

An enzyme catalog for *Drosophila melanogaster* (531C)

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ABSTRACT

Drosophila melanogaster has been used as a model system to study enzyme function for over a century and a substantial proportion (~27%) of its protein-coding genome encodes enzymes. Nonetheless, many *D. melanogaster* enzymes have remained unidentified or poorly classified within biological databases, hampering research progress and inter-species comparisons. In order to address these shortcomings, we have systematically reviewed *D. melanogaster* enzyme data obtained from several key databases and the primary literature. We have now completed our review of the 6 major enzyme classes: oxidoreductases, transferases, hydrolases, lyases, isomerases and ligases. All verified activities have been annotated using appropriate Gene Ontology (GO) and Enzyme Commission (EC) terms while incorrect annotations have been corrected, providing feedback to the source databases as necessary. In addition, we have compiled convenient 'Gene Group' reports within FlyBase for each enzyme class. These improvements will benefit all researchers working with enzyme data, aiding studies of fly metabolism in particular.

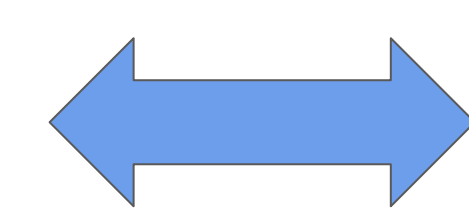
METHOD

Select enzyme class

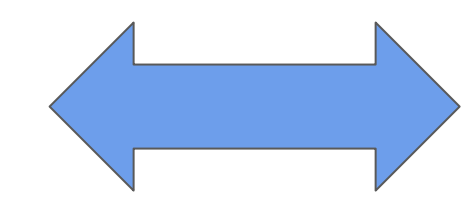


Integrate and cross-check enzyme data:

- GO annotations (FlyBase)
- EC annotations (UniProt, KEGG)
- Annotations to human orthologs (GOA)
- Protein domains (InterPro)
- Uncurated literature



Liaise with databases



Contact experts



Improve GO & EC annotation



Rationalize gene names



Produce Gene Group reports

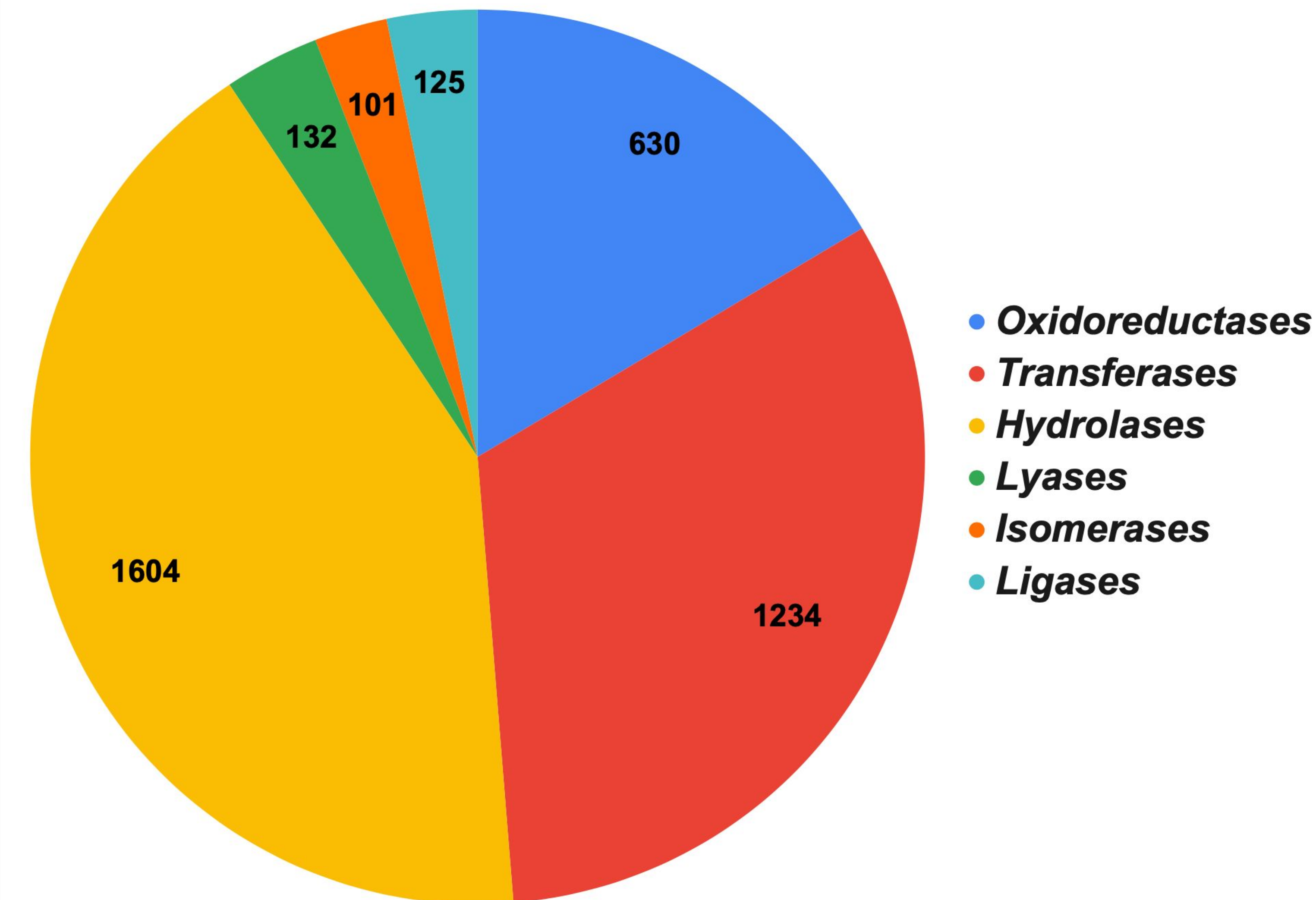


Publish review

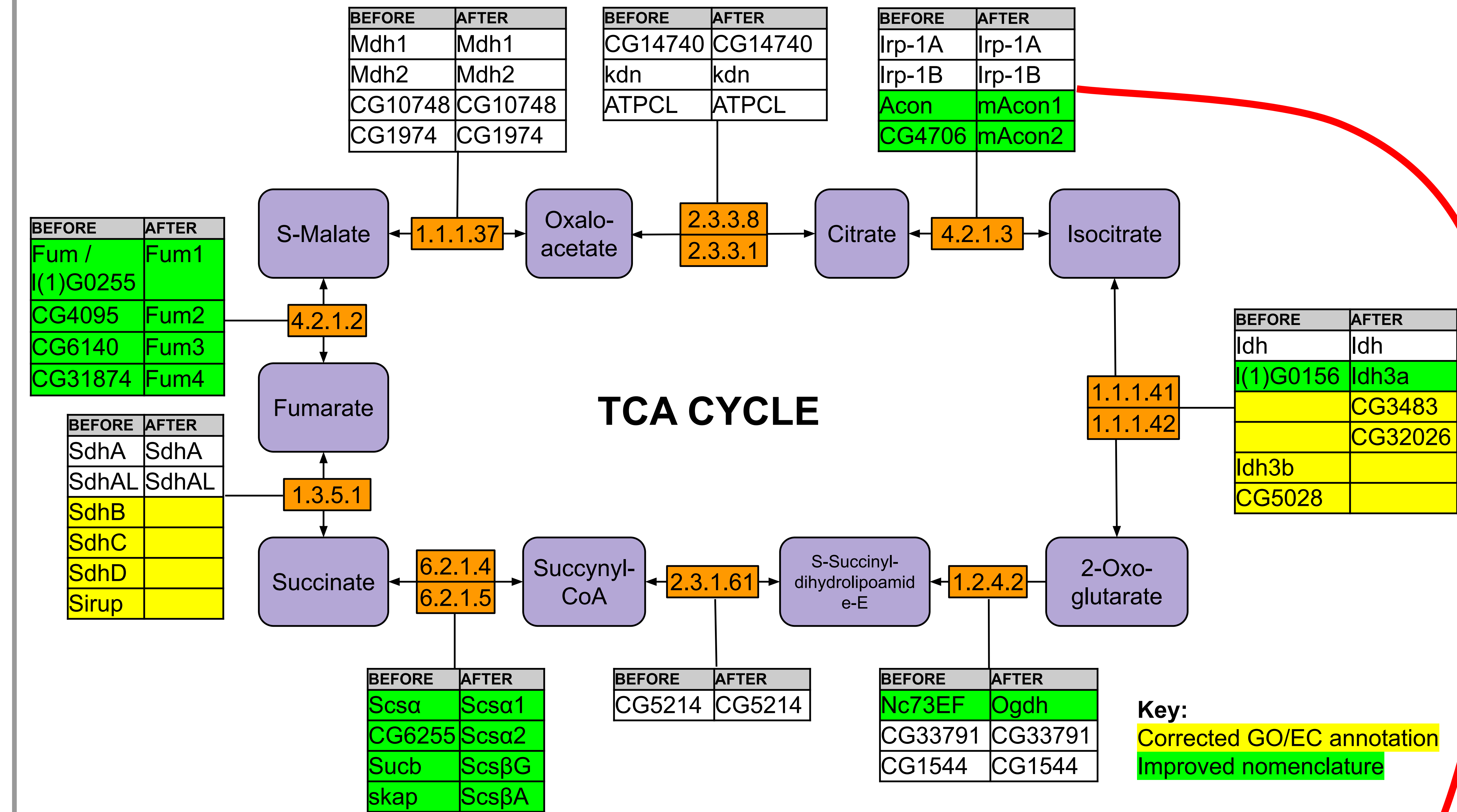
- References:**
- Ahn and Marygold (2021) The UDP-Glycosyltransferase Family in *Drosophila melanogaster*: Nomenclature Update, Gene Expression and Phylogenetic Analysis. *Front Physiol* 12 648481
 - Marygold et al. (2020) In silico identification of *Drosophila melanogaster* genes encoding RNA polymerase subunits. *microPubl Biol* 000320
 - Marygold et al. (2020) The DNA polymerases of *Drosophila melanogaster*. *Fly* 14(1-4) 49-61
 - Garapati et al. (2019) Towards comprehensive annotation of *Drosophila melanogaster* enzymes in FlyBase. *Database* 2019 bay144.
 - Lu et al. (2015) The aminoacyl-tRNA synthetases of *Drosophila melanogaster*. *Fly* 9(2):53-61

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ANNOTATED ENZYMES BY CLASS



IMPROVED GO/EC ANNOTATIONS & NOMENCLATURE - EXAMPLE



ORGANIZATION INTO GENE GROUPS

- ENZYMES (3826)
- LYASES (132)
 - CARBON-CARBON LYASES (33)
 - ALDEHYDE DECARBOXYLASES (1)
 - ALDEHYDE-LYASES (5)
 - CARBOXY-LYASES (23)
 - DNA PHOTOLYASES (2)
 - GTP 3',8'-CYCLASES (1)
 - OXO-ACID-LYASES (1)
 - CARBON-HALIDE LYASES (1)
 - CARBON-NITROGEN LYASES (13)
 - AMIDINE-LYASES (10)
 - AMINE-LYASES (2)
 - AMMONIA-LYASES (1)
 - CARBON-OXYGEN LYASES (52)
 - 5'-DEOXYRIBOSE-5-PHOSPHATE LYASES (2)
 - CARBON-OXYGEN LYASES, ACTING ON PHOSPHATES (2)
 - DNA-(APURINIC OR APYRIMIDINIC SITE) LYASES (4)
 - HYDRO-LYASES (44)
 - ACONITASES (4)
 - CARBONIC ANHYDRASES (16)
 - FUMARATE HYDRATASES (4)
 - OTHER HYDRO-LYASES (20)
 - CARBON-SULFUR LYASES (4)
 - FERROCHELATASES (1)
 - PHOSPHORUS-OXYGEN LYASES (29)
 - ADENYLATE CYCLASES (13)
 - CYCLIC PYRANOPTERIN MONOPHOSPHATE SYNTHASES (1)
 - GLYCOSYLPHOSPHATIDYLINOSITOL DIACYLGLYCEROL-LYASES (2)
 - GUANYLATE CYCLASES (13)
 - RECEPTOR GUANYLATE CYCLASES (8)
 - SOLUBLE GUANYLATE CYCLASES (2)
 - SOLUBLE GUANYLATE CYCLASES ATYPICAL (3)

FlyBase Gene Group : ACONITASES

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General Information

| | | | |
|--------------------|------------|-------------------|------------------------|
| Name | ACONITASES | Species | <i>D. melanogaster</i> |
| Symbol | ACO | FlyBase ID | FBgg0000888 |
| Date last reviewed | 2019-11-08 | Number of members | 4 |

Description

Aconitases are tricarboxylic-acid cycle enzymes that catalyze the stereo-specific isomerization of citrate to isocitrate via cis-aconitate. (Adapted from FBfr0221188).

Notes on Group

In *D. mel* there are two types of aconitases: mitochondrial aconitase (Acon and CG4706) and cytosolic aconitase (Irp-1A and Irp-1B). (FBfr0221188 and FBfr0195255).

Source Material

The ACONITASES Gene Group has been compiled by FlyBase curators using the following publication(s): Cheng et al., 2013 and Lind et al., 2006 .

Key Gene Ontology (GO) terms

| | |
|--------------------|------------------------------|
| Molecular Function | aconitate hydratase activity |
| Biological Process | tricarboxylic acid cycle |
| Cellular Component | mitochondrion cytosol |

Related Gene Groups

Parent group(s) HYDRO-LYASES

Members (4)

| Gene Symbol | Gene Name | Also Known As | Source Material for Membership |
|-------------|----------------------------|--|--------------------------------------|
| Irp-1A | Iron regulatory protein 1A | IRP1A, cytosolic aconitase, IRP-1, IRP, c-aconitase | (FlyBase, 2017-, Lind et al., 2006) |
| Irp-1B | Iron regulatory protein 1B | cytosolic aconitase, c-aconitase, IRP-1, IRP, cAcon | (FlyBase, 2017-, Lind et al., 2006) |
| mAcon1 | Mitochondrial aconitase 1 | Acon, Aconitase, mitochondrial aconitase, mAcon, m-aconitase | (FlyBase, 2017-, Cheng et al., 2013) |
| mAcon2 | Mitochondrial aconitase 2 | | (FlyBase, 2017-, Cheng et al., 2013) |

External Data

Equivalent Group(s)

Other resource(s)

Synonyms and Secondary IDs

References (4)

- Textual description and comments
- Source references
- Key GO terms
- Related Gene Groups
- Export/analysis tools
- Members
- Equivalent human gene group