	228
Panax	Lipids	235
Panax	Interleukin-6	199
Panax	Insulin Resistance	225
Panax	Insulin	233
Panax	Inflammation	100



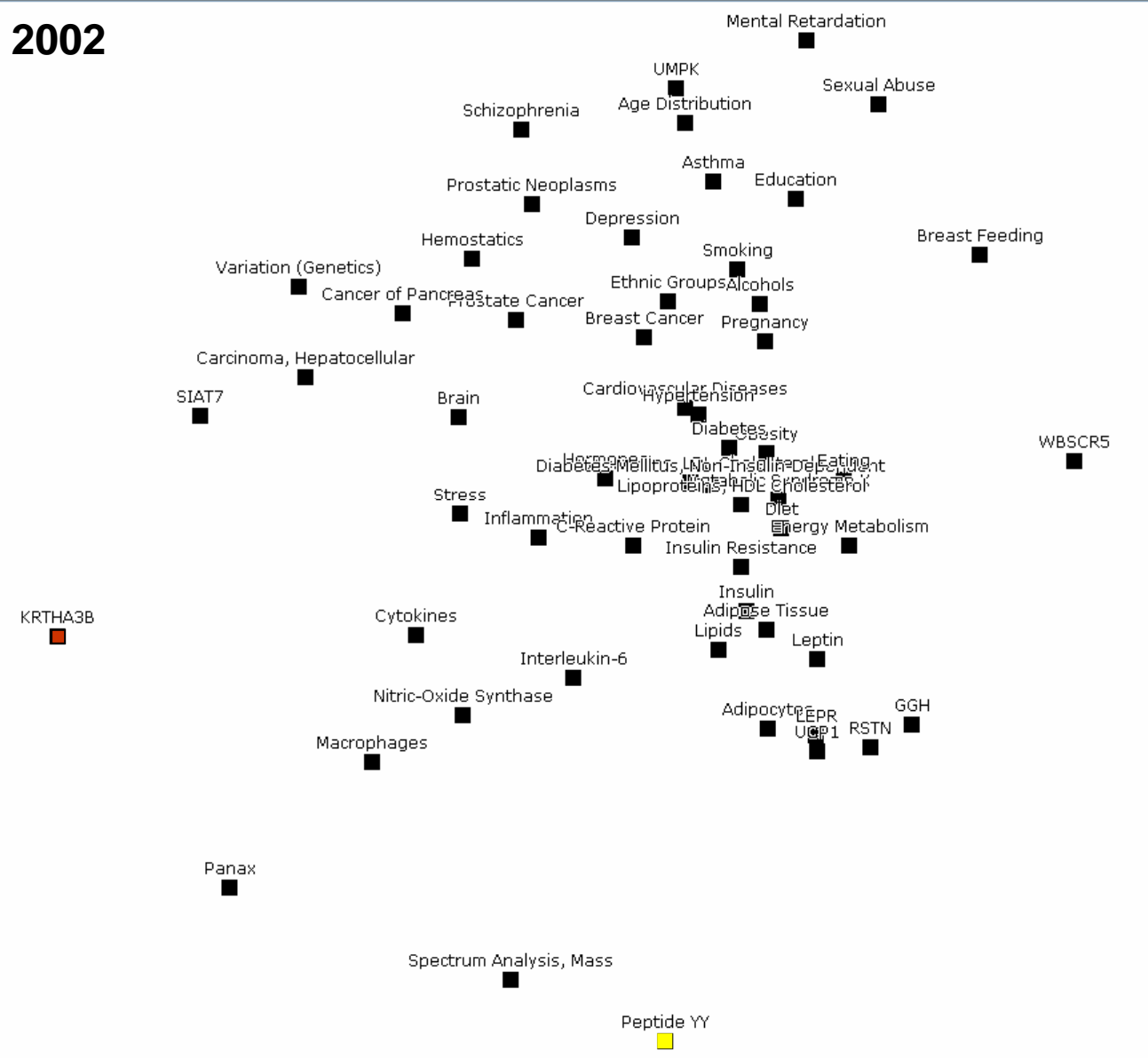
2001



From	To	Distance
Panax	Panax	0
Panax	Cytokines	63
Panax	Cardiovascular Diseases	239
Panax	Peptide YY	240
Panax	C-Reactive Protein	245
Panax	Breast Feeding	252
Panax	Breast Cancer	239
Panax	Brain	215
Panax	Metabolic Syndrome X	218
Panax	Variation (Genetics)	228
Panax	Asthma	229
Panax	Stress	66
Panax	Spectrum Analysis, M...	204
Panax	Prostate Cancer	251
Panax	Smoking	247
Panax	Schizophrenia	238
Panax	Cancer of Pancreas	251
Panax	Prostatic Neoplasms	253
Panax	Pregnancy	243
Panax	Leptin	225
Panax	Obesity	238
Panax	Sexual Abuse	247
Panax	Mental Retardation	249
Panax	Macrophages	161
Panax	Lipoproteins, LDL Cho...	215
Panax	Lipoproteins, HDL Ch...	205
Panax	Lipids	225
Panax	Interleukin-6	170
Panax	Insulin Resistance	202
Panax	Insulin	162
Panax	Inflammation	185
Panax	Adipocytes	162



2002



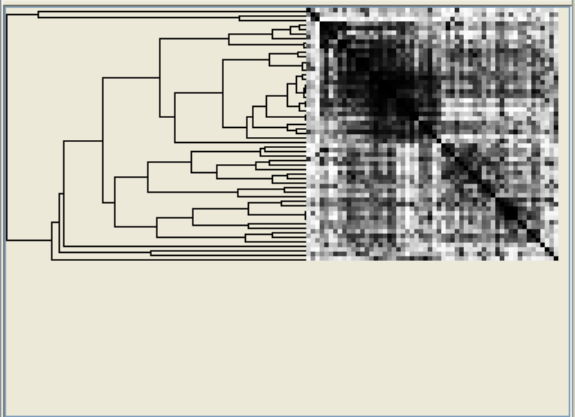
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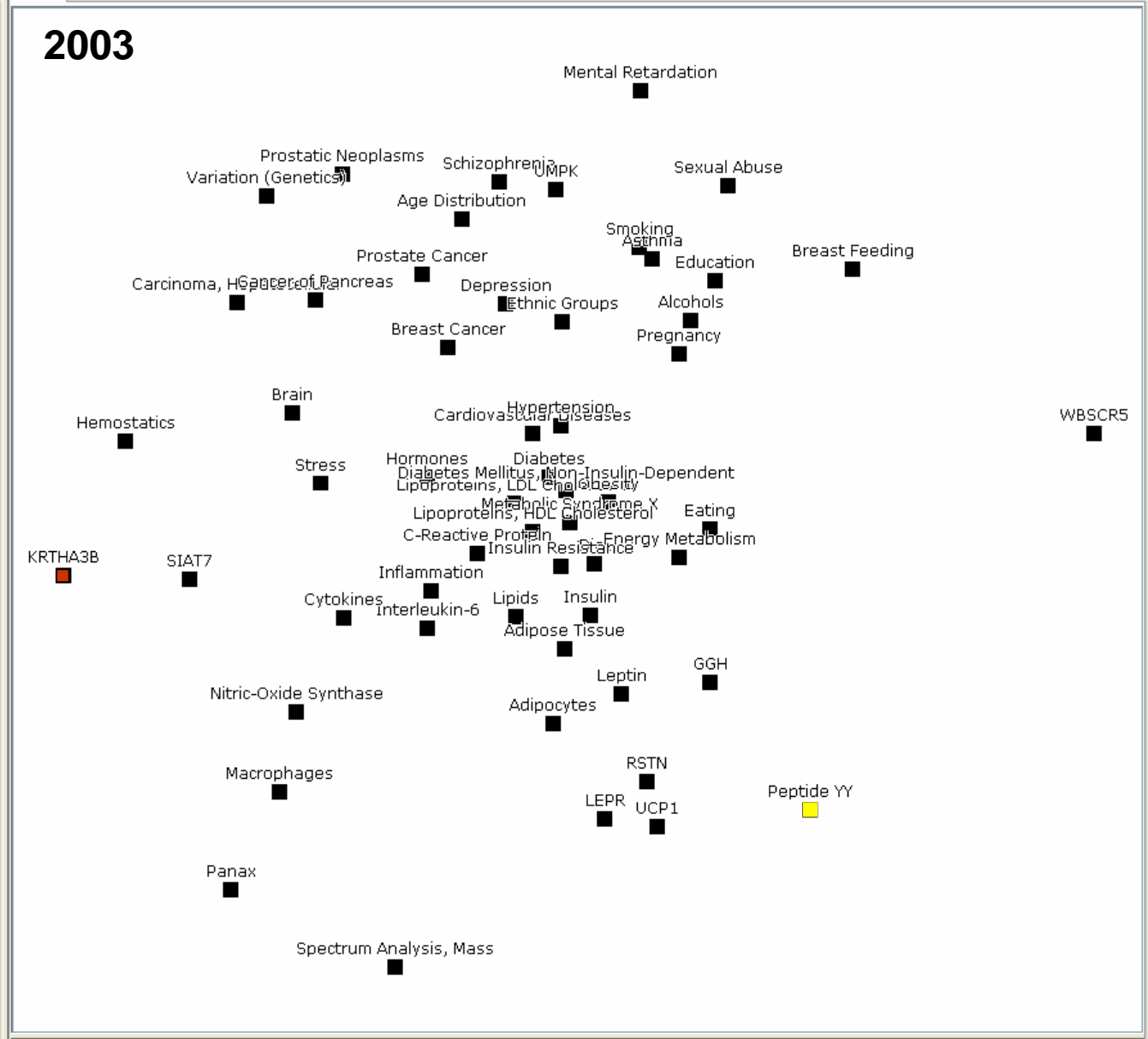


Explorer Distances "2003" Seed concepts

From	To	Distance
Panax	Panax	0
Panax	Cytokines	192
Panax	Cardiovascular Diseases	225
Panax	Peptide YY	242
Panax	C-Reactive Protein	220
Panax	Breast Feeding	255
Panax	Breast Cancer	206
Panax	Brain	190
Panax	Metabolic Syndrome X	216
Panax	Variation (Genetics)	237
Panax	Asthma	226
Panax	Stress	40
Panax	Spectrum Analysis, M...	122
Panax	Prostate Cancer	227
Panax	Smoking	240
Panax	Schizophrenia	251
Panax	Cancer of Pancreas	223
Panax	Prostatic Neoplasms	243
Panax	Pregnancy	218
Panax	Leptin	178
Panax	Obesity	220
Panax	Sexual Abuse	249
Panax	Mental Retardation	251
Panax	Macrophages	156
Panax	Lipoproteins, LDL Cho...	153
Panax	Lipoproteins, HDL Ch...	55
Panax	Lipids	78
Panax	Interleukin-6	92
Panax	Insulin Resistance	158
Panax	Insulin	150
Panax	Inflammation	213



Viewer

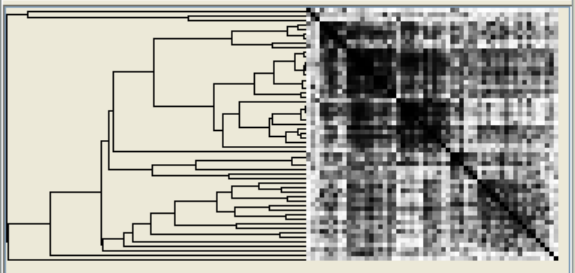


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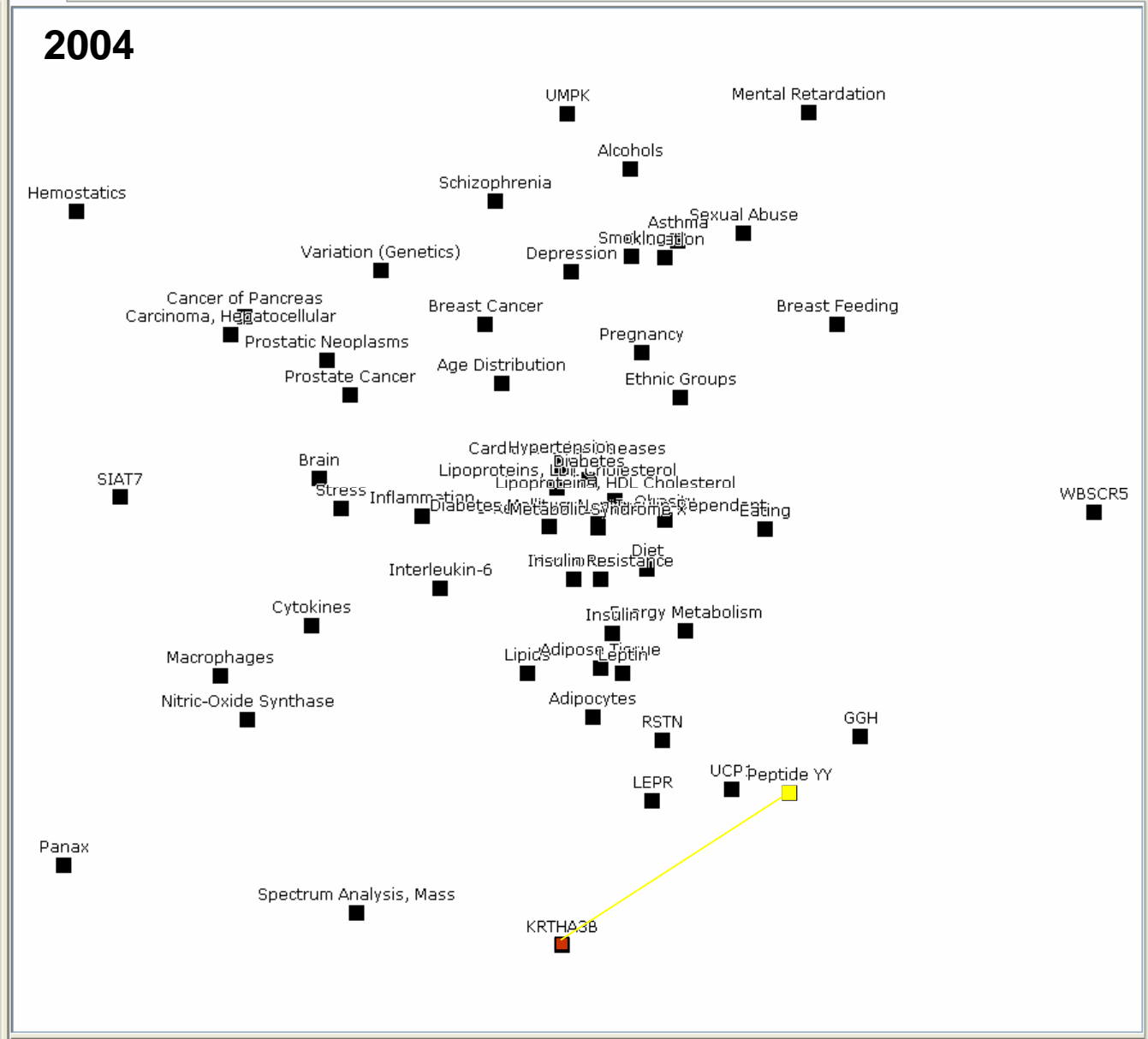
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Explorer Distances "2004" Seed concepts

From	To	Distance
Panax	Panax	0
Panax	Cytokines	86
Panax	Cardiovascular Diseases	246
Panax	Peptide YY	237
Panax	C-Reactive Protein	249
Panax	Breast Feeding	253
Panax	Breast Cancer	244
Panax	Brain	232
Panax	Metabolic Syndrome X	230
Panax	Variation (Genetics)	240
Panax	Asthma	247
Panax	Stress	230
Panax	Spectrum Analysis, M...	132
Panax	Prostate Cancer	95
Panax	Smoking	255
Panax	Schizophrenia	244
Panax	Cancer of Pancreas	247
Panax	Prostatic Neoplasms	133
Panax	Pregnancy	254
Panax	Leptin	221
Panax	Obesity	252
Panax	Sexual Abuse	254
Panax	Mental Retardation	249
Panax	Macrophages	179
Panax	Lipoproteins, LDL Cho...	249
Panax	Lipoproteins, HDL Ch...	249
Panax	Lipids	233
Panax	Interleukin-6	206
Panax	Insulin Resistance	200
Panax	Insulin	170
Panax	Inflammation	208



Viewer



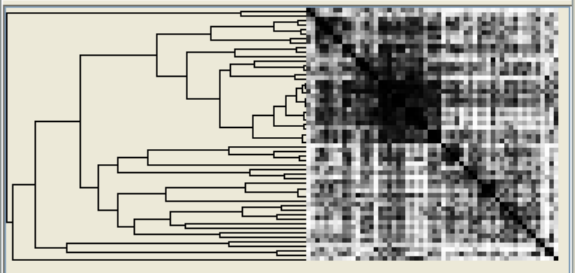
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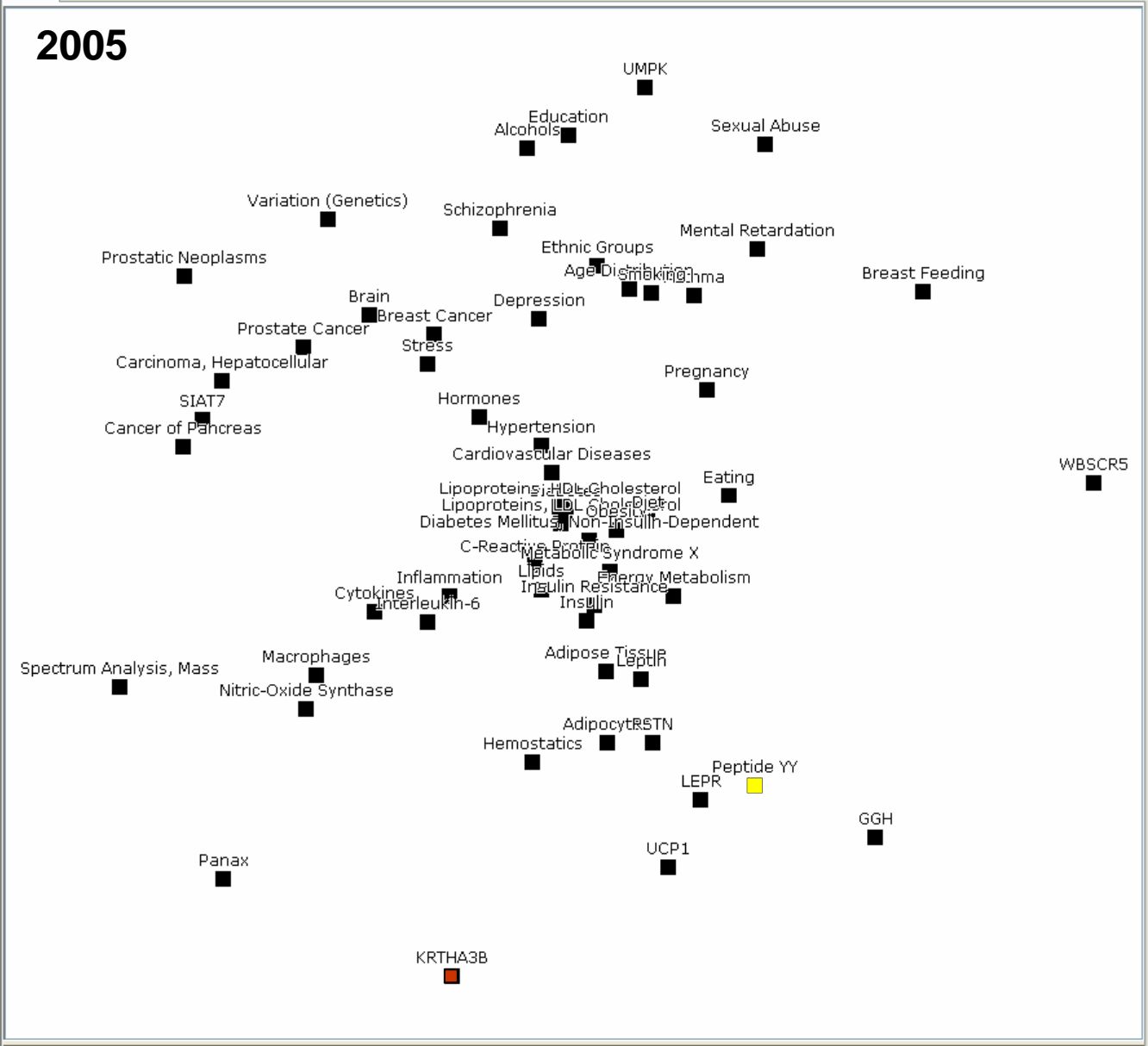


Explorer Distances "2005" Seed concepts

From	To	Distance
Panax	Panax	0
Panax	Cytokines	140
Panax	Cardiovascular Diseases	226
Panax	Peptide YY	167
Panax	C-Reactive Protein	228
Panax	Breast Feeding	243
Panax	Breast Cancer	243
Panax	Brain	207
Panax	Metabolic Syndrome X	167
Panax	Variation (Genetics)	208
Panax	Asthma	245
Panax	Stress	172
Panax	Spectrum Analysis, M...	42
Panax	Prostate Cancer	241
Panax	Smoking	250
Panax	Schizophrenia	254
Panax	Cancer of Pancreas	239
Panax	Prostatic Neoplasms	232
Panax	Pregnancy	252
Panax	Leptin	121
Panax	Obesity	48
Panax	Sexual Abuse	252
Panax	Mental Retardation	250
Panax	Macrophages	53
Panax	Lipoproteins, LDL Cho...	233
Panax	Lipoproteins, HDL Ch...	230
Panax	Lipids	211
Panax	Interleukin-6	172
Panax	Insulin Resistance	139
Panax	Insulin	175
Panax	Inflammation	204



Viewer

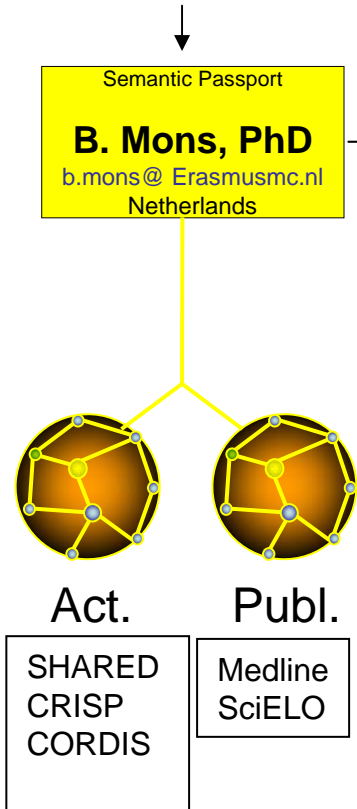


The Million Minds Approach

Semantic Tagging (distributed and central)

- **Tag-as-you-Type/Like**
 - Proposals-Projects (NIH, Wellcome Trust as environment)
 - Manuscripts-Papers (BMC, Plos, **SciELO** as test environment)
- **Retrospective Tagging**
 - **Text** (PubMed, projects, patents, open access journals, **own papers!**)
 - **Data base records** (SwissProt, EntrezGene, GO, OMIM, BIND)
- **Thesaurus Enrichment** (with Wikipedia, U-Wiktionary)
- **Semantic linking at concept level** (All tagged resources)

Minimal personal data



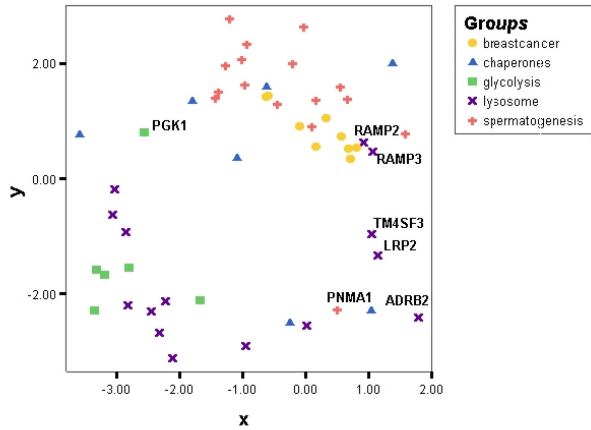
Semantic Passport

Output 1 (**confirm** Focus)
Maybe different panels

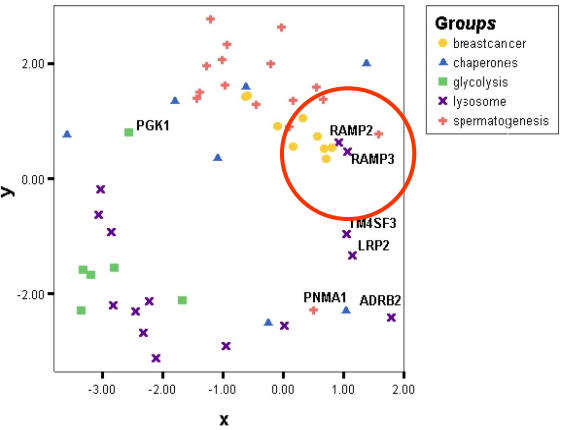
- All output with clickbox
- Your **Topics**
 - Your **concepts**
- People
 - Similar
 - Complementary
- Semantic types (**topics**)
 - TextBlast output
 - Restricted to 'logic'
- Resources
 - Medline
 - CRISP
 - CORDIS
 - LILACS
 - Others based on
 - Sem.types
 - Metadata (country)
- Interactive tools
 - Add (missing papers/projects)
 - Invite colleagues
 - Etc.

confirm →

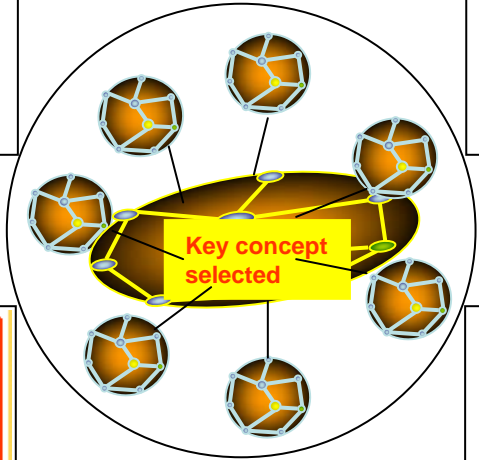
A = Established Knowledge



B = suggested Knowledge



BLAST-over



C = Suggested Experts

- Accept
- Block
- Add
- Invite to chat, etc.
- Send e-mail (group)
- Etc.

People identified by their surname and initials
found: 1099

- Alcala Brevis, C relev. artides: 7 of 20
- Bujowski Argota, R relev. artides: 6 of 17
- Pajuelo Ramirez, J relev. artides: 5 of 14
- PE-SUNYER, FC relev. artides: 4 of 10
- Cepillo de Hernandez, C relev. artides: 4 of 15
- Figueroa de Quintana, O relev. artides: 4 of 16
- Soto de Sanabria, I relev. artides: 4 of 17
- Ferraz, C relev. artides: 4 of 22
- DANIELS, SR relev. artides: 3 of 5
- Kain B., J relev. artides: 4 of 6
- Malencowicz M., A relev. artides: 3 of 3
- Lopez B., L relev. artides: 3 of 16

D = Suggested PMID's

Screenshot of a PubMed search results page for "RAMP and Cancer".

DAILY Feed

The cycle of computer-assisted distributed annotation

