

Contribute to BRENDA! Your enzyme data is important for BRENDA. Send us your paper, and we will do all the work to include your data into our database. [More...](#)

Enzyme, Ligand

contains

add search field

delete search field

start search

Text-based queries

- Full-text Search
- Advanced Search
- Enzyme & Disease

Structure-based queries

- Ligand Structure Search
- Metabolic Pathways
- Enzyme Structures

Explorer

- Enzyme Classification
- TaxTree
- Protein folding: CATH / SCOPe
- Ontologies

Visualization

- Word Maps
- Genomes
- Functional Parameter Statistics
- Metabolic Pathways

Prediction

- Membrane Helices
- Localization Prediction
- EnzymeDetector

Supporting & External

- BRENDA Tissue Ontology
- Biochemical Reactions
- MetaboMAPS

News

NEW Release online! - February 1, 2021
Release 2021.1 online including 76 new and 623 updated enzyme classes.

BRENDA Tutorial

Full-text Search

Advanced Search

Enzyme & Disease

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for Release 2021.1

The „Full-text Search“ is a simple search option for a quick database search over all BRENDA data fields.

[evaluate BRENDA!](#)

 Information


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 **ELIXIR**
Core Data Resource

UPDATE!
Release 2021.1 (January 2021)
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Fulltext Search

Search term: contains

(use **AND**, **OR**, **AND NOT** for simple boolean queries) 

Search in the complete database ☒

Include text mining results ☒

or search only specified fields:

- Activating Compound
- Amino Acid Sequence
- Application
- CAS Registry Number
- Cloned(Commentary)

(hold the ctrl-key to select more than one field)

Enter a search term and perform the query.

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You can perform a search with the default query options or restrict your search to specific data fields or include/exclude text mining results.

On the result page you get a table showing the number of hits in the different data fields.

More details can be obtained by clicking on the data field name...

Field	Hits found
Activating Compound	6
Application	61
Cloned(Commentary)	18
Cofactor	4
Engineering	26
Enzyme Names (Synonyms)	2
Expression	12
General Information	171
Inhibitors	121
Ki Value [mM]	1
KM Value [mM]	1
Ligands	1
Localization	1
Natural Substrates/ Products (Substrates)	230
Organism	1
Reaction	5
Recommended Name	1
Reference	7312
Source Tissue	21
Specific Activity [micromol/min/mg]	3
Substrate	155

Fulltext Search

Search term: alkaloid
contains

(use AND, OR, AND NOT for simple boolean queries)

Search in the complete database

Include text mining results

or search only specified fields:

Activating Compound
Amino Acid Sequence
Application
CAS Registry Number
Cloned(Commentary)

(hold the ctrl-key to select more than one field)

Search

...to find the list of enzymes containing the search term in their entries

Results 1 - 10 of 61

EC Number ▼▲	Recommended Name ▼▲	Application ▼▲	Commentary ▼▲
1.1.1.206	tropinone reductase I	synthesis	co-expression of putrescine N-methyltransferase and tropinone reductase I genes in Anisodus acutangulus hairy roots significantly improves the yields of tropinone alkaloids and shows higher antioxidant activity than control
1.1.1.206	tropinone reductase I	synthesis	transgenic hairy root lines expressing both tropinone reductase I and hyoscyamine-6beta-hydroxylase produce significantly higher levels of tropinone alkaloids compared with the control and single gene transformed lines, reaching up to 4.293 mg/g tropinone alkaloids. In addition, the content of anisodine is also greatly improved. The average content of anisodine in double transformed lines is 0.984 mg/g dry weight, about 18fold of control lines
1.1.1.247	codeinone reductase (NADPH)	synthesis	Papaver bracteatum hairy roots expressing CodR gene have a high potential to produce morphinan alkaloids
1.1.1.415	noscaphine synthase	synthesis	complete biosynthesis of noscaphine and halogenated alkaloids in yeast and optimizing noscaphine production toward scalable manufacturing. Engineered strain contains 25 heterologous plant, bacteria, and mammalian genes and 6 mutant or overexpressed yeast genes. The noscaphine biosynthetic pathway in endomembrane-localized plant enzymes, highlighting the ability of the yeast to express and properly localize large numbers of heterologous enzymes into the endoplasmic reticulum. Cell titers were improved by 18000fold (to low mg/l levels) via a combination of enzyme engineering, strain engineering, and fermentation optimization. Microbial fermentation can be scaled up to produce halogenated alkaloid derivatives, which can ultimately serve as potential drug leads, and amino acid derivatives to strains
1.4.3.4	monoamine oxidase		used to successfully identify the alkaloid (+/-)-crispine A as a target for chemo-enzymatic deracemisation yielding the biologically active (R)-enantiomer in 97% enantiomeric excess
1.6.2.4	NADPH-hemoprotein reductase	medicine	a Saccharomyces cerevisiae strain is engineered to express seven heterologous enzymes (Papaver somniferum norcoclaurine 6-O-methyltransferase (Ps6OMT), Papaver somniferum 3'-hydroxy-N-methylcoclaurine 4'-O-methyltransferase 2 (Ps4'OMT), Papaver somniferum coclaurine N-methyltransferase (PsCNMT), Papaver somniferum berberine bridge enzyme (PsBBE), Thalictrum

directly linked to the Enzyme Summary Page

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Enzyme, Ligand

contains

add search field delete search field start search

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evaluate BRENDA!

 Information

The „Advanced Search“ is a query system providing target-oriented searches.

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Release 2021.1 (January 2021)
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Advanced Search

Organism:

(synonyms, domain, kingdom, phylum, class or order)

exact ▾

(e.g. eukarya, animals, chordata or primates)

Search for sepecific enzyme or organism

EC Number:

exact ▾

use * as a wildcard

Enzyme Name:

exact ▾

Search in text fields

⊕

1.

Choose a subitem ▾

exact ▾

Search in numeric fields

⊕

1.

Choose a subitem ▾

= ▾

Search tip: If you search a value between two limits write 'min-max' and choose between.

Whereby min is the minimum value and max the maximum value.

Search for this specific information

Cloned ☐

Crystallized ☐

Protein Variants ☐

Purified ☐

Renatured ☐

PDB entry ☐

Refine your search

Application:

Nothing selected ▾

Cofactor:

Nothing selected ▾

Localization:

Nothing selected ▾

Metals / Ions:

Nothing selected ▾

Organic Solvent Stability against:

Nothing selected ▾

Source Tissue:

Nothing selected ▾

The „Advanced Search“ allows you to combine 20 different query criteria.

Advanced Search

Organism:

(synonyms, domain, kingdom, phylum, class or order)

exact

(e.g. eukarya, animals, chordata or primates)

Search for sepecific enzyme or organism

EC Number:

exact

3.4

use * as a wildcard

Enzyme Name:

exact

Search in text fields

1.

Choose a subitem

exact

Search in numeric fields

1.

pH Optimum

<

6

Search tip: If you search a value between two limits write 'min-max' and choose between. Whereby min is the minimum value and max the maximum value.

Search for this specific information

Cloned

☐

Crystallized

☒

Protein Variants

☒

Purified

☐

Renatured

☐

PDB entry

☒

Enter your search criteria and click the corresponding checkbox

Refine your search

Application:

Nothing selected

Cofactor:

Nothing selected

Localization:

Nothing selected

Metals / Ions:

Nothing selected

Organic Solvent Stability against:

Nothing selected

Source Tissue:

Nothing selected

Advanced Search results

New advanced search
Adapt search

Results 1 - 10 of 58

tripeptidyl-peptidase I
(EC 3.4.14.1) from *Homo sapiens*

pH Optimum Minimum	pH Optimum Maximum	Commentary	Reference
5.5		assay at	707715

Crystallization (Commentary)	Reference
molecular docking of substrate beta-(2-thienyl)Ala-beta-(7-methoxycoumarin-4-yl)Ala-Ser-Gly-Tyr(3-NO2). The interactions between the amino-terminal group of the substrate and the Asp1 and Gly277 of Cat C are responsible for the substrate N-terminus docking and are crucial for proteolytic activity	752592

Protein Variants	Commentary	Reference
additional information	a recombinant form of cathepsin C lacking its exclusion domain is a monomer with endoprotease activity and affinity for hydrophobic residues such as Phe, Leu or Pro, but not Val, in the P2 position	755315
R272P	missense mutation found in patients affected with classical features of Papillon-Lefevre syndrome	708279

tripeptidyl-peptidase I
(EC 3.4.14.9) from *Homo sapiens*

pH Optimum Minimum	pH Optimum Maximum	Commentary	Reference
3		endopeptidase	755266
3.5		assay at	708664
4			665428
4.5	5	hydrolysis of Ala-Ala-beta-(7-methoxycoumarin-4-yl)-L-phenylalanine	647185
5		N-terminal tripeptide	755266
5	5.5	hydrolysis of Ala-Ala-beta-(7-methoxycoumarin-4-yl)-L-phenylalanine	647181

Crystallization (Commentary)	Reference
deglycosylated inactive proenzyme pro-TPP1, hanging drop vapour diffusion	698964
fully-glycosylated TPP1 precursor, hanging drop vapour diffusion	698963

Protein Variants	Commentary	Reference
C365R	decreased activity	678513
C365R	protein processing different from wild-type, mutant is not localized in lysosomes, intracellular trafficking	708664
D165A	inactive mutant	665428
D276A	kcat/Km is 21% of the wild-type value	664950
D327A	kcat/Km is 6% of the wild-type value	664950

The result page displays all enzymes which meet the search criteria.

directly linked to the Enzyme Summary Page

directly linked to the detailed reference information

Contribute to BRENDA! Your enzyme data is important for BRENDA. Send us your paper, and we will do all the work to include your data into our database. [More...](#)

Please enter a search term

Enzyme, Ligand contains

[add search field](#) [delete search field](#) [start search](#)

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NEW Release online! - February 1, 2021
Release 2021.1 online including 76 new and 623 updated enzyme classes.



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 [Information](#)

The topic „Enzyme & Disease“ provides searches for disease-related enzyme information.

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Please enter a search term

Enzyme, Ligandcontains

add search fielddelete search fieldstart search

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You can either search
DRENDA or the **MeSH**
Ontology

Search Disease/ Diagnostics

Disease/ Diagnostics
contains
show 10 results

Refine your search

Recommended Name: ☒ contains

EC Number: contains

PubMed ID: ☒ contains

Title of Publication: ☒ contains

Category: ☒ contains

Confidence Level: ☒ =

search

DRENDA provides searches for disease-related enzyme information based on text mining methods.

Enter the disease-related term

☒ Diseases and/or Diagnostics which are related to enzyme classes

Please choose one of the four different Confidence Levels:

Confidence Level 1: Precision > 75%, Accuracy > 70%
Confidence Level 2: Precision > 77%, Accuracy > 70%
Confidence Level 3: Precision > 85%, Accuracy > 80%
Confidence Level 4: Precision > 95%, Accuracy > 80%

DRENDA (Disease Related ENzyme information DAtabase) [1]

DRENDA is a new supplement to BRENDA providing disease-related enzyme information on the absence or malfunction of enzymes which have a major influence on the metabolism, regulation, and immunity etc. causing severe diseases. The development of DRENDA focuses on the automatic search of enzyme-disease relations from titles and abstracts of the PubMed database [2] and its classification. This approach is based on a text-mining method, supported by:

- BRENDA vocabularies (~100 000 items)
- EC numbers
- Enzyme names (including synonyms)
- MeSH terms for diseases and metabolic disorders from the NCBI database (~23 500 terms)

This approach resulted in 0.9 million enzyme-disease combinations extracted from the literature. Further on the enzyme-disease relations are classified into four categories using machine learning methods via Support Vector Machines [3]:

- causal interaction: if the absence or the malfunction of an enzyme causes a disease
- therapeutic application: the therapeutic usage of an enzyme as drug target or therapeutic agent is described
- diagnostic usage: the enzyme is used for a diagnostic approach/analysis tests or the malfunction of an enzyme is detected to diagnose a disease
- ongoing research: the research about the enzyme-disease relation is still in progress

Search Disease/ Diagnostics

Disease/ Diagnostics: contains show results

Refine your search

Recommended Name: ☒ contains

EC Number: contains

PubMed ID: ☒ contains

Title of Publication: ☒ contains

Category: ☒ contains

Confidence Level: ☒ -

search

DRENDA provides searches for disease-related enzyme information based on text mining methods.

You can refine search by choosing one of the four categories:

- therapeutic application
- ongoing research
- diagnostic usage
- causal interaction

☒ Diseases and/or Diagnostics which are related to enzyme classes

Please choose one of the four different Confidence Levels:

Confidence Level 1: Precision > 75%, Accuracy > 70%
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- ongoing research: the research about the enzyme-disease relation is still in progress

Search Disease/ Diagnostics

Disease/ Diagnostics: contains show results

Refine your search

Recommended Name: ☒ contains

EC Number: contains

PubMed ID: ☒ contains

Title of Publication: ☒ contains


Category: ☒ diagnostic usage contains

Confidence Level: ☒ =

search

DRENDA provides searches for disease-related enzyme information based on text mining methods.

You can further refine your search by entering the Confidence Level

 Diseases and/or Diagnostics which are related to enzyme classes

Please choose one of the four different **Confidence Levels**:

Confidence Level 1: Precision > 75%, Accuracy > 70%

Confidence Level 2: Precision > 77%, Accuracy > 70%

Confidence Level 3: Precision > 85%, Accuracy > 80%

Confidence Level 4: Precision > 95%, Accuracy > 80%

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- diagnostic usage: the enzyme is used for a diagnostic approach/analysis tests or the malfunction of an enzyme is detected to diagnose a disease
- ongoing research: the research about the enzyme-disease relation is still in progress

Search Disease/ Diagnostics

☐ Refine search

Disease/ Diagnostics
Alzheimer
contains
show
10
results

Refine your search

Recommended Name:
☒

contains

EC Number:
contains

PubMed ID:
☒

contains

Title of Publication:
☒

contains

Category:
☒
diagnostic usage
contains

Confidence Level:
☒
4
=






















Search

This page shows the results of the DRENDA text mining procedure, containing the relevant references, with the chosen category and confidence level, including the enzyme information in BRENDA.

Search term: Alzheimer


Enzyme Summary Page
473
>>>
CSV
its as CSV

Link to PubMed

EC Number ▼▲	Recommended Name ▼▲	Disease ▼▲	PubMed ID ▼▲	Title of Publication ▼▲	Category	Confidence Level
   1.1.1.1	alcohol dehydrogenase	Alzheimer Disease	27808372	Role of ADH1B rs1229984 and ALDH2 rs671 gene polymorphisms in the development of Alzheimer's disease.	diagnostic usage	4
   1.1.1.178	3-hydroxy-2-methylbutyryl-CoA dehydrogenase	Alzheimer Disease	19756307	Enhanced levels of mitochondrial enzyme 17beta-hydroxysteroid dehydrogenase type 10 in patients with Alzheimer disease and multiple sclerosis.	diagnostic usage	4
   1.1.1.27	L-lactate dehydrogenase	Alzheimer Disease	10443553	Activities of key glycolytic enzymes in the brains of patients with Alzheimer's disease.	diagnostic usage	4
   1.1.1.27	L-lactate dehydrogenase	Alzheimer Disease	20866111	Codon 129 polymorphism specific cerebrospinal fluid proteome pattern in sporadic creutzfeldt-jakob disease and the implication of glycolytic enzymes in prion-induced pathology.	diagnostic usage	4
   1.1.1.27	L-lactate dehydrogenase	Alzheimer Disease	28534431	Ameliorating effect of anti-Alzheimer's drugs on the bidirectional association between type 2 diabetes mellitus and Alzheimer's disease.	diagnostic usage	4
   1.1.1.49	glucose-6-phosphate dehydrogenase (NADP+)	Alzheimer Disease	10443553	Activities of key glycolytic enzymes in the brains of patients with Alzheimer's disease.	diagnostic usage	4
   1.1.1.49	glucose-6-phosphate dehydrogenase (NADP+)	Alzheimer Disease	27378307	Glucose-6-phosphate dehydrogenase a novel hope on a blood-based diagnosis of Alzheimer's disease.	diagnostic usage	4

Ontology explorer

MeSH (Medical Subject Headings) is the controlled vocabulary thesaurus for PubMed

 **Medical Subject Headings (MeSH)**

Change ontology:

Medical Subject Headings (MeSH)

Version 2020-01-01

Term or Synonym:

contains

use AND (NOT) or OR

Definition:

contains

use AND (NOT) or OR

EC Number:

contains

use AND (NOT) or OR

Title:

contains

use AND (NOT) or OR

Category:

☒ causal interaction

☐ diagnostic usage

☐ ongoing research

☐ therapeutic application

Confidence Level:

☒ 4

☐ 3

☐ 2

☐ 1

Id:

contains

restrict to BRENDA links:

Localization

☐

Ligand

☐

Tissue

☐

search

Details for Diseases

Medical Subject Headings (MeSH) ID


MESH:C


MESH:C is linked to 2764 enzymes:


1.1.1.1


Show enzyme

Legend


 is an element of the parent element


 is a part of the parent element


 is related to the parent element


 derives from the parent element

Categories:

 Causal interaction

 Diagnostic usage

 Ongoing research

 Therapeutic application

Condensed Tree View

Tree view

MESH

Diseases

MESH

Analytical, Diagnostic and Therapeutic Techniques and Equipment

Anatomy

Chemicals and Drugs

Diseases

Phenomena and Processes

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UPDATE!

Ontology explorer


Medical Subject Headings (MeSH)

Change ontology: Medical Subject Headings (MeSH) Version 2020-01-01

Term or Synonym: contains pancreatitis use AND (NOT) or OR

Definition: contains use AND (NOT) or OR

EC Number: contains use AND (NOT) or OR

Title: contains use AND (NOT) or OR

Category: ☒ causal interaction ☐ diagnostic usage ☐ ongoing research ☐ therapeutic application

Confidence Level: ☒ 4 ☐ 3 ☐ 2 ☐ 1

Id: contains

Enter the search term or an EC number

restrict to BRENDA links:

Localization ☐
 Ligand ☐
 Tissue ☐

search

Details for Diseases

Medical Subject Headings (MeSH) ID

MESH:C

MESH:C is linked to 2784 enzymes:

1.1.1.1

Show enzyme

Legend

ⓘ is an element of the parent element
 ⓘ is a part of the parent element
 ⓘ is related to the parent element
 ⓘ derives from the parent element

Categories:

☒ Causal interaction
☐ Diagnostic usage
☐ Ongoing research
☐ Therapeutic application

Condensed Tree View Tree view

MESH

- Diseases ⓘ

MESH ⓘ

- Analytical, Diagnostic and Therapeutic Techniques and Equipment ⓘ
- Anatomy ⓘ
- Chemicals and Drugs ⓘ
- Diseases ⓘ ⓘ ⓘ ⓘ ⓘ
- Phenomena and Processes ⓘ

Ontology explorer

Medical Subject Headings (MeSH)

Change ontology: Medical Subject Headings (MeSH) Version 2020-01-01

Term or Synonym: exact pancreatitis use AND (NOT) or OR

Definition: contains use AND (NOT) or OR

EC Number: contains use AND (NOT) or OR

Title: contains use AND (NOT) or OR

Category: ☒ causal interaction ☐ diagnostic usage ☐ ongoing research ☐ therapeutic application

Confidence Level: ☒ 4 ☐ 3 ☐ 2 ☐ 1

Id: contains

restrict to BRENDA links:

Localization ☐

Ligand ☐

Tissue ☐

On the result page you find the details of the corresponding MeSH terms ...

Details for Pancreatitis

Medical Subject Headings (MeSH) ID
MESH: C.06.689.750

MESH: C.06.689.750 is linked to 370 enzymes:

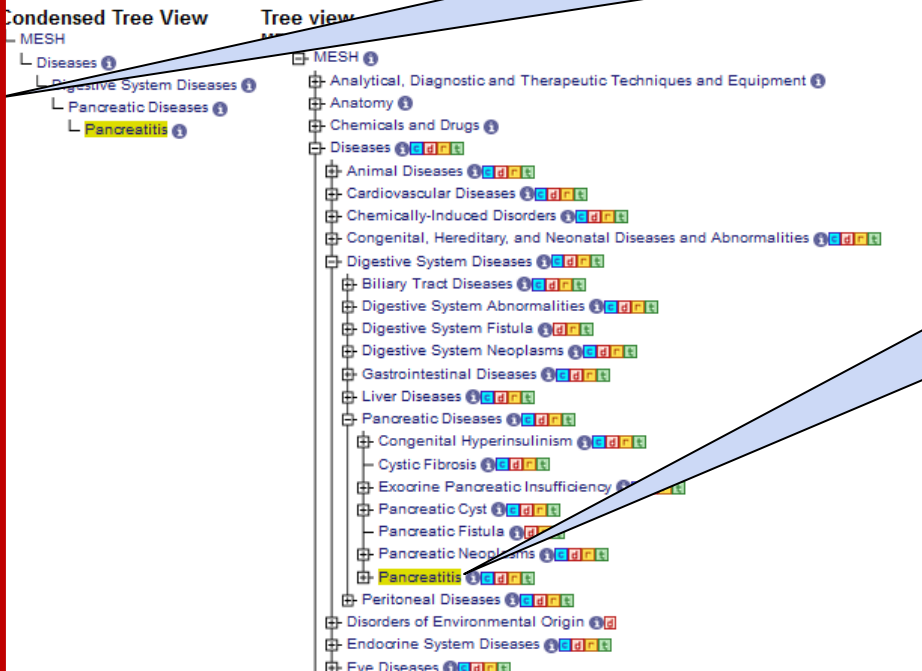
1.1.1.1

Definition

INFLAMMATION of the PANCREAS. Pancreatitis is classified as acute unless there are computed tomographic or endoscopic retrograde cholangiopancreatographic findings of CHRONIC PANCREATITIS (International Symposium on Acute Pancreatitis, Atlanta, 1992). The two most common forms of acute pancreatitis are ALCOHOLIC PANCREATITIS and gallstone pancreatitis.

Synonyms

1. Pancreatitis
2. Acute Edematous Pancreatitis
3. Acute Pancreatitis
4. Pancreatic Parenchyma with Edema
5. Pancreatic Parenchymal Edema
6. Pancreatitis, Acute
7. Pancreatitis, Acute Edematous
8. Peripancreatic Fat Necrosis
9. Acute Edematous Pancreatitides
10. Acute Pancreatitides
11. Edema, Pancreatic Parenchymal
12. Edematous Pancreatitides, Acute
13. Edematous Pancreatitis, Acute
14. Fat Necrosis, Peripancreatic
15. Necrosis, Peripancreatic Fat



...and the position in the MeSH ontology, including the definition.

Details for Pancreatitis

Medical Subject Headings (MeSH) ID
 MESH:C.06.689.750

MESH:C.06.689.750 is linked to 370 enzymes:

1.1.1.1

Show enzyme

Definition

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8. Peripancreatic Fat Necrosis
9. Acute Edematous Pancreatitides
10. Acute Pancreatitides
11. Edema, Pancreatic Parenchymal
12. Edematous Pancreatitides, Acute
13. Edematous Pancreatitis, Acute
14. Fat Necrosis, Peripancreatic
15. Necrosis, Peripancreatic Fat
16. Pancreatic Parenchymal Edemas
17. Pancreatitides, Acute
18. Pancreatitides, Acute Edematous
19. Parenchymal Edema, Pancreatic
20. Peripancreatic Fat Necroses

References

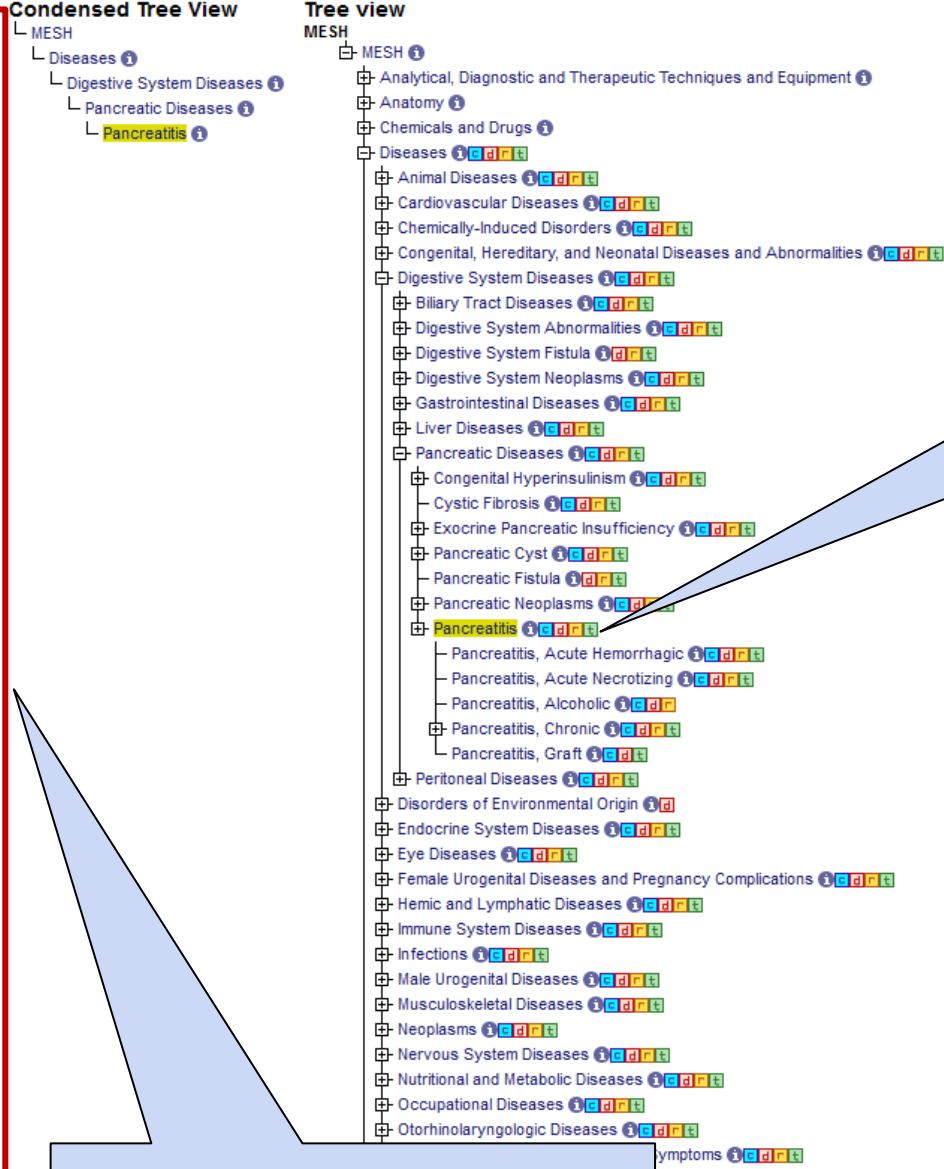
1. MESH: C.06.689.750

Legend

- I** is an element of the parent element
- P** is a part of the parent element
- R** is related to the parent element
- D** derives from the parent element

Categories:

- C** Causal interaction
- D** Diagnostic usage
- R** Ongoing research
- T** Therapeutic application



...and the position of the disease within Tree View of the MeSH ontology...

In the box you find further details about the disease, the MeSH-IDs, direct links, synonyms...

Details for Pancreatitis

Medical Subject Headings (MeSH) ID
MESH:C.06.689.750
MESH:C.06.689.750 is linked to 370 enzymes:
1.1.1.1
1.1.1.118
1.1.1.204
1.1.1.27
1.1.1.28
1.1.1.284
1.1.1.34
1.1.1.37
1.1.1.49
1.1.1.6
1.1.1.9
1.1.3.22
1.1.5.3
1.11.1.24
1.11.1.6
1.11.1.7
1.11.1.9
1.11.2.2
1.13.1.12
1.13.1.4

Legend
I is an enzyme of the parent element
D is a parent element
R is related to parent element
+ derives from parent element
Categories
C Causal
D Diagnostic

...and links to the corresponding enzymes in BRENDA

Condensed Tree View

- MESH
 - Diseases
 - Digestive System Diseases
 - Pancreatic Diseases
 - Pancreatitis

Tree View

- MESH
 - Analytical, Diagnostic and Therapeutic Techniques and Equipment
 - Anatomy
 - Chemicals and Drugs
 - Diseases
 - Animal Diseases
 - Cardiovascular Diseases
 - Chemically-Induced Disorders
 - Congenital, Hereditary, and Neonatal Diseases and Abnormalities
 - Digestive System Diseases
 - Biliary Tract Diseases
 - Digestive System Abnormalities
 - Digestive System Fistula
 - Digestive System Neoplasms
 - Gastrointestinal Diseases
 - Liver Diseases
 - Pancreatic Diseases
 - Congenital Hyperinsulinism
 - Cystic Fibrosis
 - Exocrine Pancreatic Insufficiency
 - Pancreatic Cyst
 - Pancreatic Fistula
 - Pancreatic Neoplasms
 - Pancreatitis
 - Pancreatitis, Acute Hemorrhagic
 - Pancreatitis, Acute Necrotizing
 - Pancreatitis, Alcoholic
 - Pancreatitis, Chronic
 - Pancreatitis, Graft
 - Peritoneal Diseases
 - Disorders of Environmental Origin
 - Endocrine System Diseases
 - Eye Diseases
 - Female Urogenital Diseases and Pregnancy Complications
 - Hemic and Lymphatic Diseases
 - Immune System Diseases
 - Infections
 - Male Urogenital Diseases
 - Musculoskeletal Diseases
 - Neoplasms
 - Nervous System Diseases
 - Nutritional and Metabolic Diseases
 - Occupational Diseases
 - Otorhinolaryngologic Diseases
 - Pathological Conditions, Signs and Symptoms
 - Respiratory Tract Diseases
 - Skin and Connective Tissue Diseases
 - Stomatognathic Diseases
 - Wounds and Injuries
 - Phenomena and Processes

You can browse along the tree to get further information