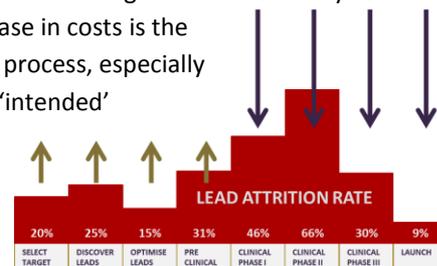


### Bio Relations and Intelligence Network [BRAIN<sup>[2]</sup>]

#### Late stage lead attrition in biotech & pharma R&D

The cost of bringing a new drug or therapy to market has nearly tripled in the past 10 years to approximately 1.8 billion US\$<sup>1</sup>. This is causing severe pressure on the long term sustainability of biomedical R&D. One of the main causes for this steady increase in costs is the high attrition rate of leads occurring very late in the approval process, especially in the most expensive clinical Phase II & III stages. Increasing 'intended' attrition in the early stages of biomedical R&D (i.e. identifying low quality leads as soon as possible) and as a result bringing down late stage attrition is one of the most important priorities in biotech & pharma R&D today.



#### BRAIN<sup>[2]</sup> – addressing lead attrition

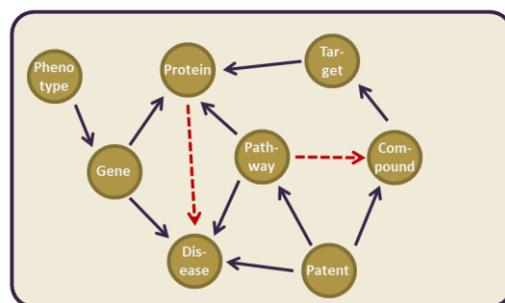
BRAIN addresses the issue of late stage lead attrition by providing unprecedented levels of access to life sciences knowledge to researchers throughout the entire R&D and approval lifecycle. One of the key elements is the abundance of publicly available information. It is hard to imagine answering today's research questions without consultation of key public resources such as Pubmed, Swissprot, Drugbank or the US Patent Office Database. Getting useful results from these data sources however is very challenging: there is too much relevant data and information is stored in too many disconnected data sources. Manually searching all these sources is time consuming; the results are at best incomplete and making the connections between results found is simply impossible. This situation is one of the biggest frustrations of life scientists today.

#### BRAIN<sup>[2]</sup> – The Euretos 'Bio Relations and Intelligence Network'

The Euretos' Bio Relations and Intelligence Network [BRAIN<sup>[2]</sup>] brings together an unprecedented range of scientifically high value data sources [see insert on the left]. BRAIN<sup>[2]</sup> reads these sources, recognises the terms mentioned and stores the statements involving these terms as a relation between the terms. BRAIN<sup>[2]</sup> thus provides one single, 'bio relations' view on *all* underlying data sources. Updates of sources and new sources are continuously added to BRAIN<sup>[2]</sup> allowing it to provide immediate alerts. With BRAIN<sup>[2]</sup> you are able to:

- ☞ Deepen the understanding of disease mechanisms
- ☞ Increase the number of high quality leads
- ☞ Decrease wasted investment in lead optimisation infrastructure and capacity
- ☞ Assess more effectively pre-clinical in vitro and in vivo test results
- ☞ Be alerted immediately on pin pointed hypotheses that are essential to R&D success

BRAIN<sup>[2]</sup> - Bio Relations and Intelligence Network



<sup>1</sup> (Nature Reviews Drug Discovery, March 2010, on R&D for pharmaceutical and small biotechnology companies)

#### BRAIN<sup>[2]</sup>

##### Data Sources include

##### Publications

- ☞ Pubmed

##### Biology

- ☞ Swissprot
- ☞ WikiPathways
- ☞ Enzyme
- ☞ Human Metabolome

##### Pharmacology

- ☞ ChEBI
- ☞ ChEMBL
- ☞ Chempidier
- ☞ Drugbank

##### Genetics

- ☞ Gene Ontology
- ☞ OMIM
- ☞ GWAS Central
- ☞ LOVD
- ☞ Riken Phantom 5
- ☞ Genbank
- ☞ Homologene
- ☞ KEGG
- ☞ Mouse Genome Database

##### Patents

- ☞ USPTO

##### People [scientists]

- ☞ Wiki People

##### Other

- ☞ UMLS
- ☞ Toxicogenomics

### Get answers 'now'!

With BRAIN<sup>[E]</sup>, key research questions can be answered that till now took either days of effort or were simply too complex to undertake. Imagine getting answers to the following questions with just a few clicks:

- ☒ "Rank a given set of potential leads on their ADME-T properties"
- ☒ "Which cell surface proteins have high expression in kidney tissue and low ones in others?"
- ☒ "Which biomarkers of hepatocellular carcinoma are part of the cirrhosis pathway"
- ☒ "How does LTB4 play a role in pulmonary hypertension"
- ☒ "List me all the oxidoreductase inhibitors active at <100 nM in both human and mouse"
- ☒ "List all co-factors for the enzymes shorter than 300 AA in Hexose Transport"
- ☒ "Which SNPs are associated with colour in my crop species?"
- ☒ "Is there an explanation in literature for an association I found in a high throughput data set?"
- ☒ "For a specific receptor give me all known agonists"
- ☒ "For a given protein-protein interaction give me all known inhibitors"

### Unique value

BRAIN<sup>[E]</sup> is simply unique and provides value that is not available elsewhere:

- ☒ It contains **over 99% of biomedical and biochemical life sciences concepts** by leveraging the most important and widely used life sciences ontologies.
- ☒ It brings together an unprecedented **scope of public scientific data sources** ranging from publications to gene databases, protein data sets, pathway spaces and patent information.
- ☒ These data sources are **updated and new sources are added** continuously by Euretos.
- ☒ All data is read, recognised and stored as relations enabling **all data to be linked**.
- ☒ All **redundancy is removed** from the data sources by making sure each term or relation is fully recognised and therefore stored only once.
- ☒ All relations are **'scientifically valued'**; for each statement a scientific value is created based on the number of reputable sources or scientists that have contributed to the statement.
- ☒ You can always **drill down to the underlying publications or data sources** to explore at the source level.

### Benefits

By using BRAIN<sup>[E]</sup> especially at the early stages of the R&D cycle, lead quality will improve, lowering late stage lead attrition. This will have direct impact on the costs levels and lead time of the biomedical R&D and approval process.

### Contact

If you would like to know more about how BRAIN<sup>[E]</sup> can improve the return on your R&D investments visit our website [www.euretos.com](http://www.euretos.com) or contact us at: [Information@euretos.com](mailto:Information@euretos.com)

Euretos is a start-up that was founded in 2012. The company is privately held. The founders of Euretos have extensive backgrounds in bio-informatics & semantics, IT integration and IT support, network solutions, big data solutions and decision support applications. Euretos works closely with a number of leading academic partners including Leiden University Medical Center, the Dutch Techcenter for life Sciences, the Netherlands eScience center and the Erasmus University Medical Center.

### Appendix 1 – Selection of relevant publications

1: **Nanopublication in the e-science era:** Mons, B. & Velterop, J. *Workshop on Semantic Web Applications in Scientific Discourse (SWASD 2009)* (Washington, DC, USA, 2009).

2: **The anatomy of a nanopublication:** Paul Groth, Andrew Gibson, Jan Velterop  
Information Services and Use, Vol. 30, No. 1. (1 January 2010), pp. 51-56, doi:10.3233/ISU-2010-0613

3: **In silico knowledge and content tracking.** Van Haagen H, Mons B.  
*Methods Mol Biol.* 2011;760:129-40.

4: **The value of data:** Mons B, van Haagen H, Chichester C, Hoen PB, den Dunnen JT, van Ommen G, van Mulligen E, Singh B, Hooft R, Roos M, Hammond J, Kiesel B, Giardine B, Velterop J, Groth P, Schultes E.  
*Nat Genet.* 2011 Mar 29;43(4):281-3.

5: **In silico discovery and experimental validation of new protein-protein interactions:** van Haagen HH, 't Hoen PA, de Morrée A, van Roon-Mom WM, Peters DJ, Roos M, Mons B, van Ommen GJ, Schuemie MJ.  
*Proteomics.* 2011 Mar;11(5):843-53. doi: 10.1002/pmic.201000398. Epub 2011 Jan 31.

6: **Novel Protein-Protein Interactions Inferred from Literature Context:** van Haagen HH, 't Hoen PA, Botelho Bovo A, de Morrée A, van Mulligen EM, Chichester C, Kors JA, den Dunnen JT, van Ommen GJ, van der Maarel SM, Kern VM, Mons B, Schuemie MJ  
*PLoS ONE* 2009, November 18

7: **Placing landMarks in the Knowledge Space: crowd-sourcing landmark publications for benchmarking text-mined predictions:** Thompson M, van Haagen H, Mons B, Schultes E.  
In proceedings of the Semantic Web Applications and Tools for the Life Sciences (SWAT4LS 2012), Paris, France, Nov 2012.

8: **Theoretical and technological building blocks for an innovation accelerator:** F van Harmelen, G Kampis, K Börner, P van den Besselaar, E Schultes, C Goble ...  
*The European Physical Journal Special Topics* 214 (1), 183-214

9: **Microattribution and nanopublication as means to incentivize the placement of human genome variation data into the public domain:** GP Patrinos, DN Cooper, E van Mulligen, V Gkantouna, G Tzimas, Z Tatum, E ...  
*Human Mutation* 3, 2012

10: **Solving bottlenecks in data sharing in the life sciences:** R Dagleish, E Molero, R Kidd, M Jansen, D Past, A Robl, B Mons, C Diaz, A ...  
*Human Mutation*

11: **Open PHACTS: Semantic interoperability for drug discovery:** AJ Williams, L Harland, P Groth, S Pettifer, C Chichester, EL Willighagen ...  
*Drug Discovery Today.* To appear 17, 2012

12: **Speeding up research with the Semantic Web:** M Roos, EA Schultes, B Mons  
*Orphanet Journal of Rare Diseases* 7 (Suppl 2), A11