

# BRENDA Exercises

## Quick Search

## Exercise 1

- How often can you find the term „glucosidase“ in enzyme names?
- How many EC classes are connected with this term?

## Exercise 2

- How many enzymes accept molybdopterin as a cofactor?
- Display the results for exact matches for molybdopterin
- To which **main EC class** do the enzymes belong?

## Exercise 3

- What is the EC number and the recommended name for the enzyme commonly termed RUBISCO?
- Display the wordmap
- RUBISCO is involved in a biological process. What is its name and what are the major metabolites of this process?
- Display the reaction diagram for RUBISCO
- How many protein sequences for RUBISCO are stored in BRENDA?

# **BRENDA Exercises The Enzyme Summery Page**

## Exercise 4

- Display the enzyme summary page for RUBISCO
- Open the menu organism-related information on the navigation bar and look at the section „organism“
- Then go back to the top of the flatfile and click *Include FRENDA results (AMENDA + additional results, but less precise; [more...](#))*
- Again open the menu organism-related information on the navigation bar and look at the section „organism“. What is different now?
- The optimal temperature for RUBISCO varies with the enzyme origin. What is the maximal value for optimal activity. In which organism has it been detected?
- You are only interested in RUBISCO from tobacco. How can you reduce the displayed data to show only those related to tobacco? (Note: if you do not know the scientific name for tobacco, you may need to study the tutorial on the Taxonomy Explorer first. If you know the name (or your instructor is willing to reveal it), you can go ahead with this task 🤔 )

# BRENDA Exercises

## Fulltext Search

## Exercise 5

- methylmalonyl-CoA is a frequently occurring metabolite. Display a list of all BRENDA data categories where this compound is mentioned.
- How many kinetic values are stored for this compound ( $K_m$ ,  $k_{cat}/K_m$ ,  $K_i$ , turnover numbers)?

## Exercise 6

- What are the EC numbers for enzymes that are related to lactate dehydrogenase deficiency?

# BRENDA Exercises Advanced Search

## Exercise 7

- Search all acetyltransferases which have been crystallized.
- How many of these have a connected pdb entry?

## Exercise 8

- Xylose from hydrolyzed wood components might be a good material for energy production or biofuel production. Find enzymes that may be useful in these processes.



# BRENDA Exercises

## EC Explorer

## Exercise 9

- You are looking for enzymes that transfer methyl groups
- There are several search modes which you might use for this search.
- However this time use the EC Explorer for this search
- Start with using the search mode of the EC Explorer
- try using a part-name
- try using a compound which is able to donate a methyl group
- try looking at various EC subclasses (remember the EC classes from the first training module? Otherwise ask your instructor 🤔 )
- Then use the browse mode
- Look at the various links and display the information provided there
- Now try other search modes for this tasks (your instructor will appreciate your feedback)



# BRENDA Exercises

## Taxonomic Tree

## Exercise 10

- Search the scientific name for yeast
- How many EC numbers and amino acid sequences are stored in BRENDA for this organism?
- How many synonyms are reported for this organism?

## Tax Tree Explorer

[browse taxonomy tree] - [search] -   [Example]

Scientific name or synonym:   (use **AND**, **OR**, **AN**)

type of synonym (optional):


NCBI Taxonomy ID:

Rank:

1 different results found

1: yeast (*Saccharomyces cerevisiae*)

### Details for *Saccharomyces cerevisiae*

 7405 aa sequences of *Saccharomyces cerevisiae*












**NCBI 4932**

Found 2518 enzymes for *Saccharomyces cerevisiae*

### Synonyms

1. *Candida robusta*
2. *Saccaromyces cerevisiae*
3. *Saccharomyces capensis*

### Condensed Tree View

- └ cellular organisms
  - └ Eukaryota  (superkingdom)
    - └ Opisthokonta 
      - └ Fungi  (kingdom)
        - └ Dikarya  (subkingdom)
          - └ Ascomycota  (phylum)
            - └ saccharomyceta 
              - └ Saccharomycotina  (subphylum)
                - └ Saccharomycetes  (class)
                  - └ Saccharomycetales  (order)
                    - └ Saccharomycetaceae  (family)
                      - └ *Saccharomyces*  (genus)
                        - └ *Saccharomyces cerevisiae* (species)

7405 amino acid sequences  
2518 EC classes  
15 synonyms

# BRENDA Exercises

## BTO

## Exercise 11

- How many terms in the BTO contain „skin“?
- How many EC numbers are stored in BRENDA for skin cancer cells?
- What is the definition of this term?

# BRENDA Exercises

## Ligands





## Exercise 12

- How many enzymes are affected by promethazine?
- Which enzymes are inhibited by this compound?
- Which enzyme can metabolize this compound and what is the product?
- What happens to the enzyme after the product is formed?

## Exercise 13

- How many enzymes can metabolize cellobiose in an oxidative manner?
- How many enzyme can hydrolyze this compounds?

## Exercise 14

- Display the structure of cellopentaose.
- What are the products of cellopentaose hydrolysis?

# BRENDA Exercises Pathways

### Exercise 15

- How many enzymes are part of the BRENDA pyrimidine metabolism?
- How many enzymes are part of the KEGG pyrimidine metabolism?

### Exercise 16

- Display the BRENDA interactive benzoyl-CoA degradation pathway
- What is the final metabolite in this pathway?
- Show the molecule diagram, the molecular formula and the INChI key for this metabolite.

# **BRENDA Exercises**

## **Sequences, Genomes**

## Exercise 17

- Search for amino acid sequences of RUBISCO from soybean (if you can't remember the EC number or the recommended name for RUBISCO or the scientific name for the soybean you might try to find it in BRENDA by yourself. Of course your instructor can give valuable tips)
- Perform a BLAST with entry [P00865](#) and find out how many other sequences can be matched with 100% identity.
- Find out the molecular weight and a literature reference for [P00865](#).

## Exercise 18

- Search for transferases in the genomes of the genus *Solanum*.
- Select 5 entries for visualization and look for enzyme details

# **BRENDA Exercises**

## **Exploring more Features**

## Extra Exercises

- a) Organisms and their enzymes are adapted to the environment in which they live. Use the search option **Functional Parameters** to display the temperature optimum for the enzymes of *Clostridium acetobutylicum*, *Homo sapiens*, and *Sulfolobus solfataricus* to display the optimal temperatures. Can you detect differences?
- b) The pH optima of enzyme-catalyzed reactions often depends on the type of reaction. Redox reactions are catalyzed best at neutral pH-values. Hydrolytic reactions require different conditions. Display the pH optima for oxidoreductases acting on C-OH bond with NAD(P)<sup>+</sup> as cofactors. Then display the pH optima for serine endopeptidases. (Note: you may have to consult the EC Explorer to find out the EC subclasses for these enzymes)