

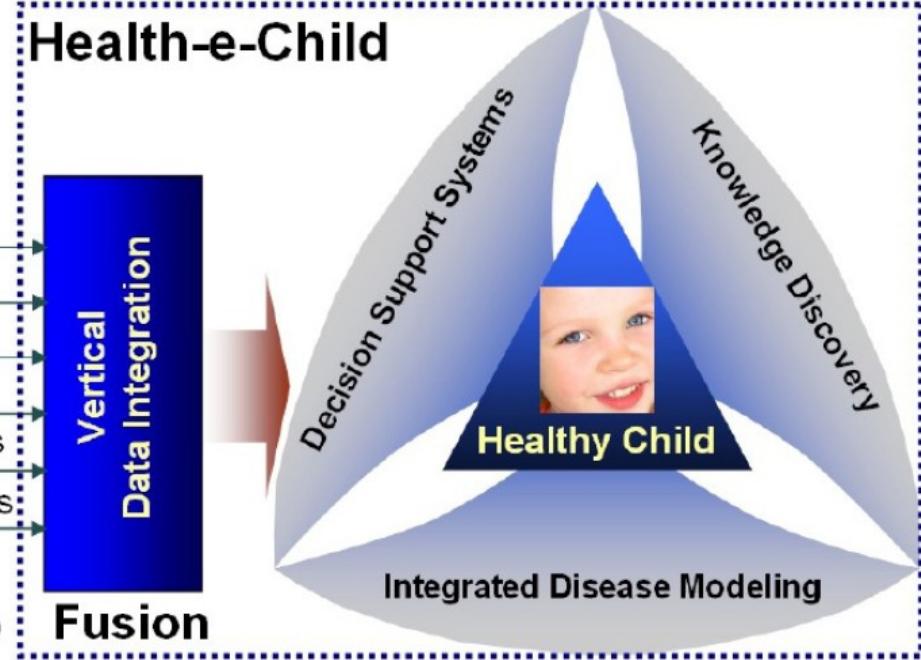
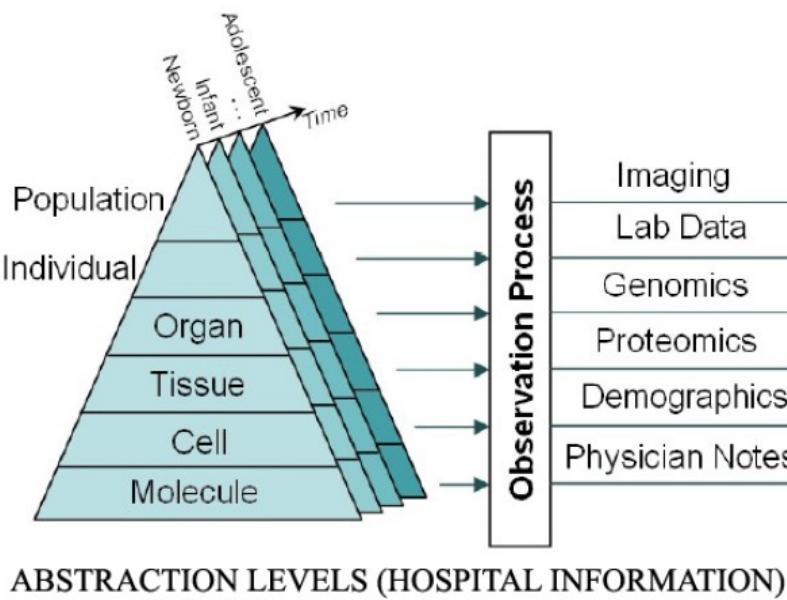
Building conceptual spaces for exploring and linking biomedical resources

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Outline

- ▶ Motivation
- ▶ Method
- ▶ Prototype Implementation
- ▶ Related Work

Motivation: HeC

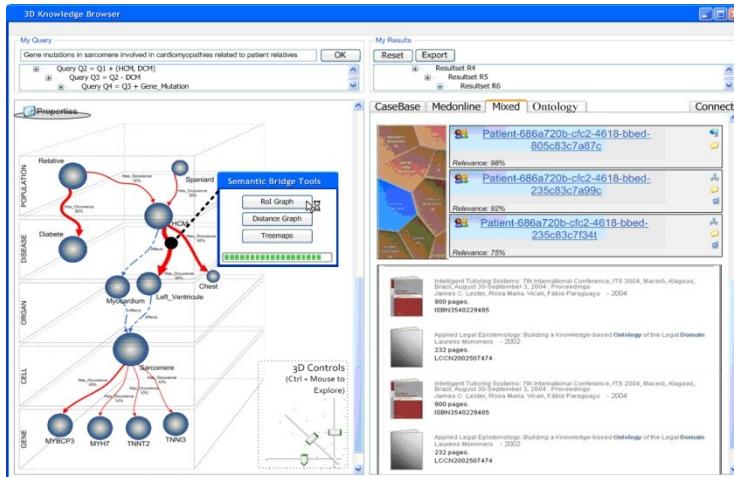


Motivation

- ▶ Linking, accessing and using
 - Biomedical terminologies (e.g. UMLS, Swissprot)
 - Text resources (e.g. Pubmed abstracts)
 - Patient data
- ▶ Providing an everyday environment
 - Clinicians use a web browser (IE or FF) to find papers/search public databases for information

Proposal: 3D Knowledge Browser

- ▶ An interactive Web-based and 3D-like tool
- ▶ To explore Semantic Spaces
- ▶ To access external resources and patient data



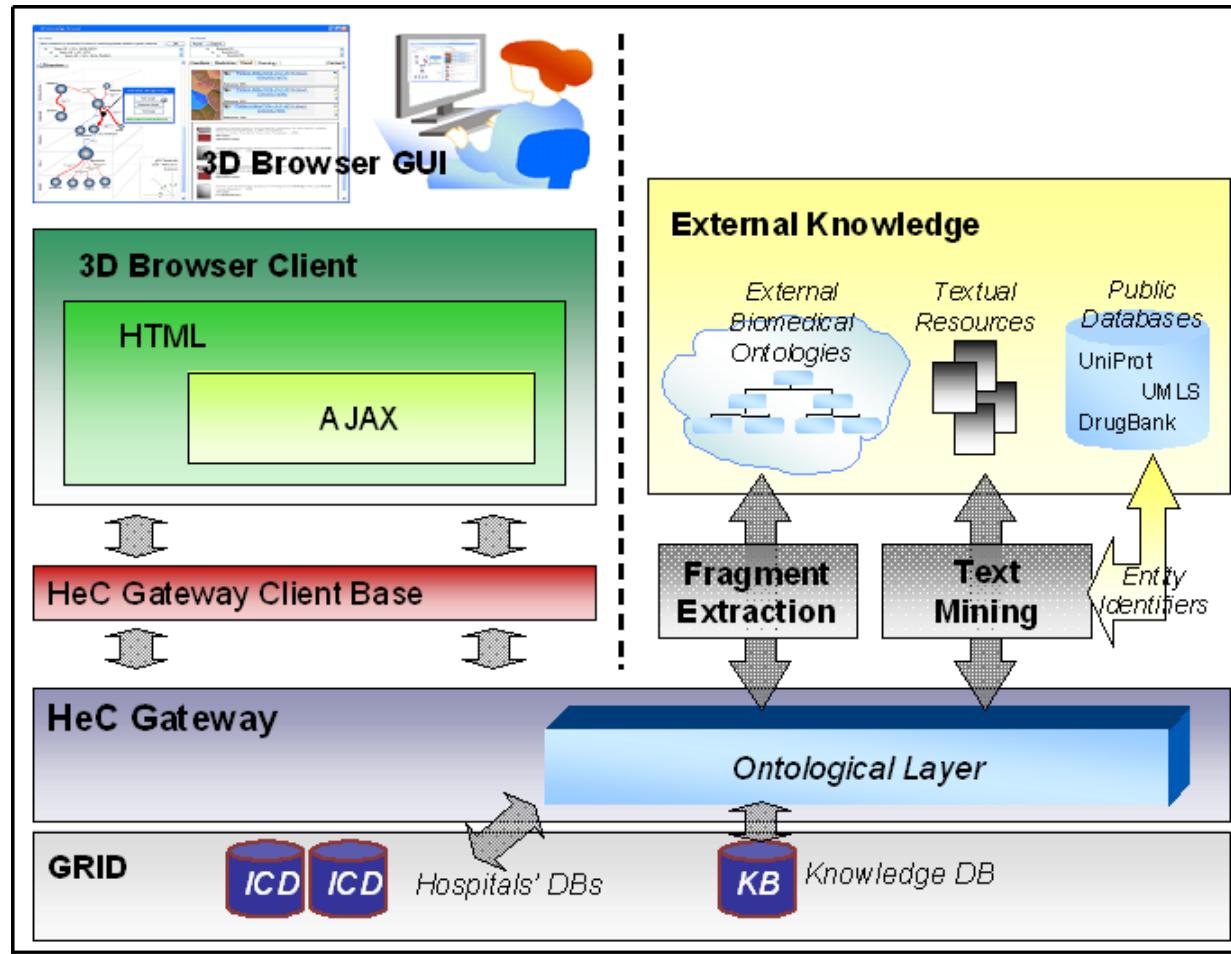
Knowledge Normalization

- ▶ UMLS has been selected as the knowledge source to feed the **semantic/concept spaces**
- ▶ UMLS concepts are partitioned in several **dimensions** according their **semantic type** and the **HeC Levels**
- ▶ UMLS taxonomy is indexed using an interval-based **labelling schema**
 - *Nebot and Berlanga. Efficient retrieval of ontology fragments using an interval-based labelling scheme. 2009*

Normalization of Resources

- ▶ Documents are annotated using UMLS terms
 - *Berlanga, Nebot and Jimenez-Ruiz. "Semantic annotations of texts through concept retrieval". 2010*
- ▶ Documents are normalized with the **most relevant concept** for each selected dimension
- ▶ Example:
 - Individual.Disease → C1384600:JIA
 - Molecular.InmunologicFactor → C0021760:IL6
 - Population.Group → C0007457:Caucasoid Race

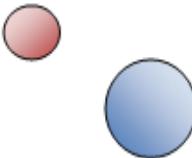
Prototype Architecture (I)



Prototype Architecture (II)

- ▶ The Graphical Engine propagates actions to the AJAX wrapper to perform the necessary queries
- ▶ A Web Service fetches queries from the AJAX side (graphical side) to the back-end (MySQL)
- ▶ then transforms the received data into XML format
- ▶ The GE takes as input that XML document with the graphical elements to draw.

3D Map Objects

ELEMENT	NAME
	Level or Semantic Layer
	Concept
	Semantic Bridge

<map>

(...)

<element type='vlevel'
id='Population_'/>

<element type='concept'
id='C0454713'
label='European country'
level='Population_' size='79'
abslevel='3' color='blue'
stype='Geographic Area' />

(...)

</map>

Prototype Implementation

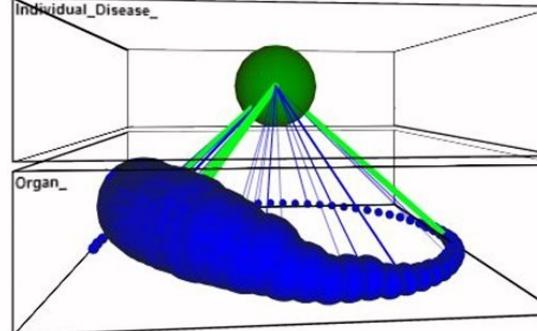
Nature Proceedings : doi:10.1038/npre.2010.5381.1 : Posted 10 Dec 2010

3D-Browser
Juvenile Idiopathic Arthritis

Selected Levels: Organ,|Body Part Organ or Organ Component;5;Individual.Disease,|Disease or Syndrome;5
Query (optional): arthritis

Level: Organ_Body Part Organ or Organ Component/5
Concept: (C0018670) - heads
Sem.Type: Body Location or Region;Body Part Organ or Organ Component

Tools



3D Map Component

Individual_Disease_

Organ_

100 %

Restore

maat
Gknowledge

3D Map configuration Section

Documents @ SwissProt @ HeC DB Tree Build Map

Granularity: depth 5 Reset Selected Levels

Vertical Levels

- Population
- Individual
 - Attribute
 - Finding
 - HealthProcedure
 - Disease
 - Disease or Syndrome
 - Mental or Behavioral Dysfunction
 - Neoplastic Process
 - Experimental Model of Disease
 - Abnormalities
 - Injury.Poisoning
- Organ
 - Body Space or Junction
 - Body Location or Region
 - Anatomical Structure
 - Body Part, Organ, or Organ Component
 - Organ or Tissue Function
 - Body System
- Tissue
- Cellular
- Molecular

Tabs Section

Prototype Implementation

Source Other_Chemical,1,HealthProcedure,1,Disease,2,Organ,1

Send

Tools

90%

Restore

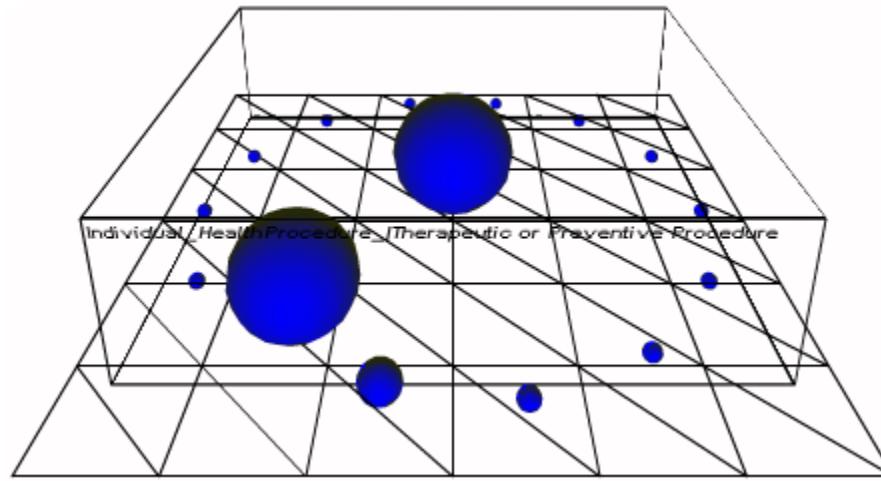
Level: Organ
Concept: (C0277784) -

- [Document:15468377](#)
Title: Favorable outcome in patients with renal involvement complicating macrophage activation syndrome in systemic onset juvenile rheumatoid arthritis
Year: 2004
Frequency: 7
- [Document:16801165](#)
Title: Macrophage activation syndrome in juvenile idiopathic arthritis
Year: 2006
Frequency: 7
- [Document:17041466](#)
Title: Macrophage Activation Syndrome in a Patient with Systemic Onset Rheumatoid Arthritis Rescue with Intravenous Immunoglobulin Therapy
Year: 2003
Frequency: 6
- [Document:15501352](#)
Title: Hemophagocytic syndrome complicating adult's seropositive rheumatoid arthritis
Year: 2004
Frequency: 6

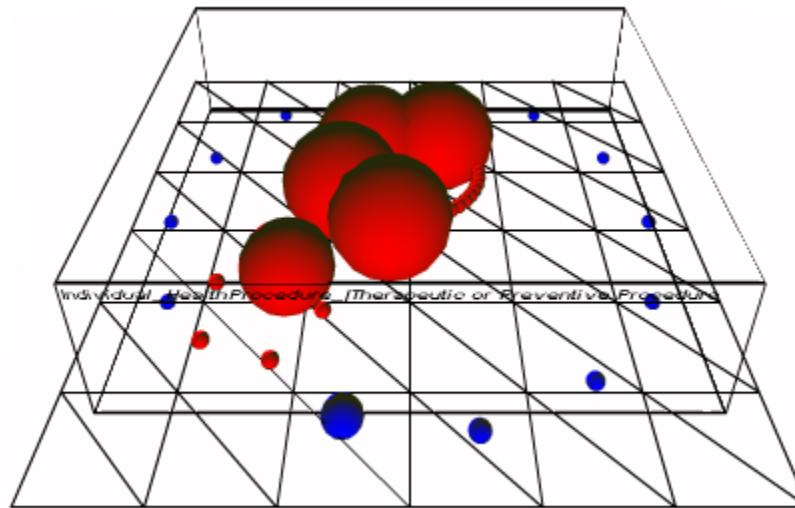
3D Map Operations

- ▶ Perform a query
 - Level Selection
 - Concrete term
- ▶ Visualization
 - Rotation, zoom, position
- ▶ Concept visualization
 - Retrieval of objects associated to the *clicked* concept/bridge
 - Expansion (i.e. subclasses) of referred concept
 - Removal of non related concepts
 - Removal of clicked concept

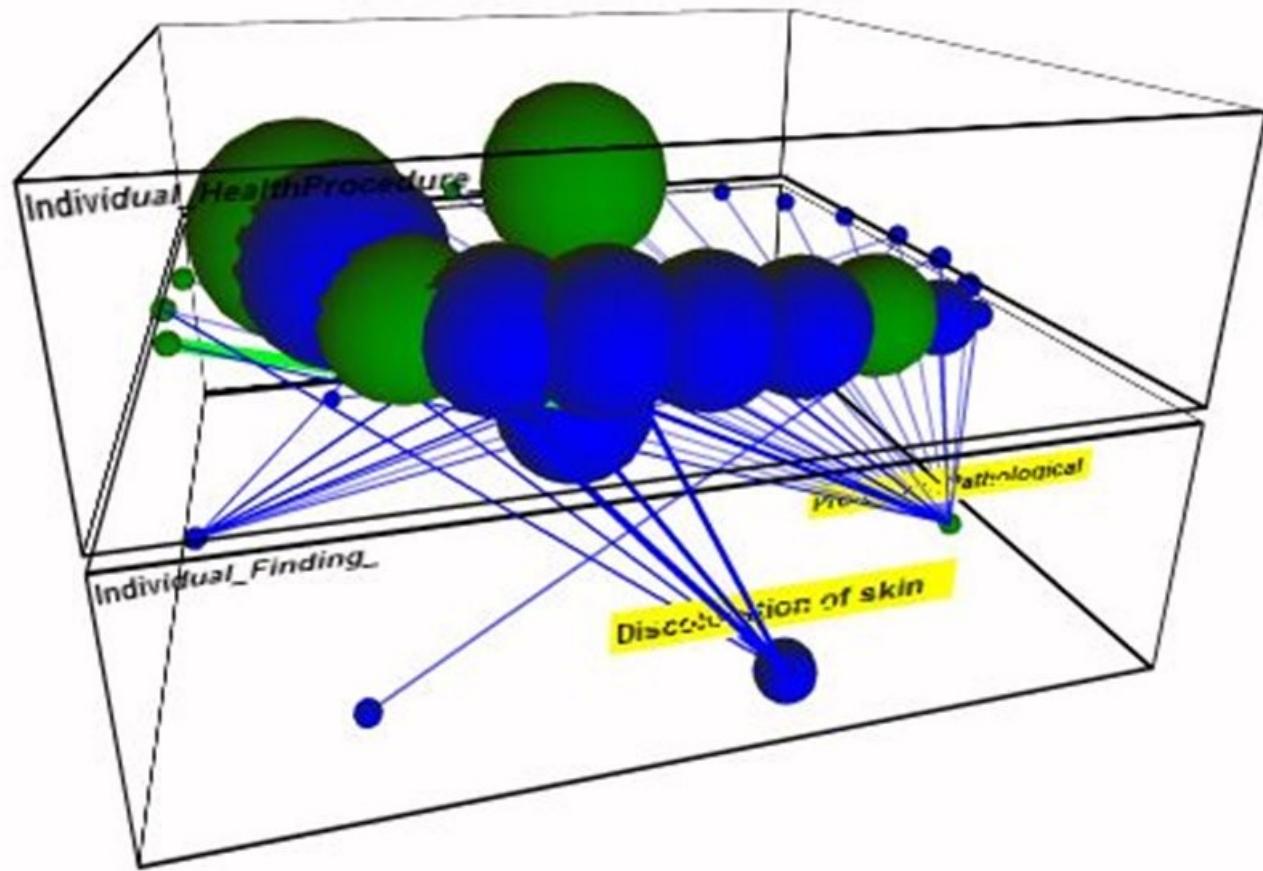
Concept Expansion (I)



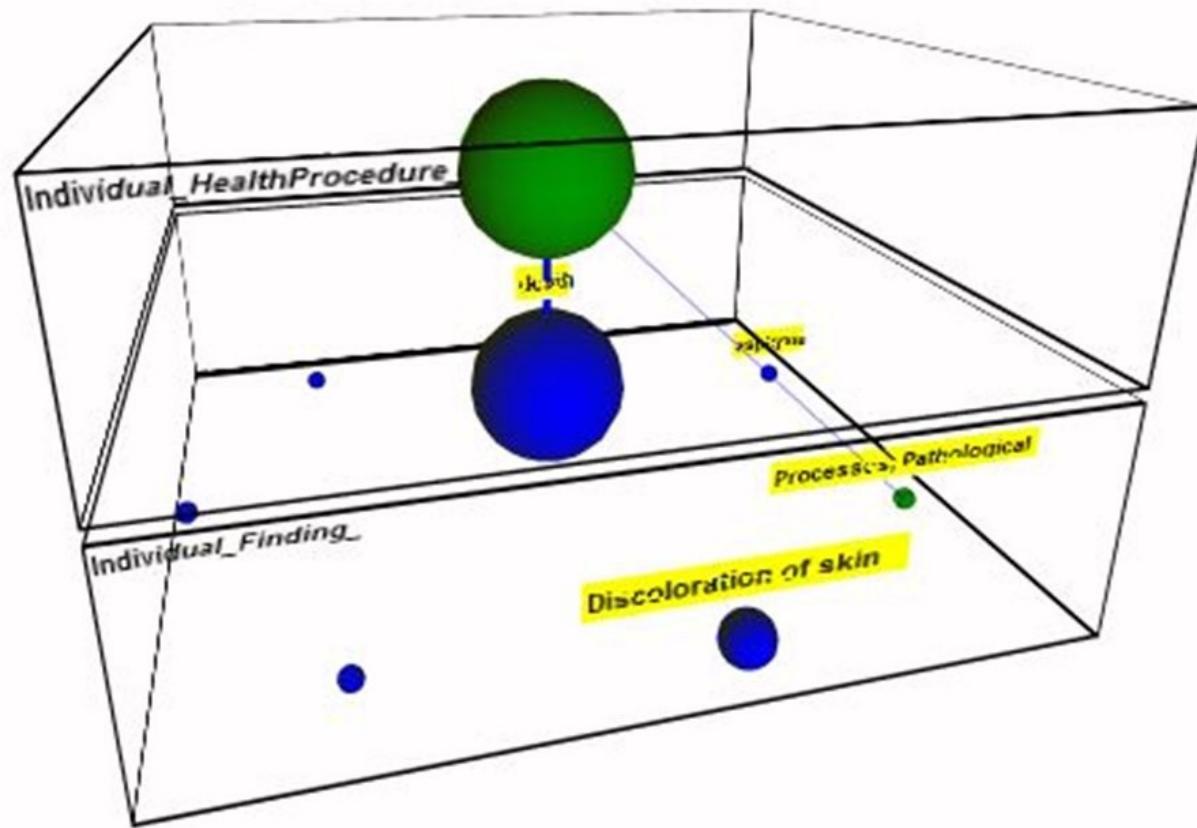
Concept Expansion (II)



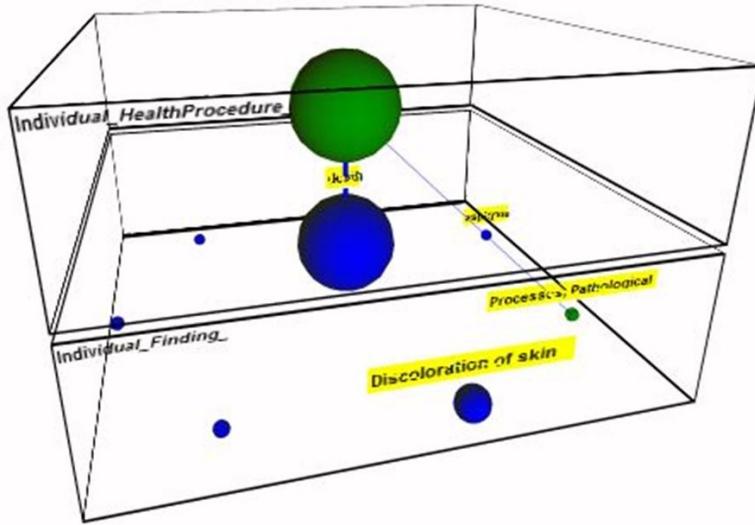
Concept Removal (I)



Concept Removal (II)



Object retrieval (I)



“Repair Fallot Tetrallogy”
related concepts

Documents @ SwissProt @ HeC DB Tree Build Map

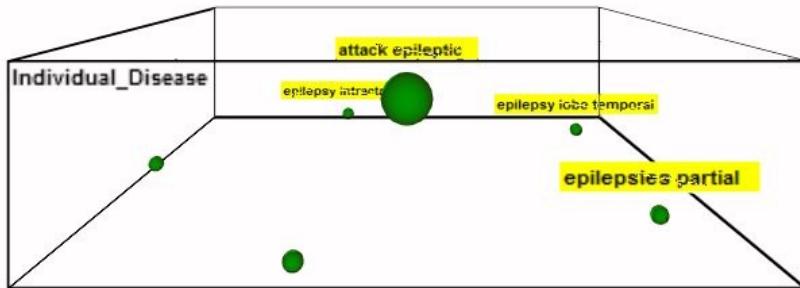
PMID: 8057026 Go
Title: Necrotizing tracheobronchitis following radical repair in tetralogy of Fallot with absent pulmonary valve
Year: 1994
Frequency: 1

PMID: 7513777 Go
Title: Surgery for tetralogy of Fallot at less than six months of age
Year: 1994
Frequency: 1

PMID: 7955286 Go
Title: Life-threatening arrhythmias and RV dysfunction after surgical repair of tetralogy of Fallot
Year: 1994
Frequency: 1

Bridge: “Repair Fallot Tetrallogy”–
“Death” related documents

Object retrieval (II)



Epilepsy dieases

	SP number: P35498	Go to NCBI	Go to KEGG
<i>Protein: NAC1</i>			
Relevance:	5		
	SP number: Q99250	Go to NCBI	Go to KEGG
<i>Protein: HBSC II</i>			
Relevance:	3		
	SP number: Q96QS3	Go to NCBI	Go to KEGG
<i>Protein: aristaless related homeobox</i>			
Relevance:	3		
	SP number: P17600	Go to NCBI	Go to KEGG
<i>Protein: brain protein 4.1</i>			
Relevance:	2		

Related Swissprot proteins

Related work

- ▶ EBIMed
 - <http://www.ebi.ac.uk/Rebholz-srv/ebimed>
- ▶ MedEvi
 - <http://www.ebi.ac.uk/Rebholz-srv/MedEvi/>
- ▶ 3D Navigation
 - Visualization
 - Definition of semantic spaces
 - Concept exploration
- ▶ Link to other resources (e.g. patient records)

Questions

- ▶ 3D Browser:
 - <http://krono.act.uji.es/Projects/hec-3dbrowser>
- ▶ Thank you!