Open PHACTS
Open Pharmacological Space

Open PHACTS
Practical Semantics For Drug Discovery

Lee Harland (CTO)

Bio-IT World 2014

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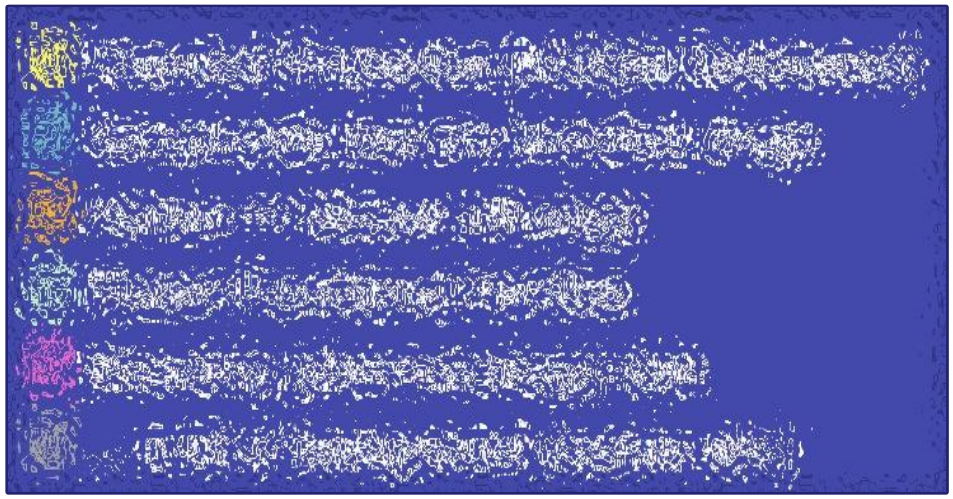
"Let me compare MW, logP and PSA for launched inhibitors of human & mouse oxidoreductases"



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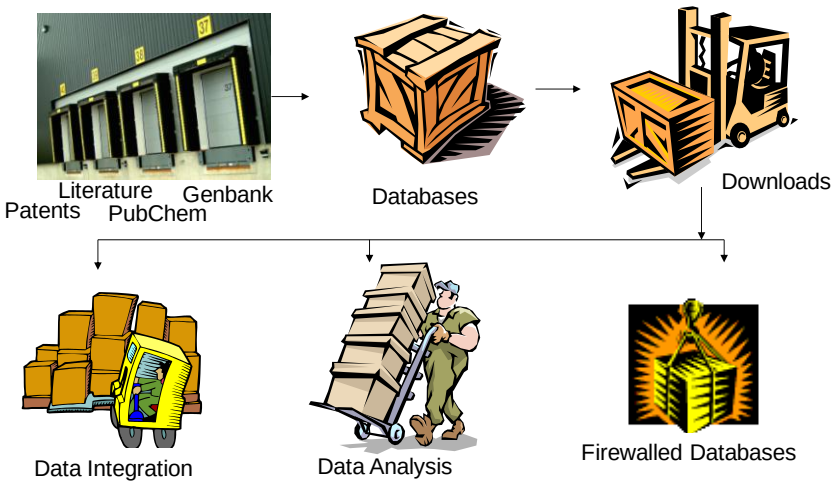
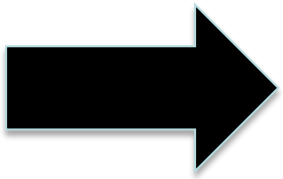
Pre-competitive Informatics:

Pharma are all accessing, processing, storing & re-processing external research data



x Repeat @ each company



A single, shared solution.

Funded under IMI March 2011-14

Lowering industry firewalls: pre-competitive informatics in drug discovery
Nature Reviews Drug Discovery (2009) 8, 701-708 doi:10.1038/nrd2944

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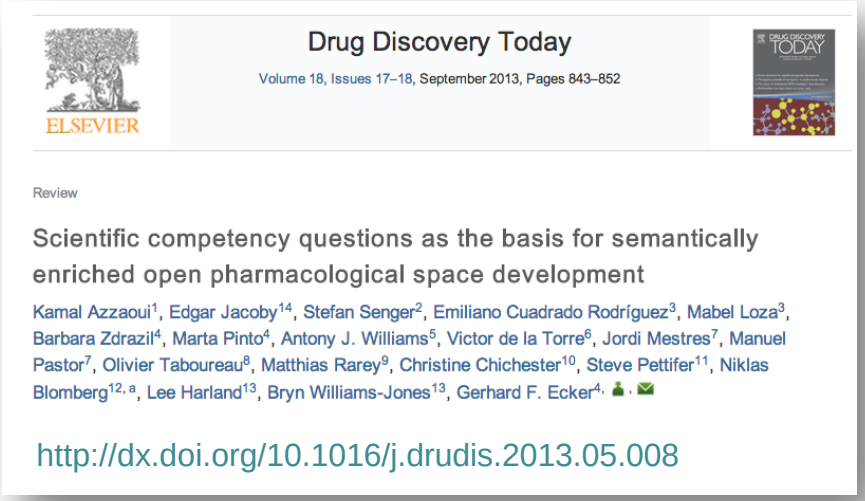
Open PHACTS Mission:

Integrate Multiple Research Biomedical Data Resources Into A Single Open & Free Access Point

Open PHACTS
Open Pharmacological Space

The Open PHACTS Discovery Platform

- **Cloud-Based "Production" Level System. Secure & Private**
- **Guided By Business Questions**
- **Uses Semantic Web Technology <u>But</u> provides a simple REST-ful API for the everyone else**



ELSEVIER

Drug Discovery Today

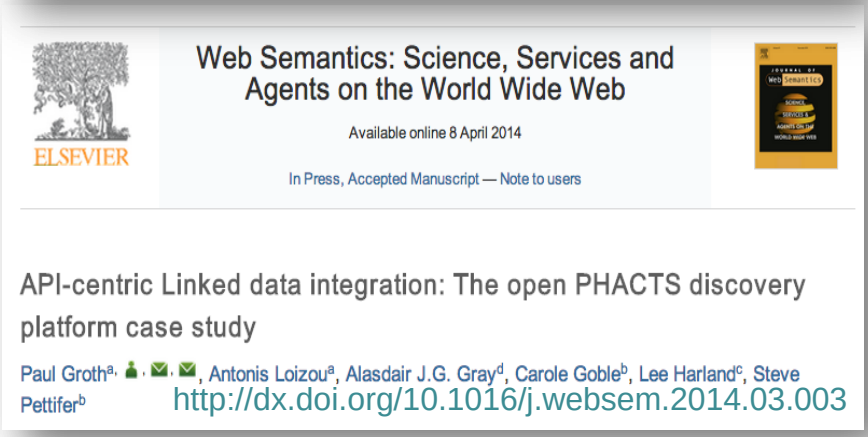
Volume 18, Issues 17–18, September 2013, Pages 843–852

Review

Scientific competency questions as the basis for semantically enriched open pharmacological space development

Kamal Azzaoui[1], Edgar Jacoby[14], Stefan Senger[2], Emiliano Cuadrado Rodríguez[3], Mabel Loza[3], Barbara Zdrazil[4], Marta Pinto[4], Antony J. Williams[5], Victor de la Torre[6], Jordi Mestres[7], Manuel Pastor[7], Olivier Taboureau[8], Matthias Rarey[9], Christine Chichester[10], Steve Pettifer[11], Niklas Blomberg[12, a], Lee Harland[13], Bryn Williams-Jones[13], Gerhard F. Ecker[4]

http://dx.doi.org/10.1016/j.drudis.2013.05.008



ELSEVIER

Web Semantics: Science, Services and Agents on the World Wide Web

Available online 8 April 2014

In Press, Accepted Manuscript — Note to users

API-centric Linked data integration: The open PHACTS discovery platform case study

Paul Groth[a], Antonis Loizou[a], Alasdair J.G. Gray[d], Carole Goble[b], Lee Harland[c], Steve Pettifer[b]

http://dx.doi.org/10.1016/j.websem.2014.03.003

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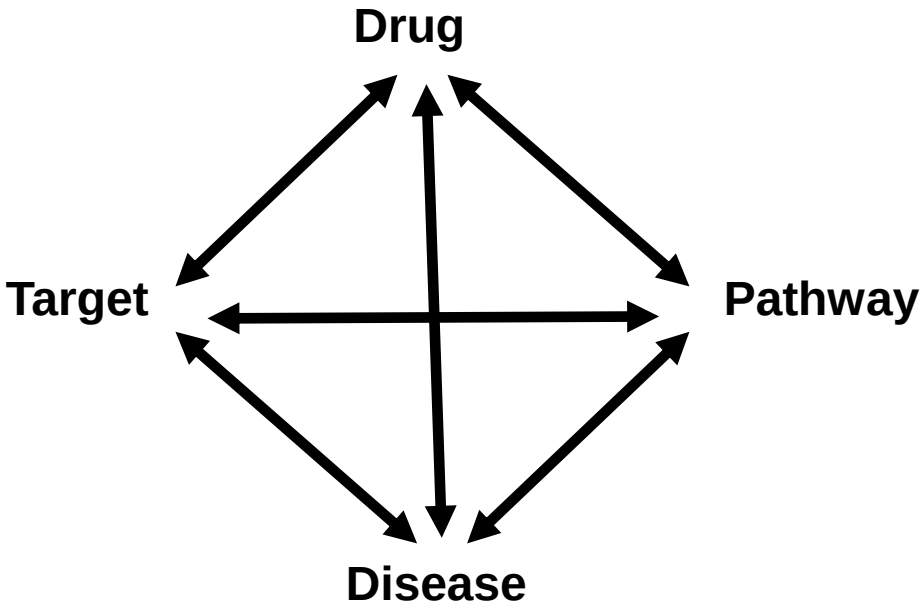

https://dev.openphacts.org/

OpenPHACTS API

Chemical Structure Exact Search	/structure/exact GET
InchiKey to URL	/structure GET
Inchi to URL	/structure GET
Chemical Structure Similarity Search	/structure/similarity GET
SMILES to URL	/structure GET
Chemical Structure Substructure Search	/structure/substructure GET
Get concept description	/getConceptDescription GET
Map free text to a concept URL based on semantic tag	/search/byTag GET
Map URL	/mapURL GET
Map free text to a concept URL	/search/freetext GET
Get ChEBI Ontology Class Members	/compound/chebi/members GET
Get ChEBI Ontology Root Classes	/compound/chebi/root GET
Get ChEBI Ontology Class	/compound/chebi/node GET
ChEBI Class Pharmacology Count	/compound/chebi/pharmacology/count GET

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Compound Information

Compound Classifications

Compound Pharmacology:

Chemical Structure Search: Similarity

Target Class Pharmacology:

Pathway Information: Get Targets

Targets for Disease: List

Tissues for Protein: List

Getting Started Guide:
http://www.slideshare.net/pgroth/ops-developerwebinarjuly312013

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Adding Further Value

Open PHACTS
Open Pharmacological Space

Directly Funding Public Resources

ChEMBL

ChemSpider
The free chemical database

utopia

ConceptWiki

BETA
WIKIPATHWAYS
Pathways for the People

neXtprot BETA

DisGeNET

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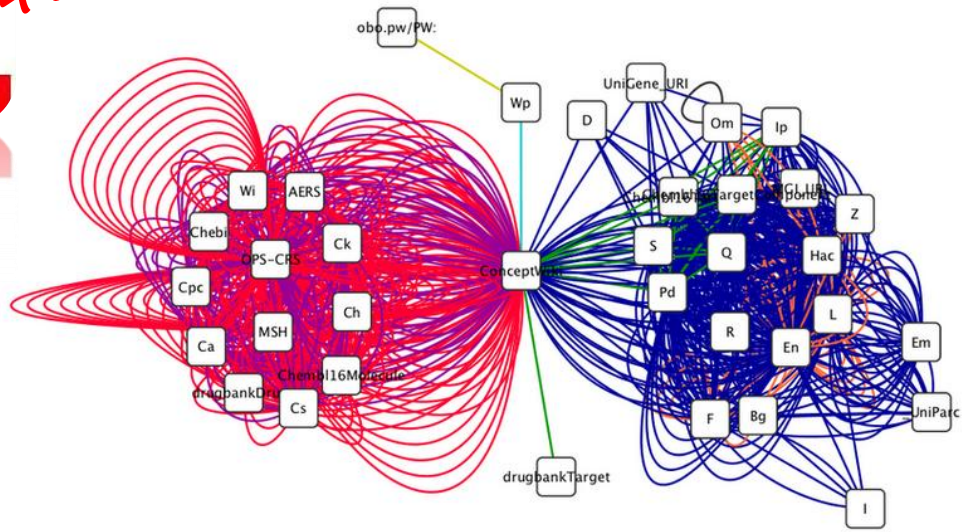
HELLO
my name is

~~RS_2353~~

~~GB:29384~~

~~P12047~~

~~X31045~~ P12047



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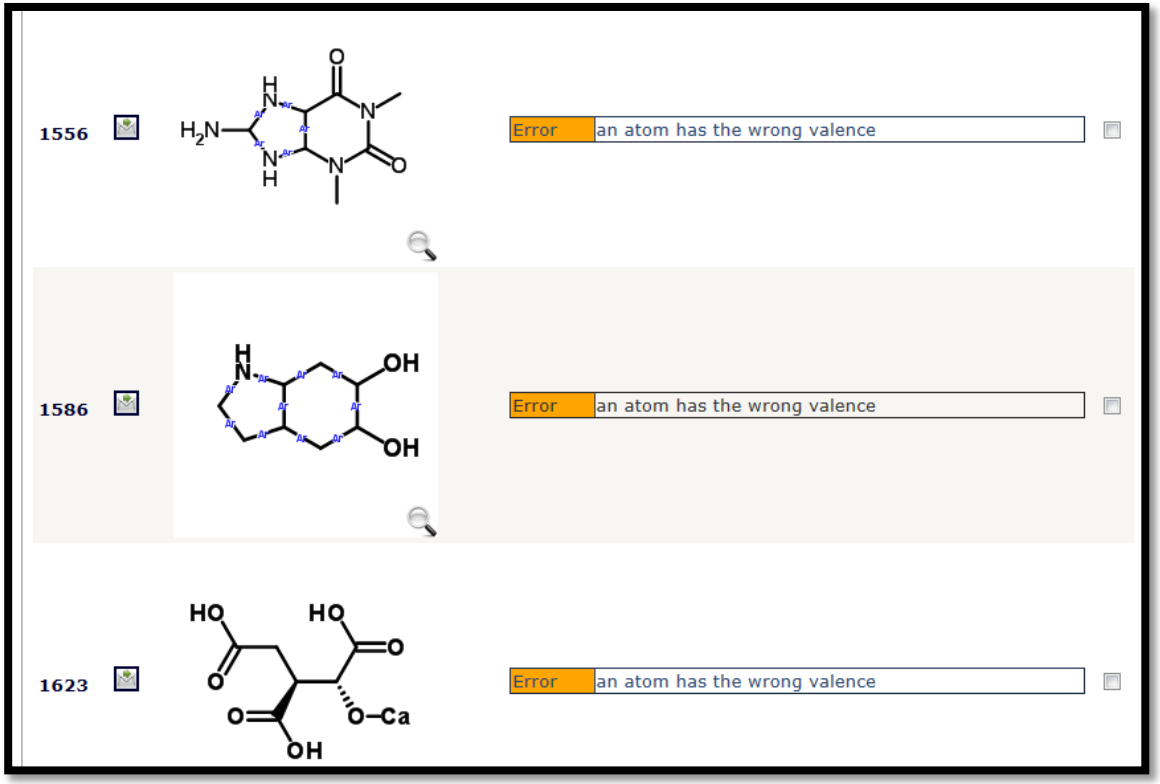
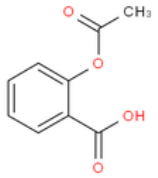
Quality Assurance

RSC | Advancing the Chemical Sciences



ChemSpider Validation & Standardization Platform
http://bit.ly/NZF5VB



Aspirin

Structure

Draw Molecule

$C_9H_8O_4$

The prototypical analgesic used in the treatment of mild to moderate pain. It has anti-inflammatory and antipyretic properties and acts as an inhibitor of cyclooxygenase which results in the inhibition of the biosynthesis of prostaglandins. Aspirin also inhibits platelet aggregation and is used in the prevention of arterial and venous thrombosis. (From Martindale, The Extra Pharmacopoeia, 30th ed, p5)

AlogP	1.19
# H-Bond Acceptors	4
# H-Bond Donors	1
Mol Weight	180.157

ChemSpider ID	OPS403534
SMILES	CC(=O)OC1=CC=CC=C1C(=O)O
Standard InChI	InChI=1S/C9H8O4/c1-6(10)13-8-5-3-2-4-7(8)9(11)12/h2-5H,1H3,(H,11,12)
Standard InChIKey	BSYNRYMUTXBXSQ-UHFFFAOYSA-N
Protein Binding	High (99.5%) to albumin. Decreases as plasma salicylate concentration increases, with reduced plasma albumin concentration or renal dysfunction, and during pregnancy.
Toxicity	Oral, mouse: LD₅₀ = 250 mg/kg; Oral, rabbit: LD₅₀ = 1010 mg/kg; Oral, rat: LD₅₀ = 200 mg/kg. Effects of overdose include: tinnitus, abdominal pain, hypokalemia, hypoglycemia, pyrexia, hyperventilation, dysrhythmia, hypotension, hallucination, renal failure, confusion, seizure, coma, and death.

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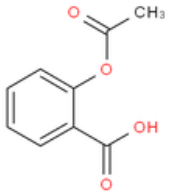
Open PHACTS Explorer Alpha | Aspirin

Home / Aspirin / Compound Information



Aspirin

Pharmacology (2677)

Structure

Draw Molecule

The prototypical analgesic us
antipyretic properties and act
biosynthesis of prostaglandins
arterial and venous thrombosis

AlogP

1.19

H-Bond Acceptors

H-Bond Donors

Mol Weight

180.157

ChemSpider ID OPS403534

SMILES CC(=O)OC1=CC=CC=C1C(=O)O

Standard InChI InChI=1S/C9H8O4/c1-6(10)13-8-5-3-2-4-7(8)9(11)12/h2-5H,1H3,(H,11,12)

Standard InChIKey BSYNRYMUTXBXSQ-UHFFFAOYSA-N

Protein Binding High (99.5%) to albumin. Decreases as plasma salicylate concentration increases, with reduced plasma albumin concentration or renal dysfunction, and during pregnancy.

Toxicity Oral, mouse: LD₅₀ = 250 mg/kg; Oral, rabbit: LD₅₀ = 1010 mg/kg; Oral, rat: LD₅₀ = 200 mg/kg. Effects of overdose include: tinnitus, abdominal pain, hypokalemia, hypoglycemia, pyrexia, hyperventilation, dysrhythmia

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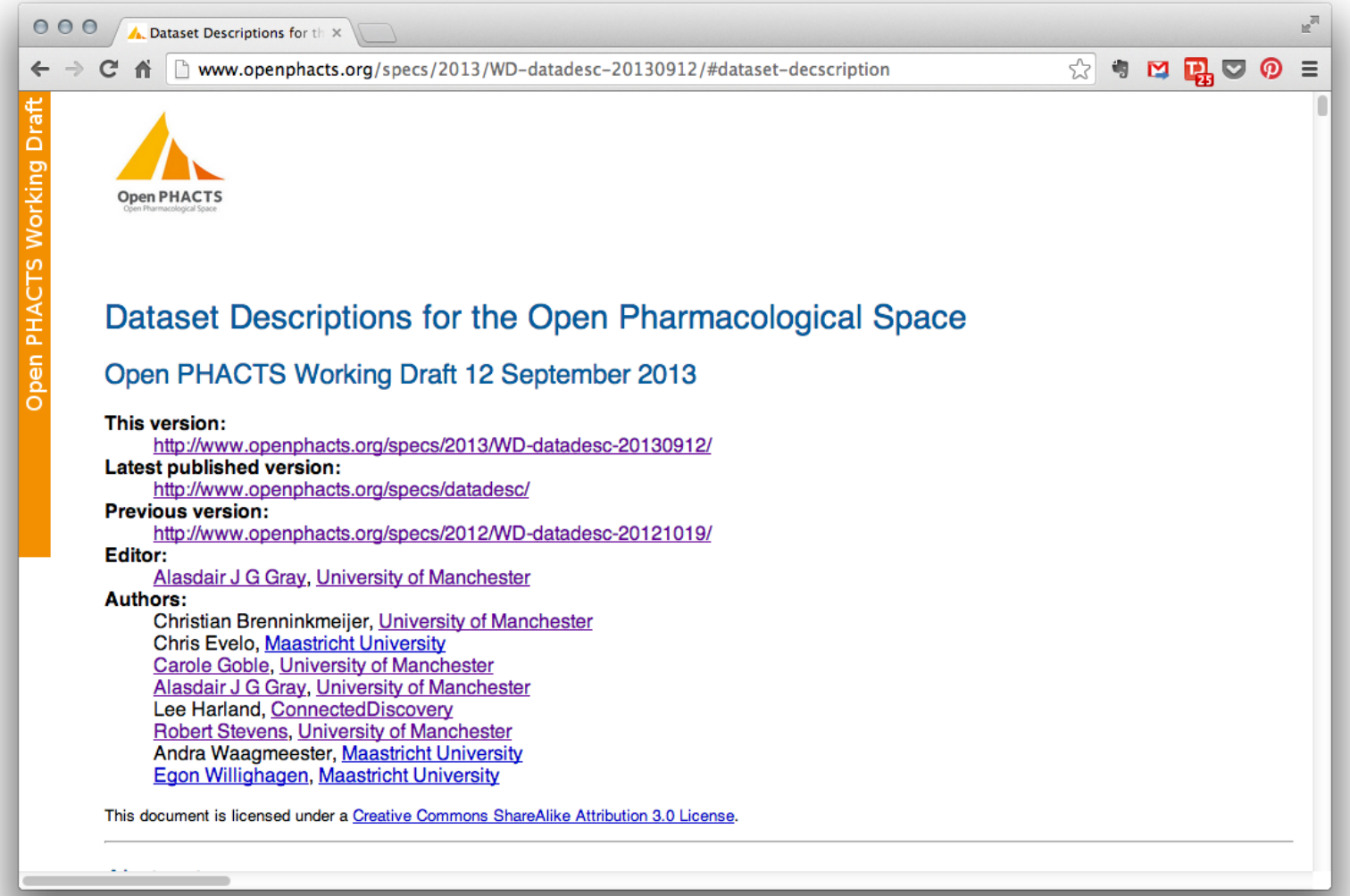

http://www.openphacts.org/specs/2013/WD-datadesc-20130912/

Is Anybody Using It?

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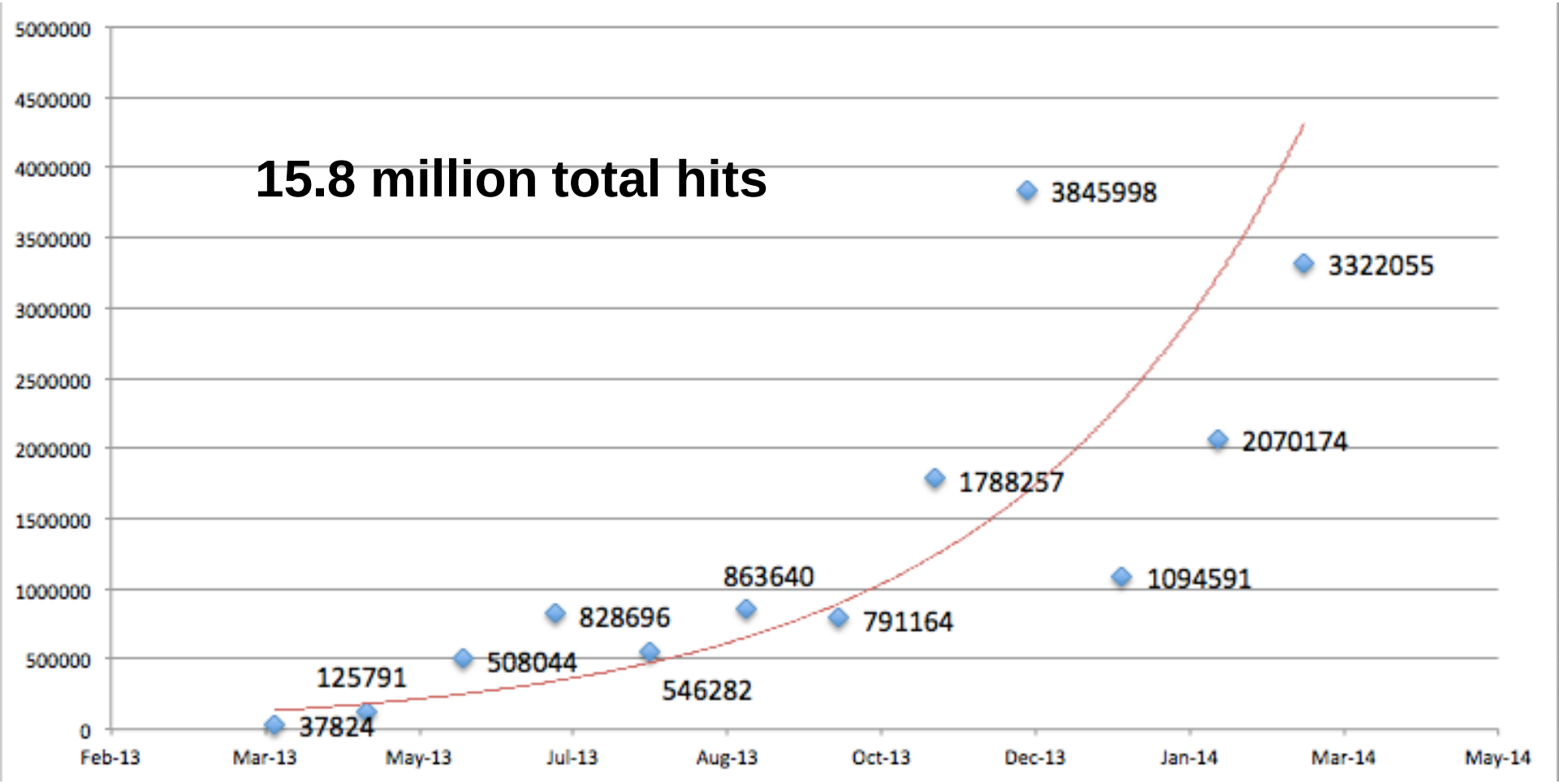
API Hits (April 2013 – March 2014)



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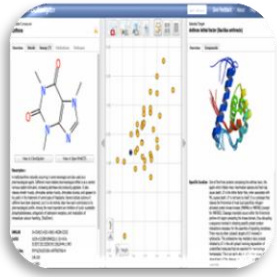
An “App Store”?

Explorer

Explorer2

ChemBioNavigator



Target Dossier

Pharmatrek

Helium

MOE

Collector

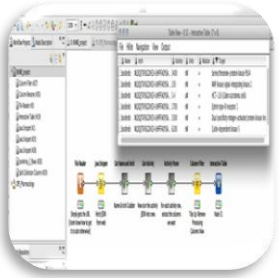
Cytophacts

Utopia

Garfield

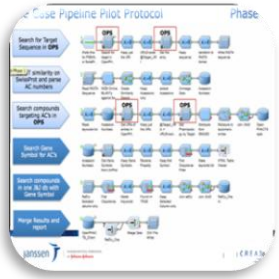
SciBite

KNIME



Mol. Data Sheets

PipelinePilot



scinav.it

Taverna

http://www.openphactsfoundation.org/apps.html

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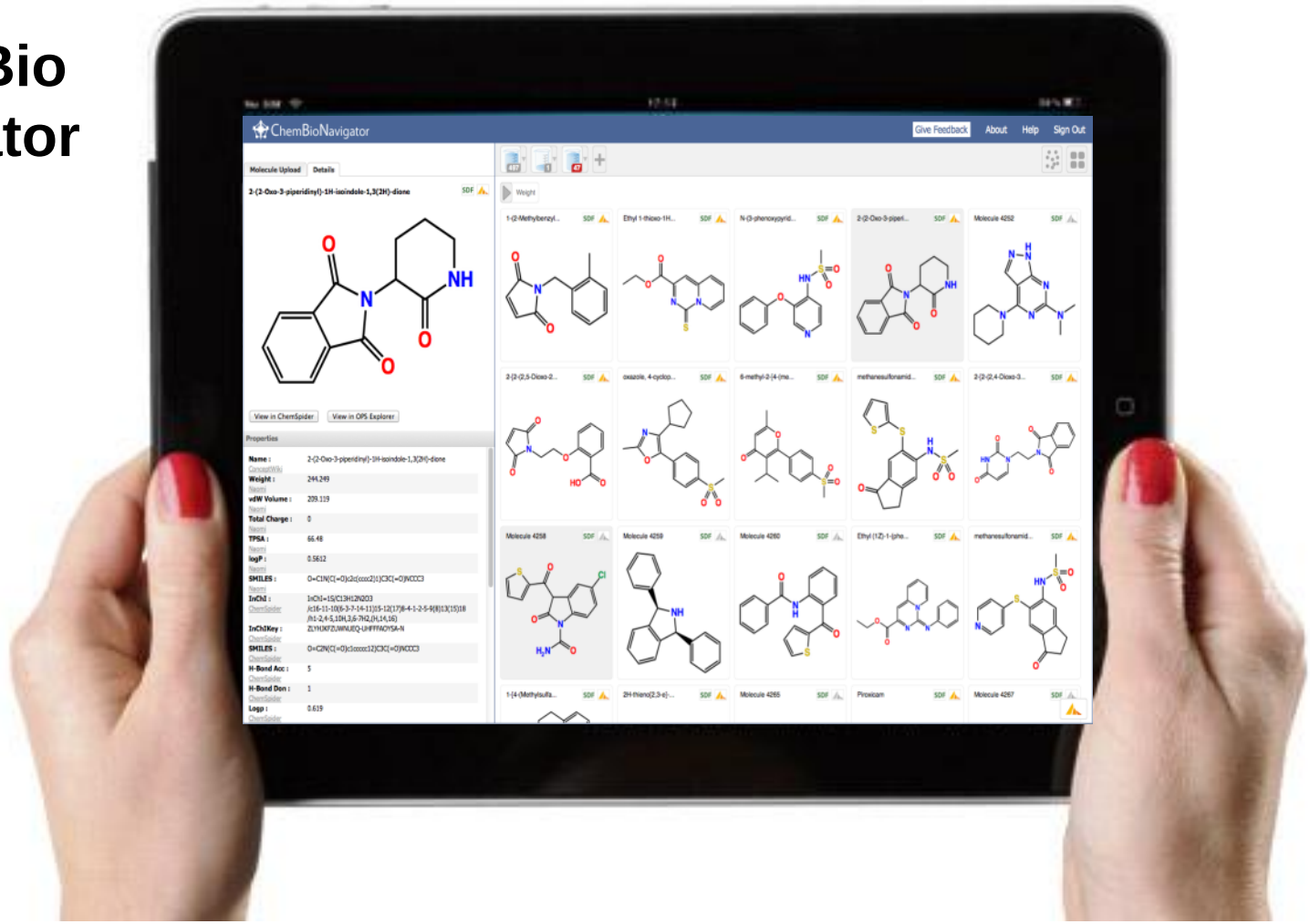
ChemBio Navigator



http://chembionavigator.com

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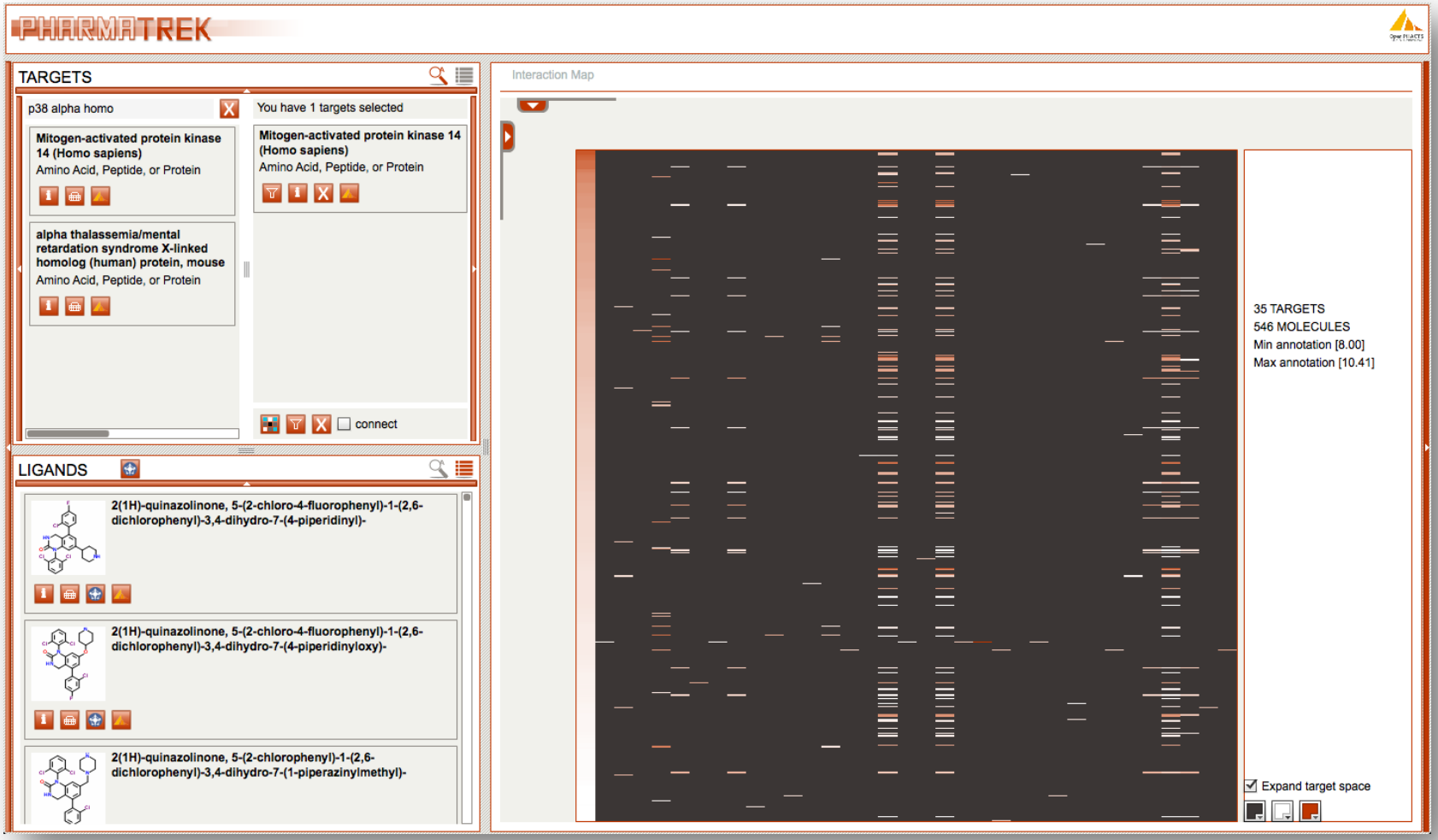
Pharmatrek (http://pharmatrek.org)



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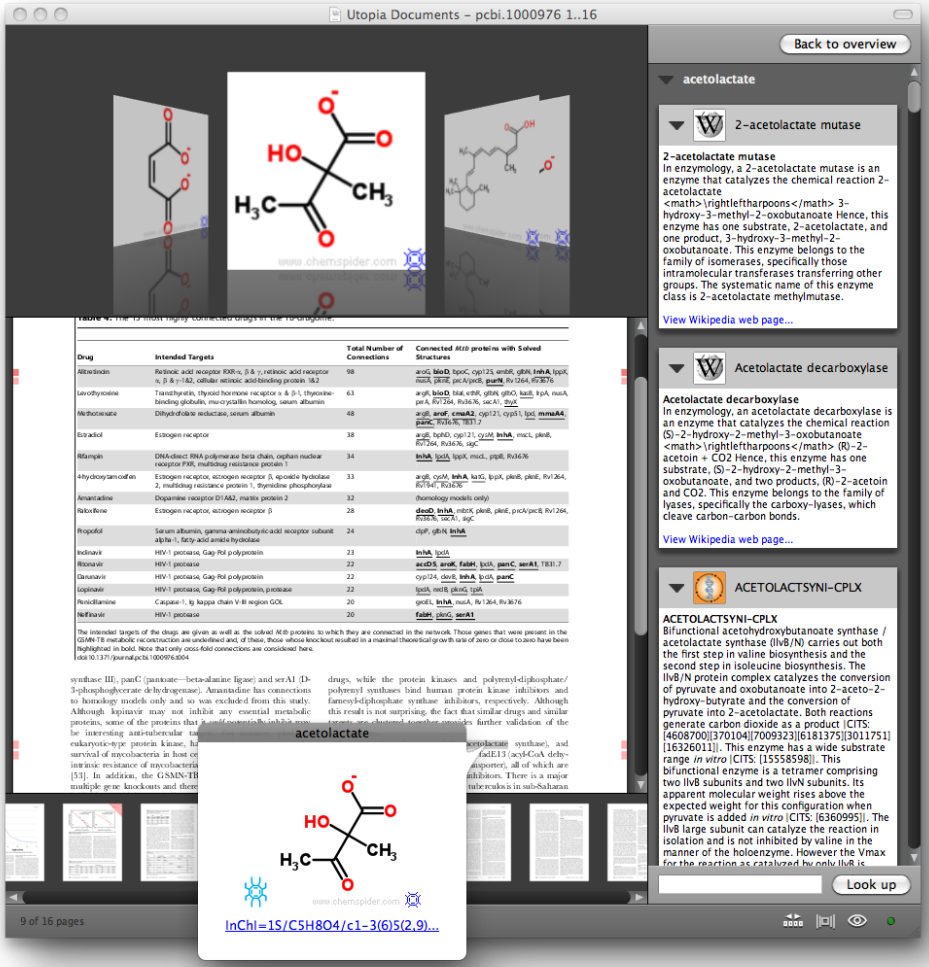
Utopia http://getutopia.org

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Open Pharmacological Space
Open PHACTS Associate Partner Community

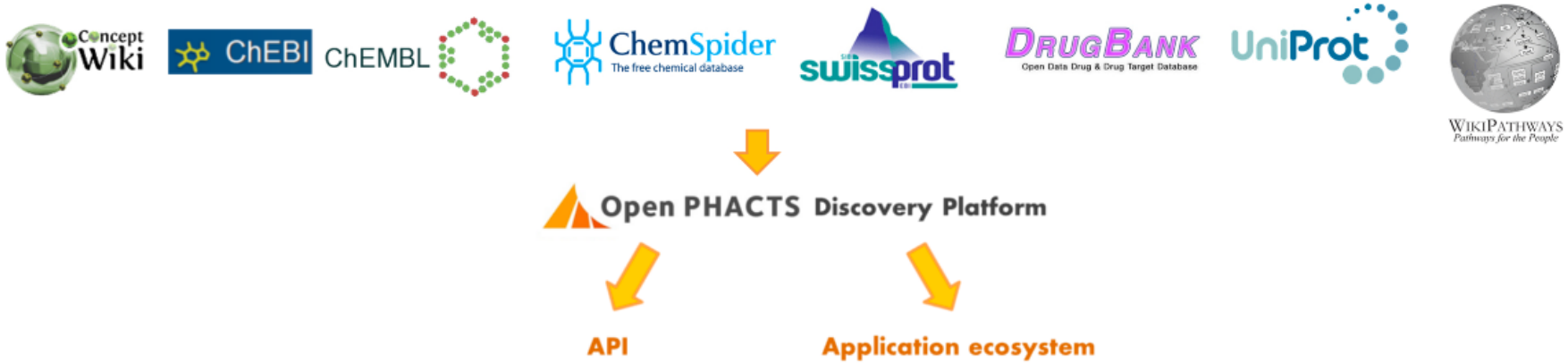
Moving Forward

The Open PHACTS Foundation

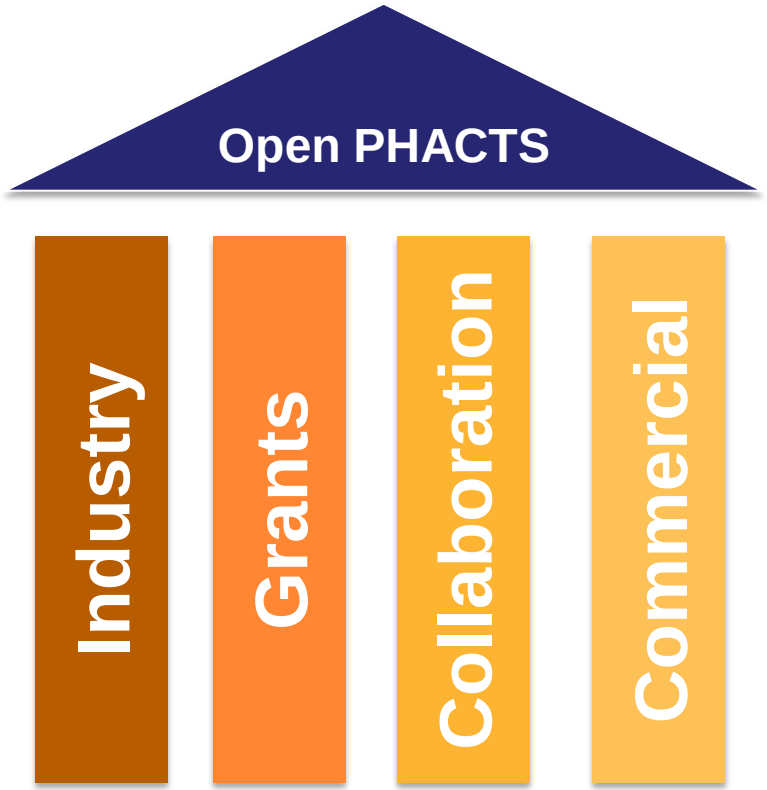
OPF is a not-for-profit membership organisation, supporting the Open PHACTS Discovery Platform:
A sustainable, open, vibrant and interoperable information infrastructure for applied life science research and development.

To reduce the barriers to drug discovery in industry, academia and for small businesses, the Open PHACTS Discovery Platform provides tools and services to interact with multiple integrated and publicly available data sources. To integrate this data, extensive cross-referencing of scientific concepts is needed across all databases.

The Open PHACTS Foundation ensures the sustainability of the Open PHACTS Discovery Platform infrastructure and acts as a hub for relevant scientific research and development.



Sustainability



Wait A Minute
Its Free – Why Pay?

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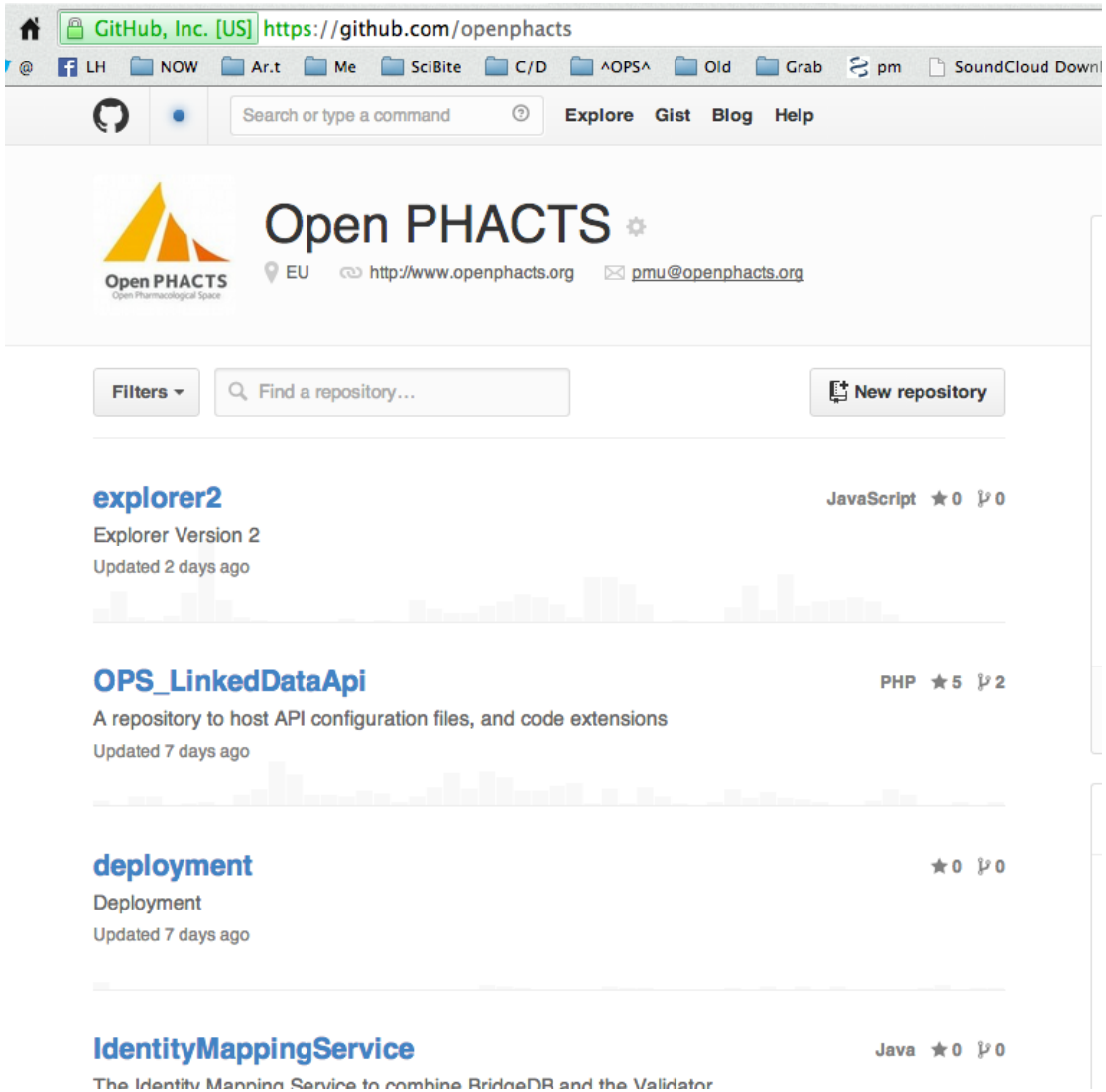

https://github.com/openphacts

Membership Benefits

The Open PHACTS Foundation

The not-for-profit Foundation maintains the Open PHACTS Discovery Platform, a versatile infrastructure of integrated biomedical data, and actively engages an ecosystem of industry and academic semantic web experts.

Integrated data:

- Pharmacological
- Physicochemical
- Disease
- Gene
- Pathways

Steer the direction

- Prioritise new projects
- Get involved with Foundation governance
- Identify development opportunities
- Propose new data sources to include
- Develop new use-cases and workflows
- [illegible]

Training opportunities

Enjoy training opportunities by experts.

Early access to releases

Members have early access to infrastructure and platform updates and new releases, including a locally installable system

Engage a community of experts and peers

The Foundation serves a unique and vibrant scientific community, facilitating collaboration between the pharma industry, academia & SMEs.

Influence the security policy

Membership Levels

[illegible] turnover. Pay in cash or by donating people-hours to the Foundation.

Full — Nominate and vote for the Board of Trustees

Contributing — Vote for the Board of Trustees

Individual **Non-voting** — Get involved in projects and collaborate

www.openphactsfoundation.org

info@openphactsfoundation.org

Open PHACTS Foundation
c/o Royal Society of Chemistry,
Thomas Graham House,
Science Park, Cambridge, CB4 0WF

[illegible]

Open PHACTS
Open Pharmacological Space

- **The (Immediate) Future Of Open PHACTS**
  - Establish the Open PHACTS foundation
  - Recruit members and partners
  - Further develop scientific resources
    - Open chemical patent data (SureChEMBL)
    - Gene-Disease associations (DisGeNet)
    - Develop the Open PHACTS VM
  - Connect with other projects (IMI+beyond)

Thanks!

lee@connecteddiscovery.co.uk | @Scibitely

Acknowledgements

Pfizer Limited
Universität Wien
Technical University of Denmark
University of Hamburg, Center for Bioinformatics
BioSolveIT GmbH
Consorci Mar Parc de Salut de Barcelona
Leiden University Medical Centre
Royal Society of Chemistry
Vrije Universiteit Amsterdam
Spanish National Cancer Research Centre
University of Manchester
Maastricht University
Aqnowledge
University of Santiago de Compostela
Rheinische Friedrich-Wilhelms-Universität Bonn
AstraZeneca
GlaxoSmithKline
Esteve
Novartis
Merck Serono
H. Lundbeck A/S
Eli Lilly
Netherlands Bioinformatics Centre
Swiss Institute of Bioinformatics
ConnectedDiscovery
EMBL-European Bioinformatics Institute
Janssen
OpenLink

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Science-Driven Dynamic Integration

"What are the physiochemical properties of warfarin salts, tautomers or stereo-isomers?"

"What are the biological responses to warfarin?"

Scientific Lenses over Linked Data: An approach to support task specific views of the data. A vision.

Christian Brenninkmeijer[1], Chris Evelo[2], Carole Goble[1], Alasdair J G Gray[1], Paul Groth[3], Steve Pettifer[1], Robert Stevens[1], Antony J Williams[4], and Egon L Willighagen[2]

http://bit.ly/1gzOhS2