Object Groups

Object Groups

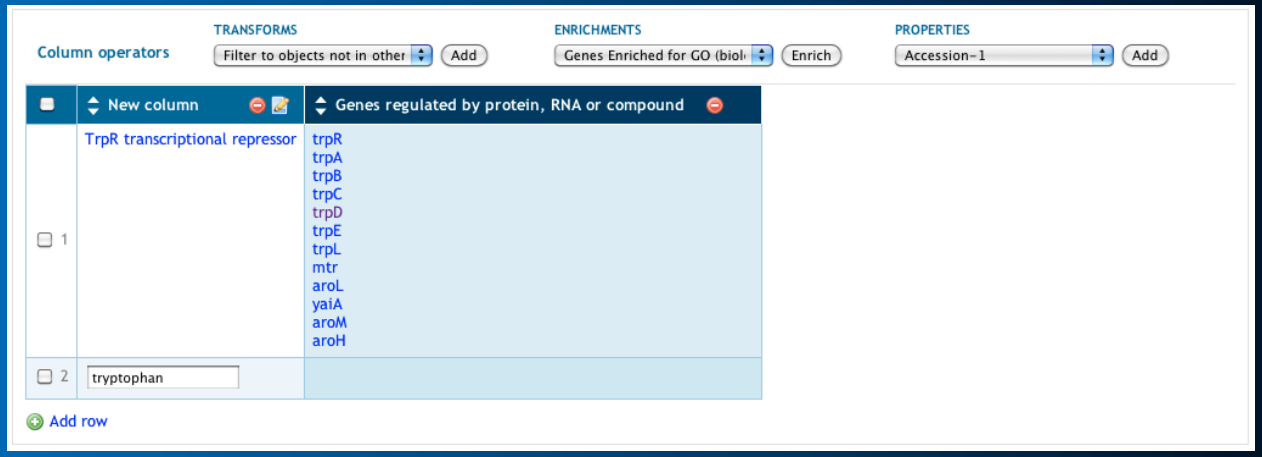
- **Collect and save lists of genes, metabolites, pathways…**
- **Transform, filter, and analyze them**
- **Share groups with colleagues**
- **Use groups in conjunction with publications**
- **Claim: Groups enable biologists to perform computations that required a programmer**

Accessing Groups

- **Desktop menu: Groups**
- **Web menu: Tools -> Groups**
  - To use Web Object Groups, you must create a (free) BioCyc account

Creating Groups: User-Defined Groups

- **Create a group by uploading a tab-delimited text file**
  - Software will assist in recognizing database objects from text
- **Create a group by typing in names**
  - You will be presented with options for the correct object; e.g. typing "tryptophan", you will get the option to choose the compound L-tryptophan, the enzyme tryptophan synthase, and others

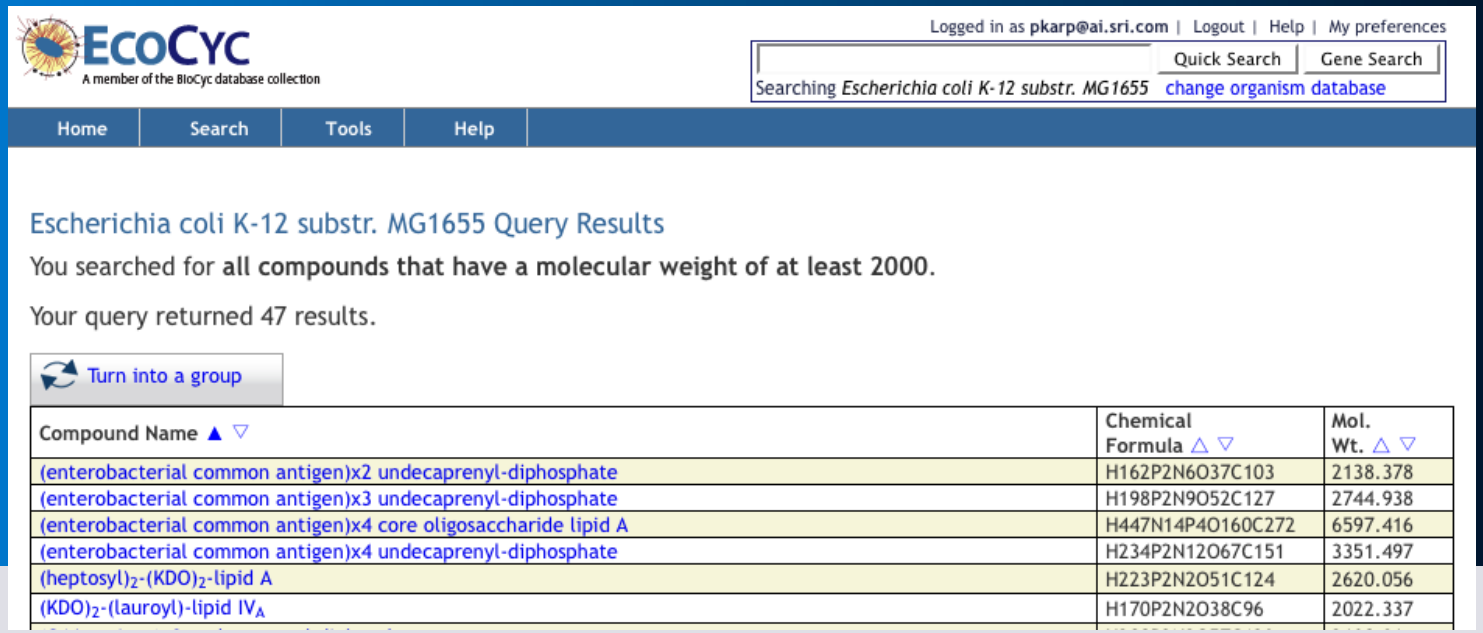


Creating Groups

Add current object to group

Add quick-search result set to group

Add object-specific search result to a group



Using Groups: Group Transformations

Use Case: Find all genes that are regulated by a transcriptional regulator.

Step 1: Create a group that contains the transcription factor.

Step 2: In the "Transforms" menu, select "Genes regulated by protein, RNA or compound".

A new column containing all genes regulated by the transcription factor is generated

Click "+" to turn that new column into a group

This group can be further transformed, e.g. into metabolic pathways

Object Group Transformations

Transform metabolite group into group of metabolic pathways, then into gene group

Transform gene group into group of regulators of those genes

Transform gene group into list of TF binding sites controlling those genes; into list of sequences

Create group of nucleotide positions; transform to closest genes; paint to cellular overview or enrich for GO terms

Using Groups: Properties

Use Case: Find the chromosome positions of all genes encoding enzymes of a pathway, sort by chromosome position. Find regulators of those genes.

Step 1: Create a group that contains the pathway.

Step 2: In the "Transforms" menu, select "Genes of pathway".

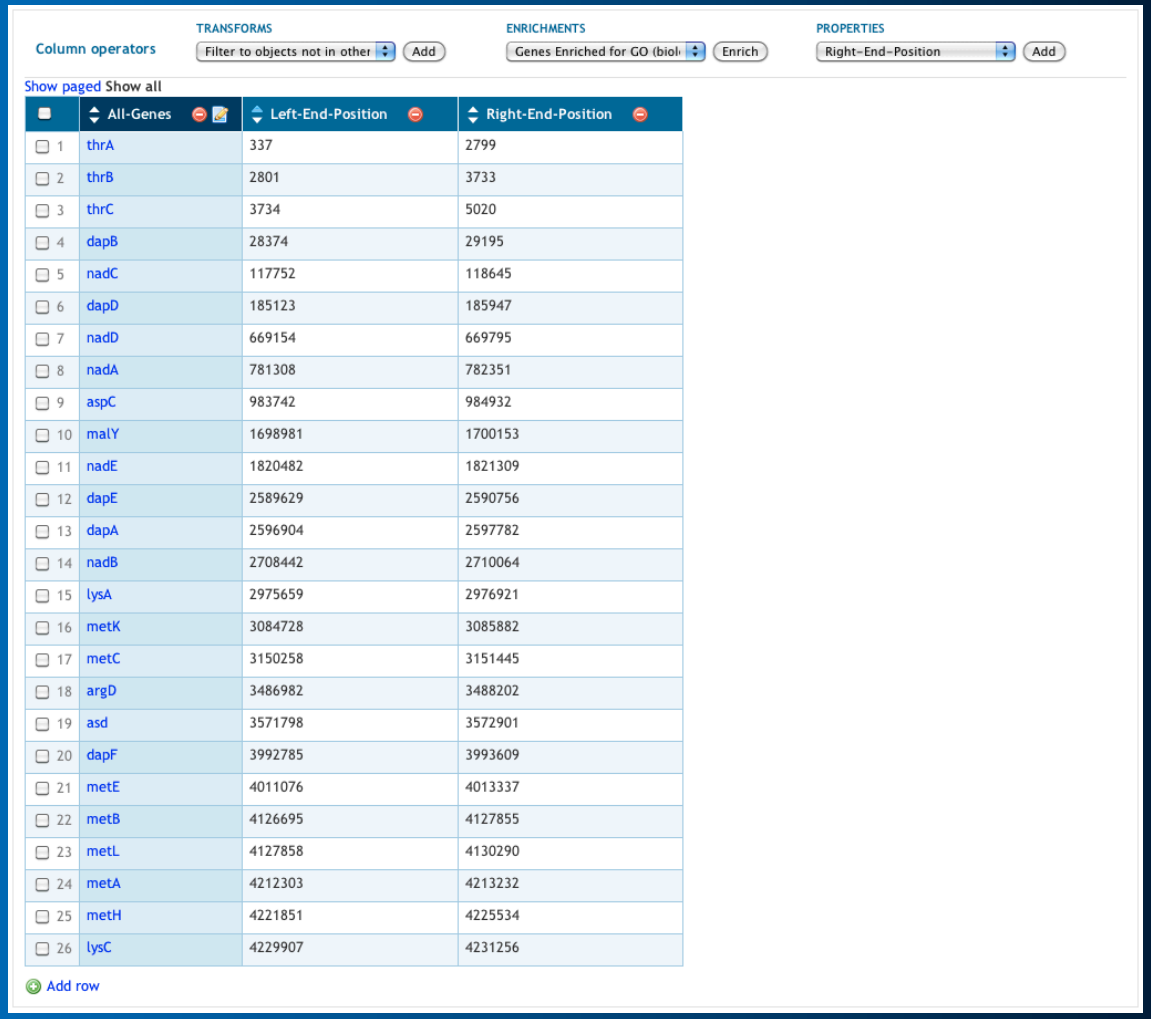
Step 3: Select gene column and select

- Groups > New > Group from column OR
- Click "+" at top of gene column

Step 4: Select "left-end-position" from "Add Property Column" menu and add. Sort by position by clicking on arrow in column header.

Step 5: Select "Direct regulators of gene" from "Add Transform Column" menu.

Genes of Aspartate Superpathway



Column operators | TRANSFORMS: Filter to objects not in other [Add] | ENRICHMENTS: Genes Enriched for GO (biol [Enrich] | PROPERTIES: Right-End-Position [Add]

Show paged Show all

	All-Genes	Left-End-Position	Right-End-Position
1	thrA	337	2799
2	thrB	2801	3733
3	thrC	3734	5020
4	dapB	28374	29195
5	nadC	117752	118645
6	dapD	185123	185947
7	nadD	669154	669795
8	nadA	781308	782351
9	aspC	983742	984932
10	malY	1698981	1700153
11	nadE	1820482	1821309
12	dapE	2589629	2590756
13	dapA	2596904	2597782
14	nadB	2708442	2710064
15	lysA	2975659	2976921
16	metK	3084728	3085882
17	metC	3150258	3151445
18	argD	3486982	3488202
19	asd	3571798	3572901
20	dapF	3992785	3993609
21	metE	4011076	4013337
22	metB	4126695	4127855
23	metL	4127858	4130290
24	metA	4212303	4213232
25	metH	4221851	4225534
26	lysC	4229907	4231256

Add row

Enrichment Analysis

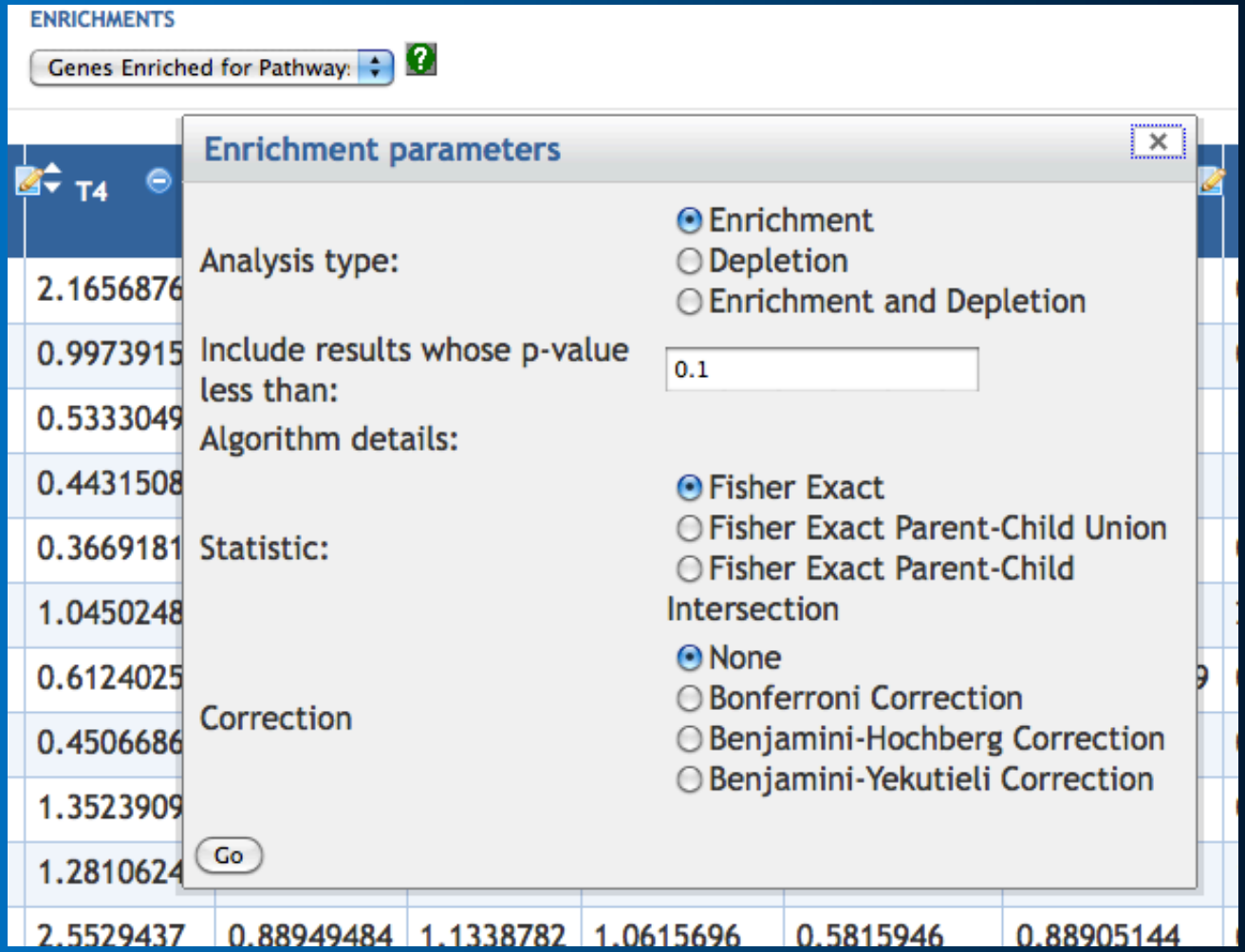
- **Example: Does a group of genes contain more genes involved in cell division than would be expected by chance?**
- **More generally: Does a group contain more entities from defined classes than expected by chance?**

- **Check gene groups for enrichment of**
  - GO terms, pathways, regulons
- **Check metabolite groups for enrichment of**
  - Pathways

Enrichment Analysis

- **Enrichment test based on the Hypergeometric Distribution**
- **Can perform enrichment, depletion, or both**
- **Multiple testing correction optional**

Enrichment Dialog



Sharing Groups

By default your groups are private

Share them with specific colleagues or make them public

- Groups -> Sharing

Group URLs are permanent and can be used in publications

Lab Exercises

1. Search for compounds having 'glucose' in their name
2. Turn into group
3. Enrichment Analysis → Compounds Enriched for Pathways
4. Use defaults in Enrichment pop-up, click 'OK'
5. Select ten most enriched pathways
6. Groups → New → From checked rows
7. Reactions of pathway
8. New group of reactions (green button on column)
9. Groups → Paint Data → On cellular overview