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A tale of genome, annotations, metabolism and phylogenomics: the pea aphid genome resources

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CycADS: the Cyc Annotation Database System

The CycADS pipeline has proven to be useful in the generation of the AcypiCyc database and we plan to use the same metabolism genes annotation strategy for other arthropods sequenced genomes.

WORKFLOW: from CycADS to AcypiCyc, and beyond...

AcypiCyc: a CycADS powered database

AcypiCyc, as all BioCyc databases, offers a framework for the analysis of the integrated metabolic network and different query tools allow the user to visualize different metabolic reactions and pathways. Thanks to CycADS several supplementary specific links can be added to complement the classic existing ones. This feature is most valuable for newly sequenced genomes that are kept in community based repository (such as AphidBase for the pea aphid).

Not only enzymes, but all genes are present in AcypiCyc. All gene pages include an annotation summary with an associated score and a set of hyperlinks to different information resources including genomics (AphidBASE and GenBank), phylogenomics (PhyloMDEB) and metabolism (KEGG orthology, BRENDA, ENZYME) database.

PhyloMDEB provides deep sequence information about the genome, expression (RNA-seq, ChIP-Seq), various genomics (expression) and screening projects (e.g., GWA, QTL, metabolomics, transcriptomics) and offers a whole-genome view of the aphid genome.

The AcypiCyc database is extended by other tools that will be available soon: AphidAtlas and AcypiCyc Metapathway. The AcypiCyc database is extended by other tools that will be available soon: AphidAtlas and AcypiCyc Metapathway. The AcypiCyc database is extended by other tools that will be available soon: AphidAtlas and AcypiCyc Metapathway.

AphidBase: a GMOD Chado database

AphidBase is a comprehensive information system set up to safely centralize, manage, mine, disseminate and promulgate data generated by the International Aphid Genomics Consortium.

It allowed an international broad community dispersed at many sites to produce a robust and comprehensive annotation of the pea aphid genome by curating gene models and gathering manual and functional annotations, which is an essential step to attain a basal data quality.

For connecting applications or scripts handling or presenting data stored into our GMOD-Chado databases, we developed two middleware, in Perl and in Java.

Chado Module: a Java middleware for Chado

We used JAVA JEE and a model-driven-architecture system (AndroMDA) for automatically generating the Hibernate classes from a Chado UML (A). Using those layers, we implemented 2 applications deployed on a Tomcat server: GMOD reports, a configurable reports builder for browsing gene, transcript or proteins (B,C) and navigating into the ontologies (D), and Chado search for accelerated database querying (E).

Table of the main features stored in AphidBase

URL:
AcypiCyc: http://acypicyc.cycadsys.org/
CycADS: http://www1.inra.fr/cycads.org
AphidBase: http://www.aphidbase.org

A genome-based phylogenetic analysis was performed for the pea aphid using the PhyloMDEB pipeline and the results are stored in the PhyloMDEB database. Links to the database are provided both from AcypiCyc and AphidBase.

The phyloMDEB analysis has also allowed the transfer of GO annotation from Drosophila melanogaster to the pea aphid.