

SciNetS Search : Inference Search over an Integrated Life-sciences Database Based on the Semantic Web



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Integration of various omics databases is a fundamental approach for comprehensive understanding of life phenomena. Scientists' Networking System (SciNetS) is a Semantic Web-based data repository that realises database integration by collecting metadata of databases described as a set of triples consisting of two bio-items such as gene and ontology terms and a semantically defined relationship between these bio-items. These triples are curated from various life-sciences databases including gene-publication relationships manually curated from MEDLINE and gene-phenotype relationships extracted from published databases by computer programs. SciNetS internally forms a metadata network by maximally concatenating triples.

SciNetS Search realizes a cross-search over the integrated databases by traversing the metadata network managed by SciNetS. SciNetS Search allows a user to discover bio-items included in the ontological category specified by the user. The results include bio-items not only having a user's keyword but also semantically inferred from these bio-items using metadata relationships, and are ranked using statistical scores computed on the basis of the metadata network. SciNetS Search is available via a user's web browser and provides search service against over 30 million bio-items of 100 thousand categories and 100 million relationships curated from over 100 public omics databases of various species including human, mouse, rice and *Arabidopsis*.

1. Database integration with Virtual Laboratories as a Service (LaaS)

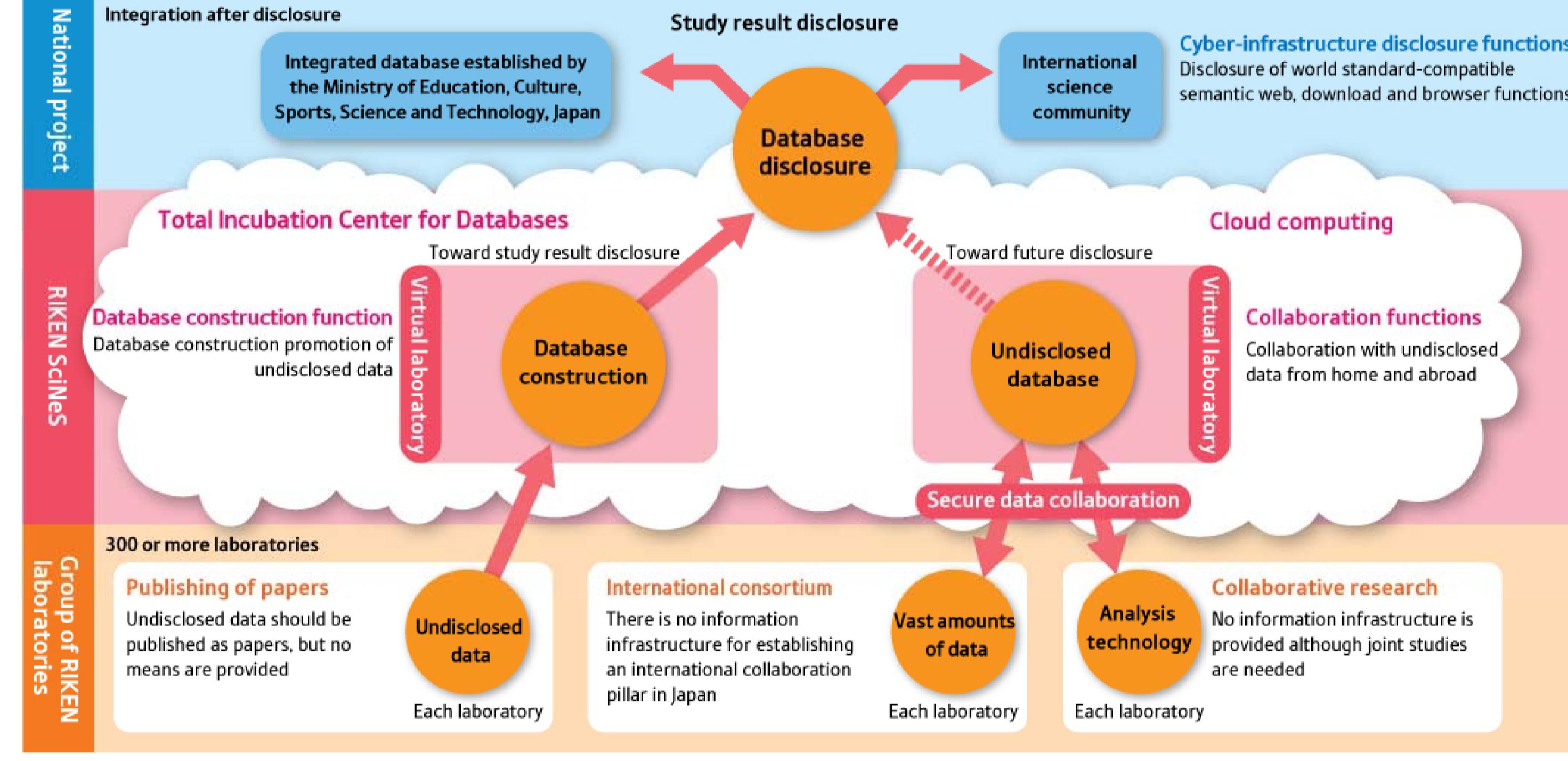


Fig. 1 Concept of LaaS. A database is curated as a Semantic-Web based metadata in a virtual laboratory (VL). Those data items are correlated with data items and ontology terms in a different VLs by semantic links: This mechanism realises semantic data integration among all databases.

2. SciNetS: an implementation of LaaS as a Semantic Web based Cloud Computing Service

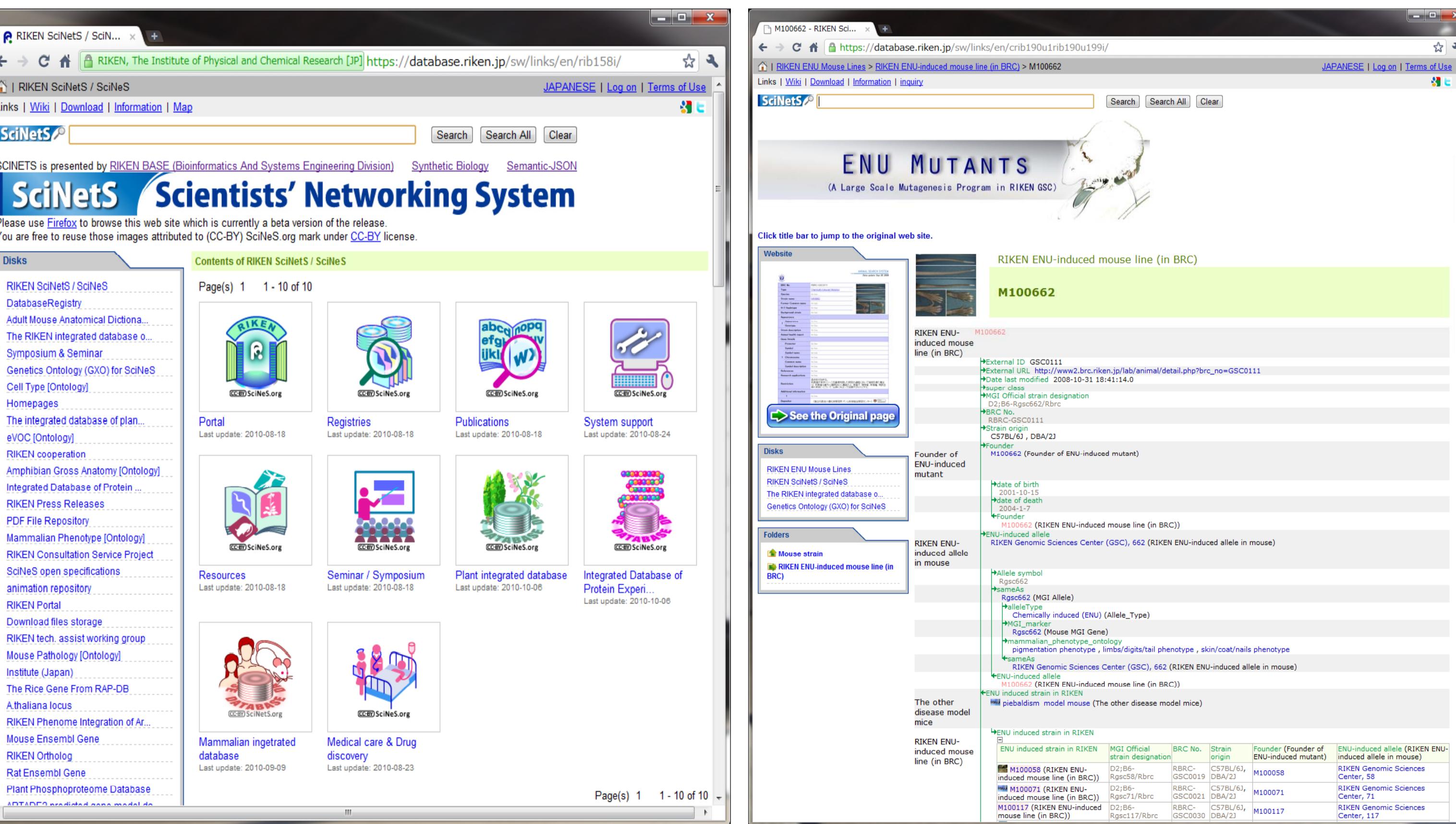


Fig. 2 Snapshots of SciNetS. (Left) The top page displaying Virtual Laboratories categorised on the bases of ontology. (Right) a data record of an ENU mouse mutant presented in a Semantic Web format.

3. Ontological inference search at SciNetS

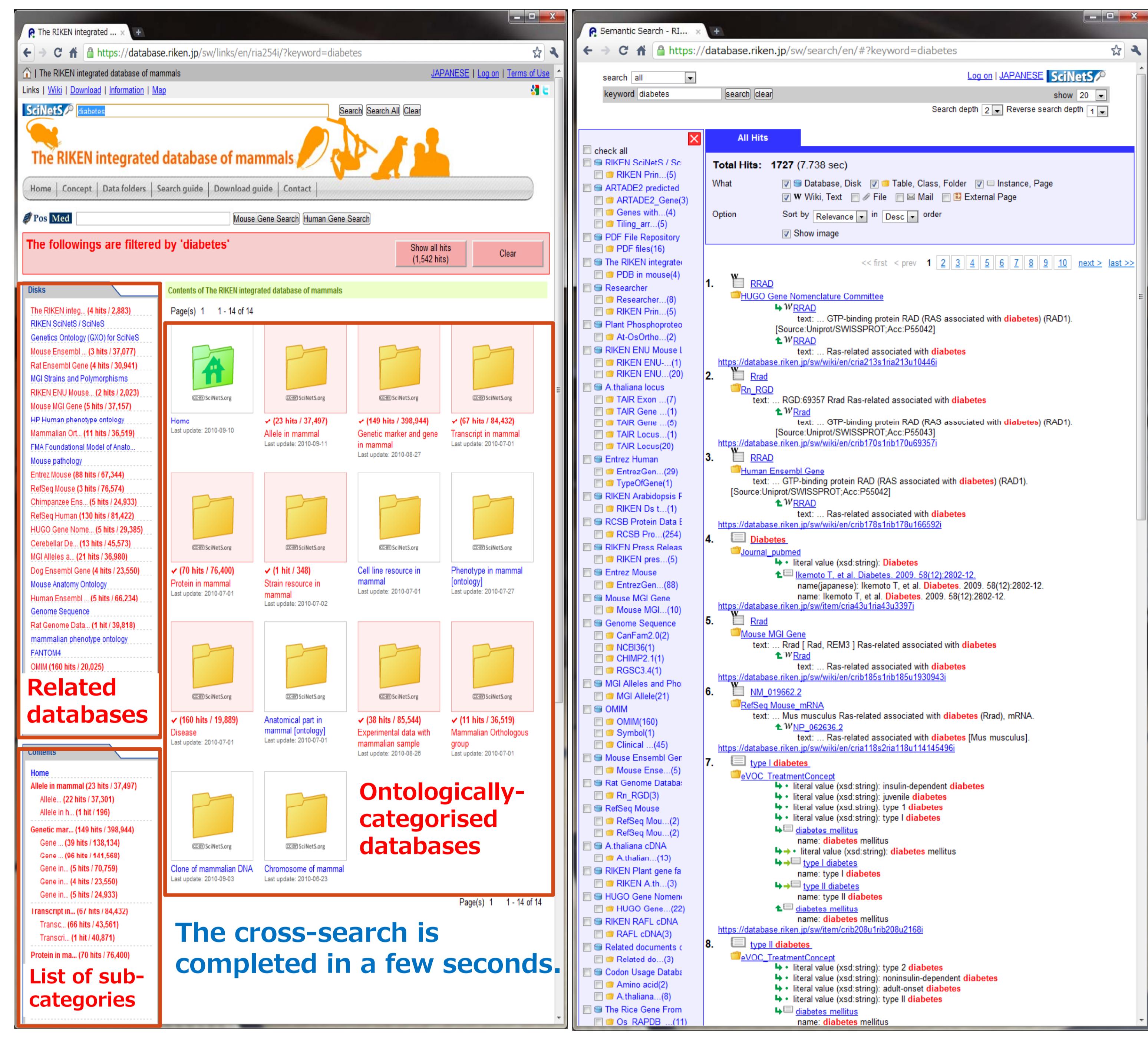


Fig. 3 Inference search results using ontological concept of hierarchy relationships. (Left) A keyword cross-search over the RIKEN integrated database of mammals categorised on the bases of ontology. (Right) A data item search. The list of data items includes not only the one having the keyword but also the one related with a data item having the keyword via a semantic link.

4. Document-based Inference Search at SciNetS

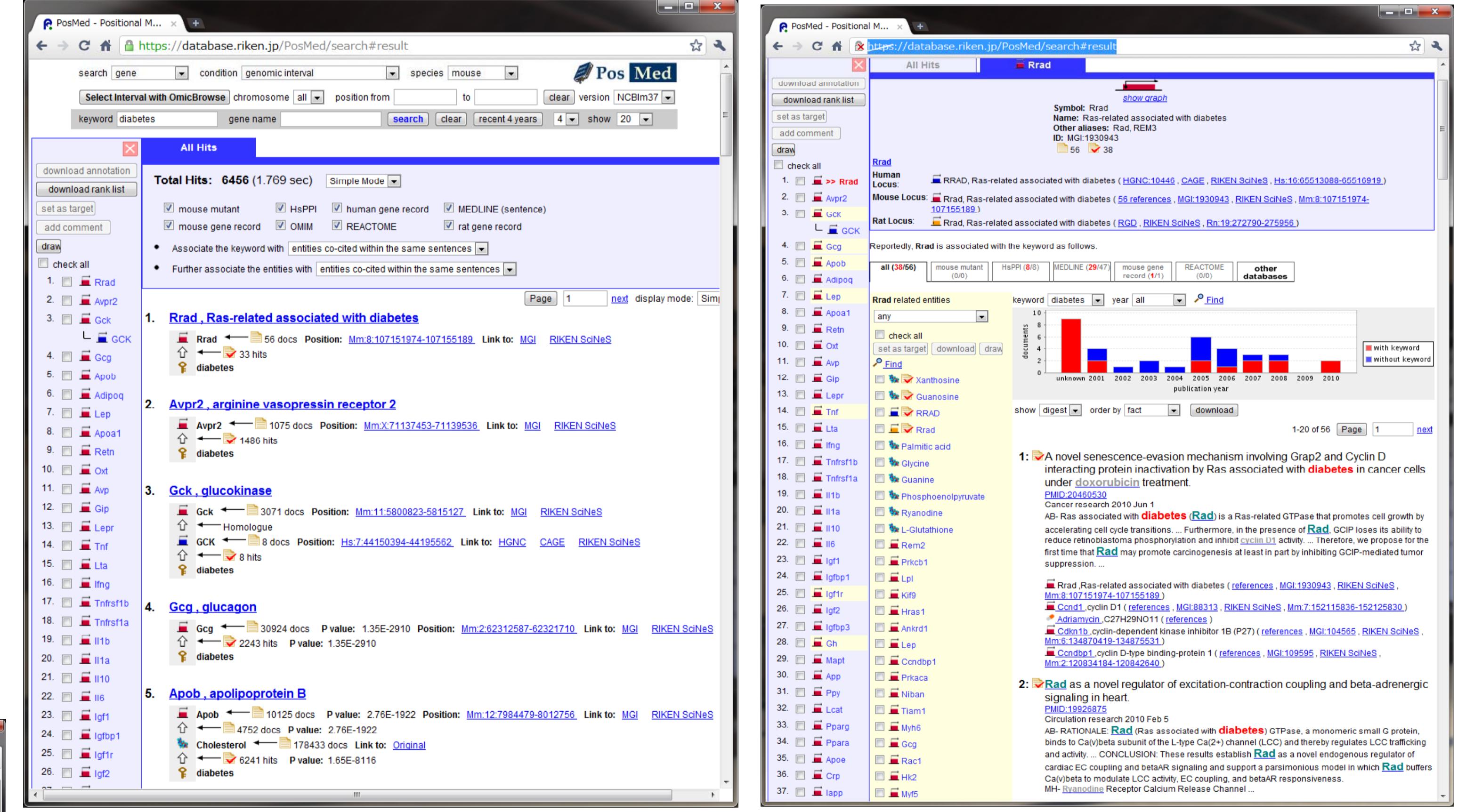


Fig. 4 A search result of Mouse Gene. This search employs human curated gene-MEDLINE relationships. The resultant mouse genes are ranked by statistical analysis based on the numbers of MEDLINE documents having a keyword. (Left) Ranking of mouse genes associated with keyword “diabetes”. (Right) MEDLINE documents related with gene “Rrad” ranked first in the left figure.

References

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SciNetS: <http://database.riken.jp>