Crop Transport information, Physiology & Signalling Knowledgebase - CropTiPS

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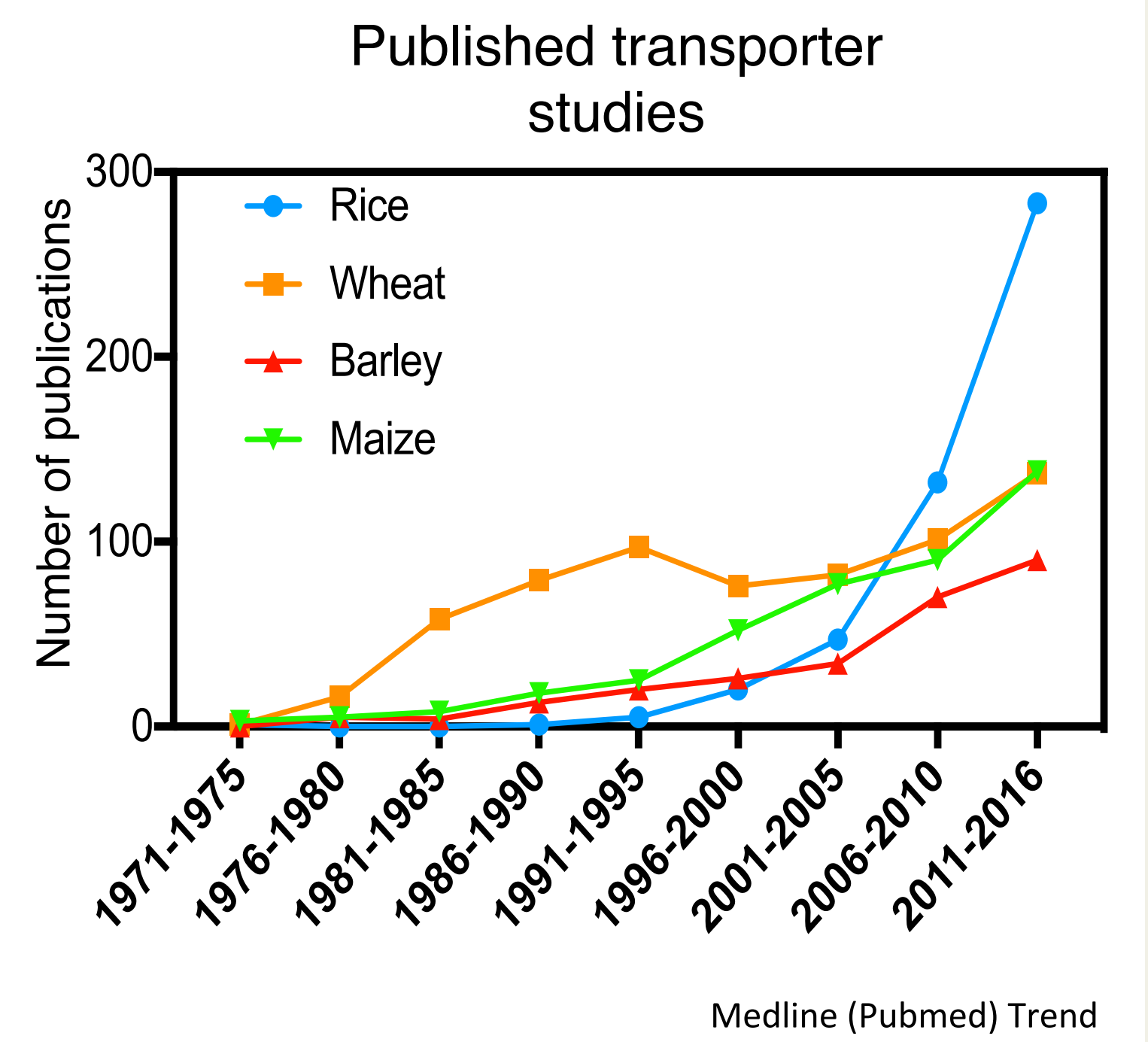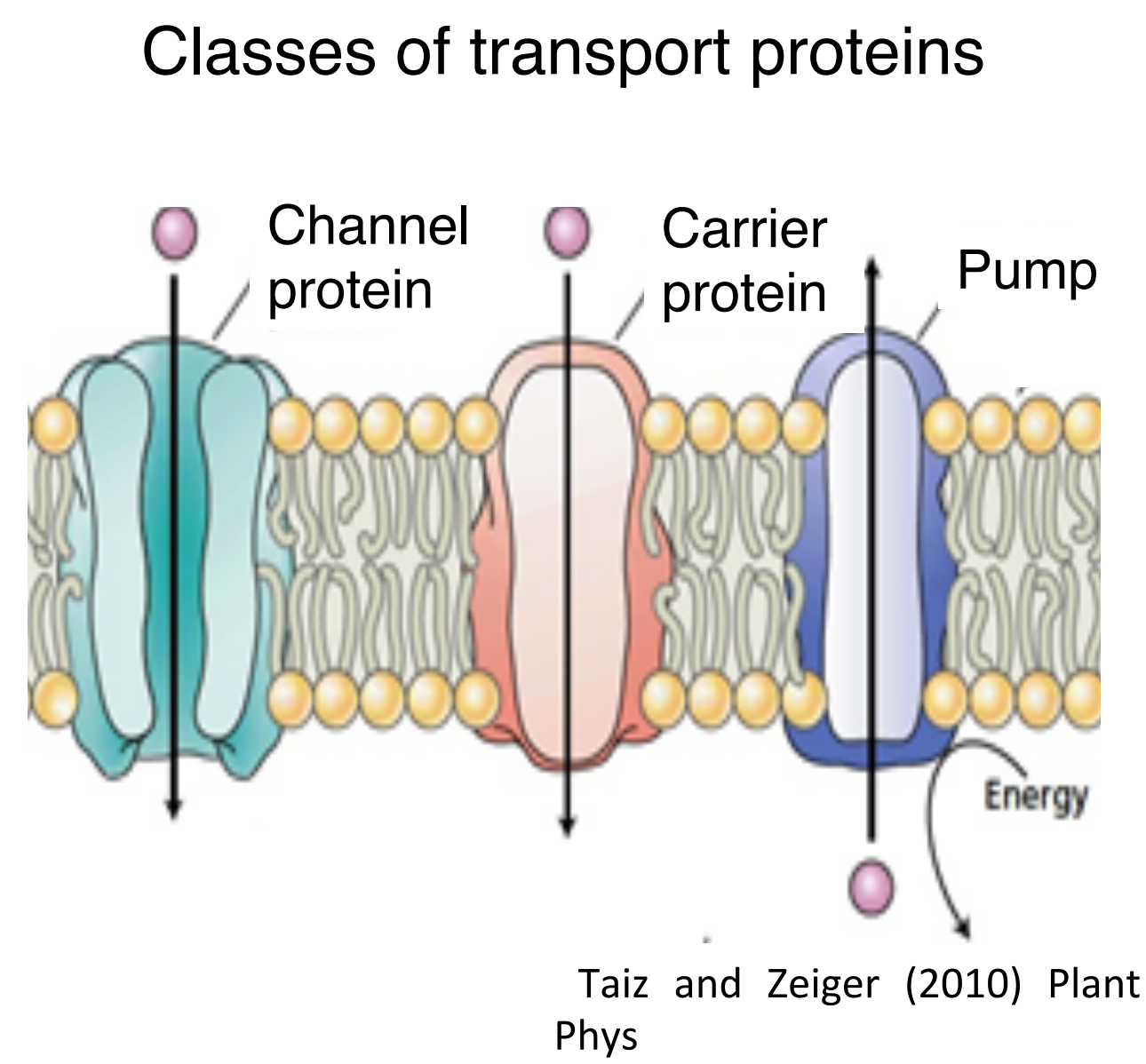
Integration of crop transporter data

Membrane transporters are ubiquitous proteins that play crucial roles in physiology, metabolism and signalling through their function in translocating ions and small molecules across biological membranes.

In plants, approximately 10-20% of the coding sequences encode transport proteins and can be functionally classified into channels, carriers and pumps (Figure 1) (Saier and Ren, 2006). Membrane transporters are the focus of extensive research in crop species (Figure 2) due to their importance in protecting plants from environmental stresses. However, this data remains dispersed and unconnected, with only limited attempts made to integrate the vast amount of molecular, physiological and biophysical information available.
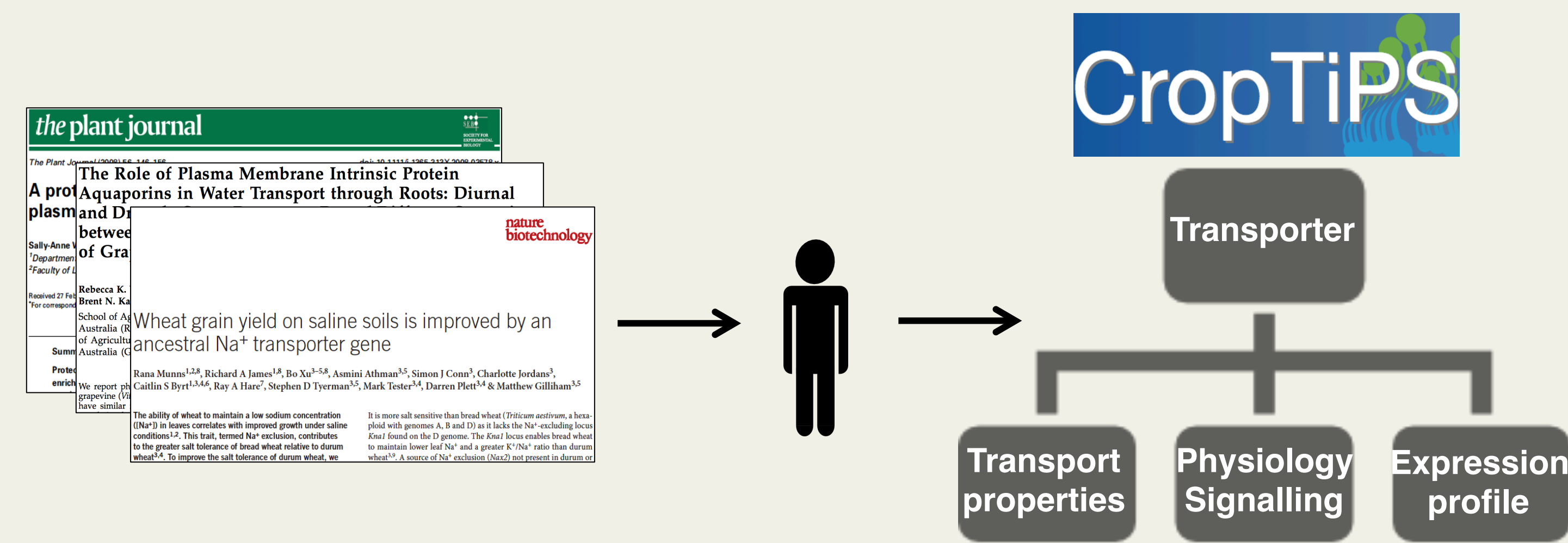
Here, we address this issue with the development of a database that contains a comprehensive collection manually curated experimental data related to transport proteins in major crop species.

Fig. 1

Classes of transport proteins

Taiz and Zeiger (2010) Plant Phys

Fig. 2

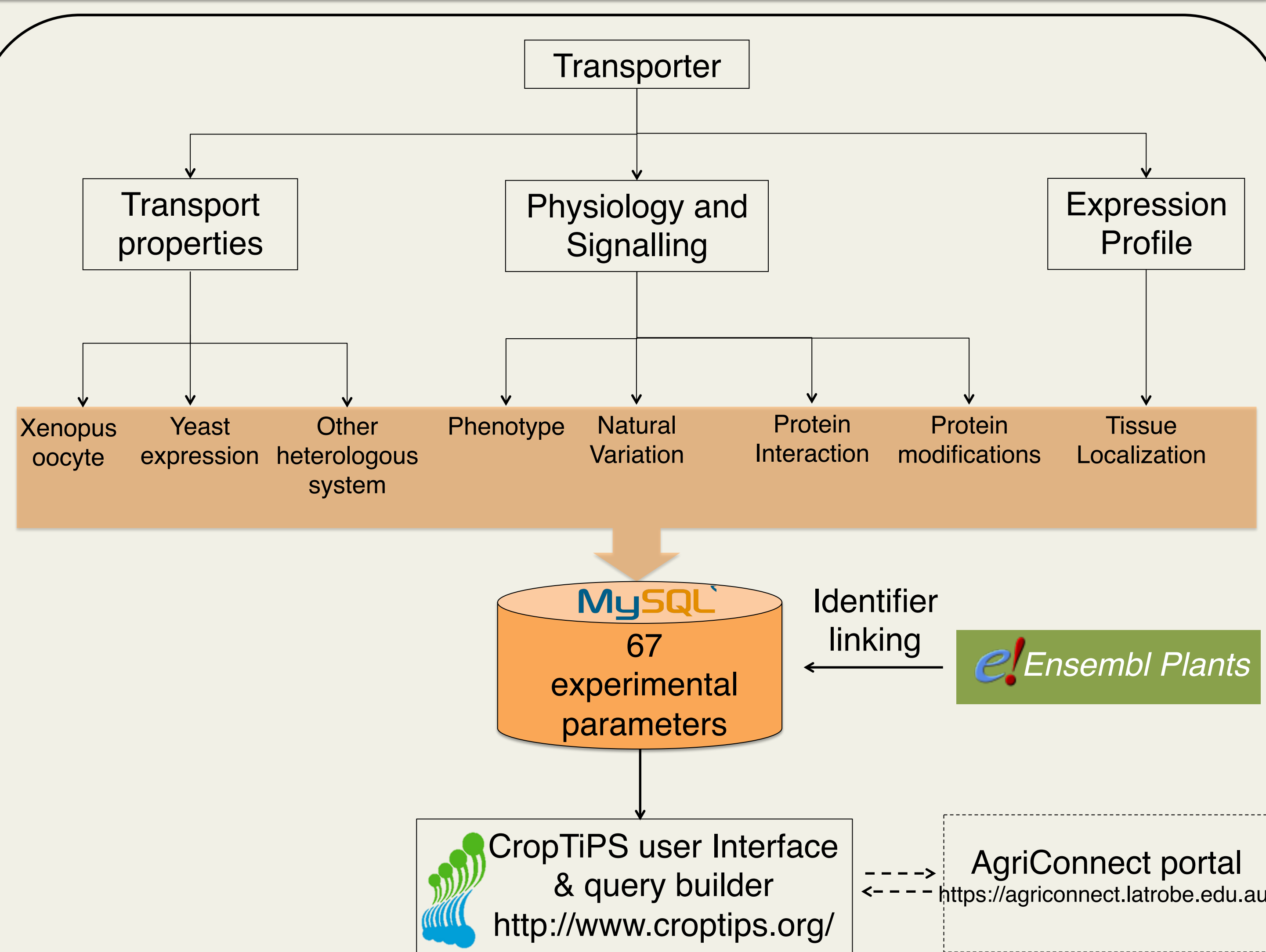Published transporter studies

Medline (Pubmed) Trend

1. Key features of CropTiPS

- Knowledgebase of membrane transporters and signalling systems in rice, wheat, barley and maize.

- Source is published literature and reference transport proteins.

- Searchable for experimental curated data/transport protein.

2. Experimental data classification

Published experimental data related to a transporter is categorized into three functional groups - Transport, Physiology & Signalling and Expression profile. Experimental approaches used to study these functions are stored in a MySQL database.

Experimental data is linked to the current genome annotations through the Ensembl Plants identifier system.

CropTiPS is linked to the AgriConnect platform that aims to connect high value crop data collections across key Australian agricultural research institutions.

3. CropTiPS user interface

Query page

Transporter information can be retrieved using the query builder:

- Choice of four crop species.
- Quick search of text or protein identifiers.
- Experimental information organised under functional categories.

The results table offers compact view of protein hits matching the query and a summary of curated experimental data:

- Results table is organised based on protein identifiers and annotation for each species.
- Summarised experimental data and PubMed links to the related articles are provided for each protein.
- Columns can be customized to display additional features such as *Arabidopsis* homology, length, isoelectric point, molecular weight for each protein.

Results tabular view

Transporter information is available as a Factsheet by clicking on the protein identifier in the results view:

- Experimental grouping allows comparative analysis of transporter function across published studies.
- Viewing data can be filtered using the display menu to narrow down to the experiment of interest.

Transporter Factsheet

4. Conclusion

The CropTiPS repository connects physiology and biophysics of transporter proteins from four important agronomic species into a single online resource. The resource is an important step in developing new strategies to manipulate transporter function to ultimately enhance crop yield and resistance to key stresses

Reference

Saier. MH Jr., Ren Q. Journal of Molecular Microbiology and Biotechnology (2006)
Taiz. L., and Zeiger. E. Plant Physiology 5th Ed (2010).