

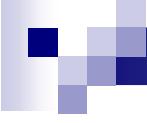
Text Mining for Health Care and Medicine

Sophia Ananiadou
Director
National Centre for Text Mining
www.nactem.ac.uk

The Need for Text Mining

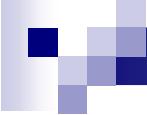
- MEDLINE
 - 2005: ~14M
 - 2009: ~18M
- Overwhelming information in textual, unstructured format
- Full papers, reports, grey literature (notes, lab records, discharge summaries)
- "About a quarter of late stage failures we surveyed could have been eliminated 2 years earlier by making all internal information in documents more widely available."

Top 5 Pharma senior VP



The problem with information overload

- Humans cannot easily:
 - Keep up-to-date with all relevant literature
 - Find relevant and precise information
 - Synthesize information from many diverse sources
 - Exploit the mass of information to generate hypotheses
 - Discover new knowledge



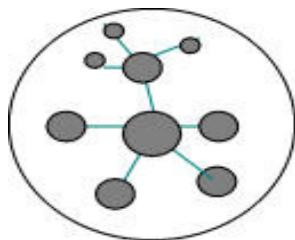
What can Text Mining do for you?

- Helps with information overload and overlook
- Discovers unsuspected links from the huge amount of literature and supports medical research
- Integrates knowledge from many sources
- Enhances clinical decision support systems
- Supports translational medicine
- Reduces costs and errors in handling information

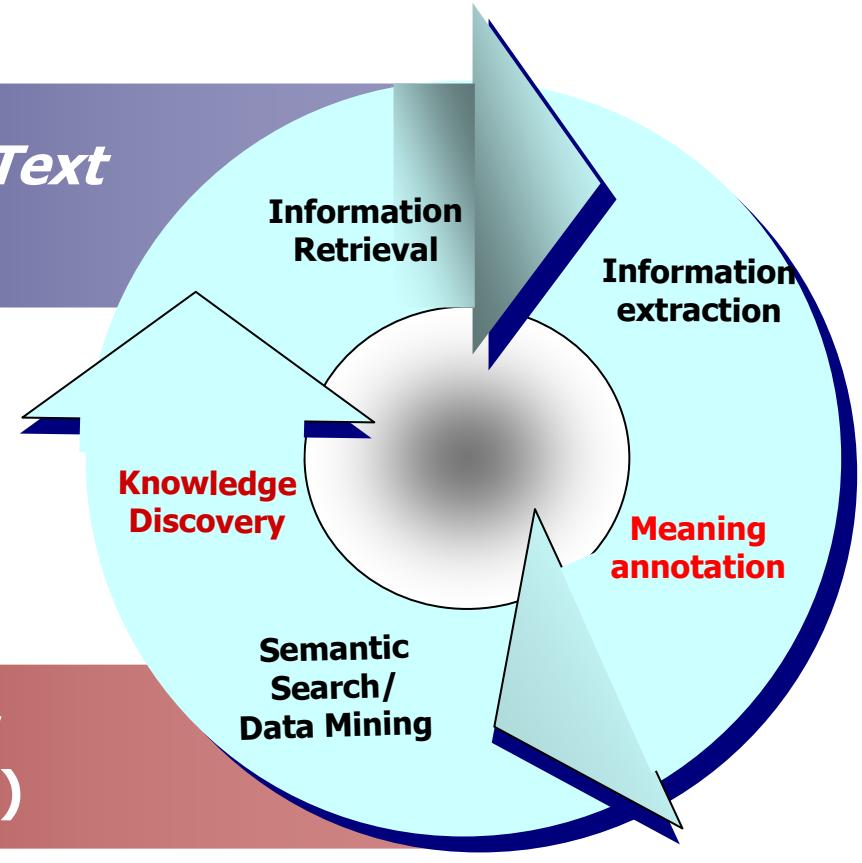
From Text to Knowledge



Unstructured Text
(implicit knowledge)



Structured content
(explicit knowledge)





National Centre for Text Mining

- 1st national text mining centre in the world
www.nactem.ac.uk
- **Location:** Manchester Interdisciplinary Biocentre (MIB) www.mib.ac.uk
- **Remit:** **Provision of text mining services to support UK research**
- **Funded by:** the JISC, BBSRC, EPSRC
- **Domains:** Biology, Medicine, Social Sciences

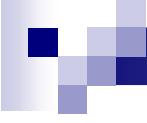


How Text Mining can Support Medical Research

- Mines textual data (literature, admission notes, reports, summaries)
- Adds meaning to data → semantic metadata
- Yields precise knowledge nuggets from the sea of information → **Information Extraction**
- Supports not just medical research but also:
 - Clinicians in their care

Applications

- Gene-disease associations
- Disease-disease associations
 - Inferring relationships
 - Showing the evidence from literature
- Toxicity prediction
 - Discovery of promising drug targets for clinical trials
- Facilitates translational research into causes and treatment of diseases
- Clinical trials (collaborative project BRC-NaCTeM)



Text mining supports hypothesis generation

- Data driven methods complementing human hypothesis generation
- Rapid mining of candidate hypotheses from text, validated against experimental data
 - Migraine and magnesium deficiency
 - Indomethacin and Alzheimer's disease
 - Using thalidomide for treating a series of diseases such as acute pancreatitis and chronic hepatitis C
 - *Curcuma longa* and retinal diseases



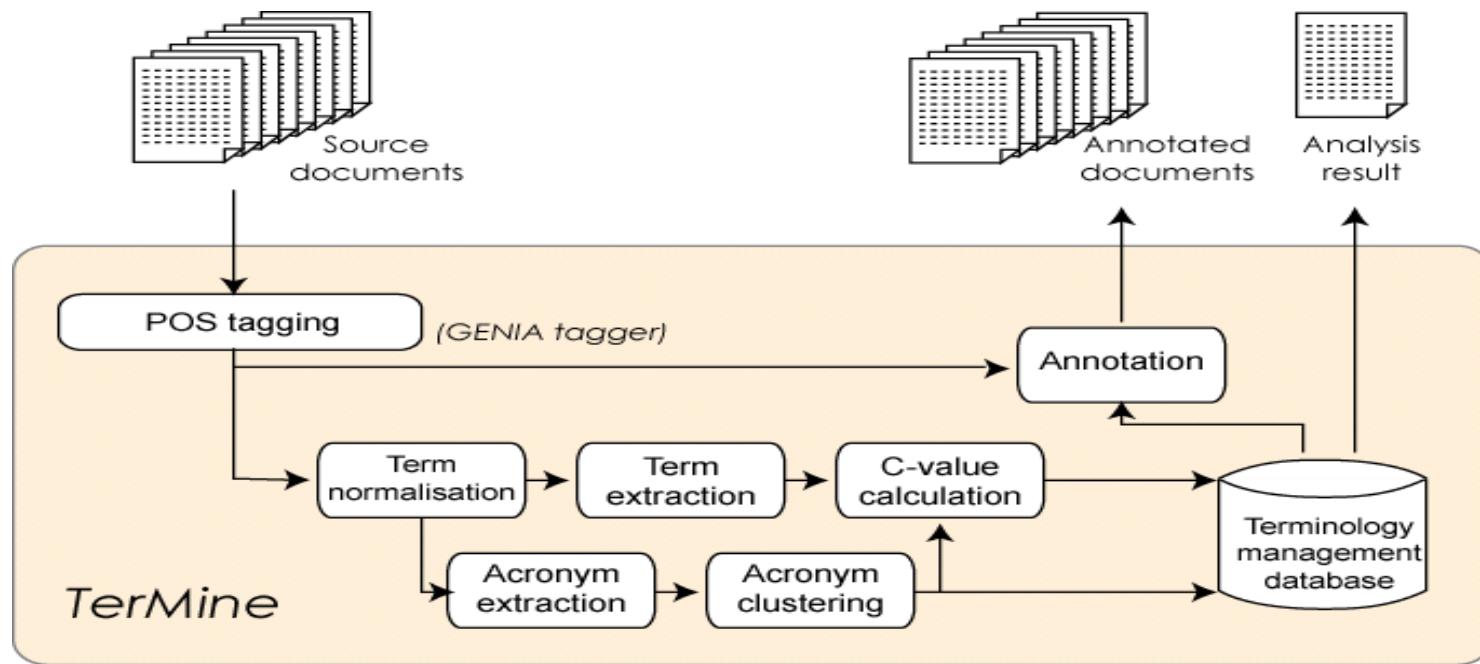
Translational Medicine

- Biomedical text mining customised for different users and needs
- Linking with “omics” data
- Supporting clinician and researcher in decision making through literature

Text Mining Systems @ NaCTeM

- **TerMine**
 - Automatic extraction of important concepts from text
- **AcroMine**
 - Acronym disambiguation and lookup
- **FACTA**
 - association mining from MEDLINE, direct and indirect
- **ASSERT**
 - aids systematic reviews, summarisation
- **KLEIO**
 - searching using semantic types and several facets
- **MEDIE**
 - searching using relations and semantic templates

TerMine





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http://www.nactem.ac.uk/software/termine/cgi-bin/termine_cvalue.cgi

Google



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TerMine (C-value) analysis

Found 1163 terms in 2.6 seconds - all terms ([in table](#)) ([in text](#)) - threshold:

Homologous desensitization of beta2-adrenergic receptors has been shown to be mediated by phosphorylation of the agonist-stimulated receptor by G-protein-coupled receptor kinase 2 (GRK2) followed by binding of beta-arrestins to the phosphorylated receptor. Binding of beta-arrestin to the receptor is a prerequisite for subsequent receptor desensitization , internalization via clathrin-coated pits , and the initiation of alternative signaling pathways. In this study we have investigated the interactions between receptors and beta-arrestin2 in living cells using fluorescence resonance energy transfer. We show that (a) the initial kinetics of beta-arrestin2 binding to the receptor is limited by the kinetics of GRK2-mediated receptor phosphorylation ; (b) repeated stimulation leads to the accumulation of GRK2-phosphorylated receptor , which can bind beta-arrestin2 very rapidly ; and (c) the interaction of beta-arrestin2 with the receptor depends on the activation of the receptor by agonist because agonist withdrawal leads to swift dissociation of the receptor-beta-arrestin2 complex. This fast agonist-controlled association and dissociation of beta-arrestins from prephosphorylated receptors should permit rapid control of receptor sensitivity in repeatedly stimulated cells such as neurons.

The beta2-adrenergic receptor (beta2-AR) belongs to the group of G-protein-coupled receptors and is present on skeletal and cardiac muscle cells and on lymphocytes. The gene encoding beta2-AR (ADRB2) displays a high level of polymorphism and sequence heterogeneity in the human population and the distributions of single-nucleotide polymorphisms (SNPs) at amino acid positions 16, 27, 30, 31, 35, 40, 42, 45, 50, 52, 54, 55, 56, 57, 58, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 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http://www.nactem.ac.uk - Term List - Mozilla Firefox

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Rank	Term	Score
1	beta2-adrenergic receptor	68.25
2	blood pressure	16.75
3	beta2-adrenergic receptor gene	11.6797
4	odd ratio	10
5	protein kinase	9.599999
6	single nucleotide polymorphism	9.509775
7	adrenergic receptor	9.142857
8	gly16 allele	8
8	a549 cell	8
10	body mass index	7.924812
10	cystic fibrosis patient	7.924812
12	cystic fibrosis	7.428571
13	metabolic syndrome	7
13	confidence interval	7
15	bioluminescence resonance energy transfer	6.8
16	blood flow response	6.424812
17	gene polymorphism	6.4
19	diastolic blood pressure	6.22095

Done Done

mine_cvalue.cgi#

Apply

...n to be mediated by phosphorylation of the agonist-stimulated binding of beta-arrestins to the phosphorylated receptor. Binding of sensitization , internalization via clathrin-coated pits , and the initiation ...ractions between receptors and beta-arrestin2 in living cells using ...cs of beta-arrestin2 binding to the receptor is limited by the kinetics of ...s to the accumulation of GRK2-phosphorylated receptor , which can ...with the receptor depends on the activation of the receptor by agonist ...-arrestin2 complex. This fast agonist-controlled association and ...mit rapid control of receptor sensitivity in repeatedly stimulated cells ...

...ein-coupled receptors and is present on skeletal and cardiac muscle ...s a moderate degree of heterogeneity in the human population and ...d positions 16 , 27 , and 164 are changed in asthma , obesity , and ...ement of the beta2-AR has also been suggested in human rheumatoid ...ience of the alleles Arg16 and Gln27 and a lower prevalence of ...genotype combination ClnCln16 ClnCln27 had higher levels of ...

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the national centre for text mining

Acromine Acronym Dictionary Demonstration - Mozilla Firefox

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The National Centre for Text Mining

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After using this service, please complete a [questionnaire](#).

Enter an acronym in "Acronym" field to search its expanded forms. Alternatively, enter an expanded form in "Fullform" field to search its acronyms.

Acronym:

Fullform:

Found 41 definitions

Acronym	Full-form	Freq	Score
CPR	cardiopulmonary resuscitation	1505	1467.1
CPR	computer-based patient record	57	55.8
CPR	c-peptide immunoreactivity	52	46.8
CPR	cefprome	38	36.6
CPR	nadph-cytochrome p450 reductase	34	32.6
CPR	receptor	28	15.8
CPR	contraceptive prevalence rate	27	25.4
CPR	computerized patient record	20	19.0
CPR	cardio-pulmonary resuscitation	19	17.9
CPR	c-peptide reactivity	10	8.8

Done

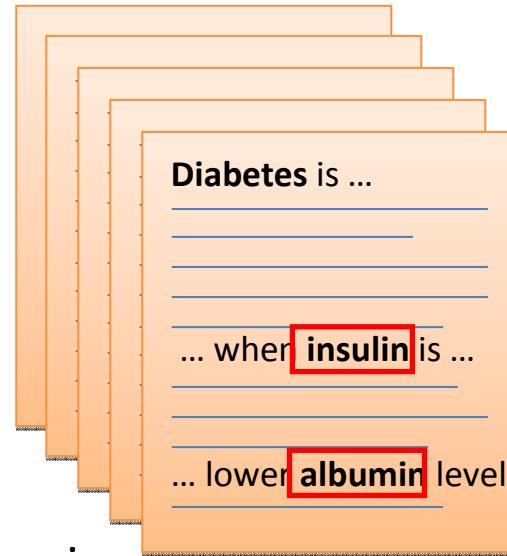
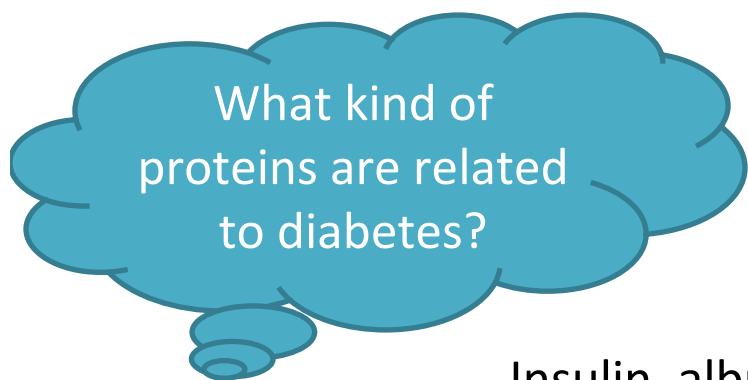
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<http://www.nactem.ac.uk/software/acromine/>

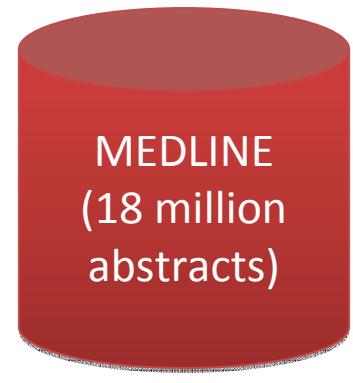
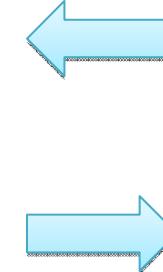
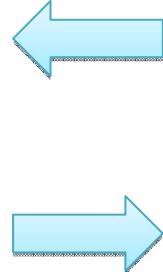
FACTA

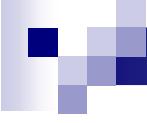
- FACTA: Finds Associated Concepts with Text Analysis
 - What diseases are related to a particular chemical?
- FACTA+: finds indirect associations between concepts
- Quick and interactive, classifies documents based on associations, provides indirect associations

Retrieving related concepts



216,000 documents
relevant to diabetes





ASSERT – aiding systematic reviews

- Goes beyond your average search engine
- Concept detection and highlighting to improve navigation
- Features include: document clustering, summarisation, user document management (MySystematicReview)

Assisting Systematic Reviews

■ Searching

- Query expansion, document clustering

■ Screening

- Document classification, sectioning

■ Synthesising

Home Set Manager

Cluster results for: 'diabetes'

All Documents (200) | Exp | Summ

Insulin Glargine (24) | Exp | Summ

Diabetes Mellitus Type

Diabetes Mellitus (21) | Exp | Summ

Type And Type Diabetes (20) | Exp | Summ

For Diabetic Retinopathy In (12) | Exp | Summ

Metabolic Syndrome Group

Patients (11) | Exp | Summ

For Renal (12) | Exp | Summ

For Blood Pressure (13) | Exp | Summ

After Myocardial Infarction (11) | Exp | Summ

For Creatinine (6) | Exp | Summ

Management For (9) | Exp | Summ

Mark as Viewed ▾ Diabetes - Treatments ▾ Commit changes

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- [VE] [The Diabetes Prevention Program and the metabolic syndrome.](#) - 16204171
- [V?] [The Diabetes Prevention Program and the metabolic syndrome.](#) - 16204173
- [V?] [Stepping up care for diabetic foot ulcers.](#) - 16205268
- [VI] [\[Contribution of apoptosis to pathogenesis of type 1 diabetes\]](#) - 16209240
- [V?] [\[Type 2 diabetes with alcohol abuse\]](#) - 16245450

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Summary of: After Myocardial Infarction

Documents Processed: 11

- We used extended Cox hazards analysis to identify independent correlates of posttransplantation de novo CHF (adjusted hazard ratio [AHR] , 95 % confidence interval [CI]) and examine de novo CHF as a predictor of death and graft loss after transplantation .
- 301 patients in the pioglitazone group and 358 in the placebo group reached this endpoint (0.84 , 0.72-0.98 , p=0.027) .
- Higher levels of myocardial 8-isoprostone (8-iso PGF (2alpha)) , oxidized glutathione (GSSG) , as well as greater upregulation of superoxide dismutase (SOD) and catalase (CAT) protein expression paralleled by increases in enzymatic activity was observed in the diabetic MI animals , indicating higher oxidative stress .
- Twenty minutes after treatment with sublingual nitroglycerin and short-acting oral antihypertensive agent , blood pressure had dropped from 201/91 mm Hg to 158/68 mm Hg , followed by abrupt onset of weakness in lower limbs , urinary retention and sensory loss in bilateral T4-L1 levels and the left lower limb at two hours after treatment .
- Advanced age and longer time on HD are factors related to LEA in non-diabetics .
- No association was found between the SPECT result and systolic function and left ventricular hypertrophy , however .
- INTERPRETATION : Pioglitazone reduces the composite of all-cause mortality , non-fatal myocardial infarction , and stroke in patients with type 2 diabetes who have a high risk of macrovascular events .
- Antagonism of aldosterone receptors with spironolactone benefits patients with severe heart failure , and eplerenone benefits those after myocardial infarction who have left ventricular dysfunction .
- Risk factors for de novo CHF included older recipient age , female sex , unemployed status at transplantation , pretransplantation comorbidities (anemia , diabetes mellitus , myocardial infarction , angina , cardiac arrhythmia , and peripheral vascular disease) , transplant from older donors , donor cardiovascular death , and delayed graft function .
- These clinical manifestations and laboratory findings suggested catastrophic antiphospholipid antibody syndrome .

Semantic search

- Specialised biomedical named entities, e.g. protein, gene...
- Linked to external knowledge sources
- Allows typed searching
- Normalises terms to include acronyms, synonyms and variants
- Faceted browsing



New Query
NaCTeM Services
Termine
Acromine
Cheshire/Termine
Medie
Info-Pubmed

Query: PROTEIN:IL-1 AND ORGAN:brain AND AUTHOR:'Rothwell NJ'

PubMedID: 15749024

Title: The interleukin-1-related cytokine IL-1 β is expressed in glial cells, but fails to induce IL-1 β signalling responses.

Abstract:
The putative new interleukin (IL)-1 family member IL-1 β (IL-1 α , IL-1 β) has been shown recently to activate mitogen activated protein kinases (MAPKs), extracellular signal-regulated MAP kinases (ERK1/2) and c-Jun N-terminal kinase (JNK), and nuclear factor kappa B (NF- κ B) via a mechanism that requires IL-1 β mRNA expression in cell lines. The aim of this study was to test the hypothesis that IL-1 β contributes to brain inflammation and injury, by studying its expression and actions in different cell types of the mouse brain in culture. Messenger RNA for IL-1 β was detected in neurons and glia (microglial cells, oligodendrocytes, progenitor cells) and to a lesser extent astrocytes) by RT-PCR. Bacterial lipopolysaccharide (LPS) had no effect on IL-1 β mRNA levels in mixed glial cultures. Recombinant mouse IL-1 β induced strong activation of ERK1/2, JNK, NF- κ B and NF-kappa B, and significant release of IL-6 and IL-8, which was blocked by LPS. In contrast, recombinant mouse IL-1 α did not influence any of these parameters. These results demonstrate that CNS cells may be a source of IL-1 β , but the failure of IL-1 β to modulate IL-1 β mRNA expression, and of recombinant IL-1 β to induce any of the classical IL-1 β responses, suggest that this cytokine has restricted activities in the brain, or that it may act via alternative pathways(s).

Legend:
PROTEIN METABOLITE ORGAN SYMPTOM or DISEASE
PHENOMON PROCEDURE INDICATOR
Acronym other

Journal: Cytokine 2005 Mar;29(6):245-50

Author(s): Wang P, Meinhardt B, Andre R, Renshaw BR, Kimber I, Rothwell NJ, Pinteaux E

Mesh Heading(s): Animals, Brain, Brain -- cytology, Brain -- metabolism, Cells, Cultured, Dinoprostone, Dinoprostone -- biosynthesis, Extracellular Signal-Regulated MAP Kinases, Extracellular Signal-Regulated MAP Kinases -- metabolism, Gene Expression, Show/Hide the rest

Acronym(s): CNS, ERK1, IL, JNK, LPS, MAPKs, mRNA, NFkappa B, PCR, PGE2, RNA, RT

NE form: JNK, c-Jun N-terminal kinase

NE type: PROTEIN

Accession Number: Q502A0, Q7TSJ7, Q966Y3

NE form: lipopolysaccharide, LPS

NE type: METABOLITE

ID Number: KEGG:CO0338[toDB]

NE form: LPS, lipopolysaccharide

NE type: GENE:PROTEIN

Accession Number: P31858

NE form: MAPKs, mitogen activated protein kinases

NE type: GENE:PROTEIN

Accession Number: Q42781, Q94737, P26696, P32485, P63085, Q00859, Q09892, Q1E6U8, Q1KTF2, Q1L5Z8, Show/Hide the rest

NE form: mitogen

NE type: PROTEIN

Accession Number: Q8L3E1, Q8LTG6

NE form: NFkappa B, nuclear factor-kappa B

NE type: GENE:PROTEIN

Accession Number: P25799, Q63369

NE form: p38

NE type: PROTEIN

Accession Number: Q95433, Q97628, P07825, P82869, Q01552, Q5U421, Q6P3F2, Q8IEV6, Q90336, Q94MT1, Q906X7, Q9Y257

NE form: PGE2, prostaglandin E2

NE type: PROTEIN

Accession Number: Q87645, Q95P10, Q9JE16

NE form: protein kinases

NE type: PROTEIN

Accession Number: P95335, Q05356, Q05357, Q6AZ63, Q6S9W6, Q84RC1, Q9LCH5, Q9LCH6, Q9LCH7, Q9LCH8, Q9LCI9, Q9LCI0, Q9LCI2, Q9LCI3, Q9LCI4, Q9LCI5, Q9LCI6, Q9XE15

NE form: RNA

NE type: METABOLITE

ID Number: ChEBI:33697[toDB]

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[DISEASE\(14600+\)](#)

[SYMPTOM\(200+\)](#)
[ORGAN\(25700+\)](#)
[DIAG PROC\(3600+\)](#)
[THERAPEUTIC PROC\(4200+\)](#)
[GENERAL PHENOM\(600+\)](#)

[HUMAN PHENOM\(30+\)](#)
[NATURAL PHENOM\(10100+\)](#)
[INDICATOR\(900+\)](#)
[author\(800+\)](#)

Articles: 1 -- 30 of 172730

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1. Posttranslational modification of human T-cell growth factor.

Journal: Biochem. Biophys. Res. Commun. 1983 Nov; 116(3): 1049-55

... acid in position 3 of the **polypeptide** chain was modified.

PubMedID [6606428](#) - [View Abstract](#)

Date: 19831101 Score: 1.000

2. Characterization of a murine lymphokine distinct from interleukin 2 and interleukin 3 (IL-3) possessing a T-cell growth factor-mast-cell growth factor activity that synergizes with IL-3.

Journal: Proc. Natl. Acad. Sci. U.S.A. 1986 Mar; 83(6): 1857-61

... may correspond to single **polypeptide** chains. The majority of the ...

PubMedID [2937061](#) - [View Abstract](#)

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http://nactem4.mc.man.ac.uk:8080/Kleio/FetchAbstract.svl?pmid=6606428&field=content&query=content%3A+"T-cell+growth+factor"++"interac

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PubMedID: [6606428](#)

Title: Posttranslational modification of [human T-cell growth factor](#).

Abstract:

Amino-terminal sequence analysis of [human T-cell growth factor](#) indicated that the [amino acid](#) in position 3 of the [polypeptide](#) chain was [Examination of the N-terminal octapeptide](#) using the [amino acid](#) analyzer and mass spectrometry demonstrated that position 3 was a [thri](#) linked to [N-acetyl-D-galactosamine](#). This site of [glycosylation](#) is of practical significance since it appears to play a role in the selectivity antibody for the [factor](#).

Legend:

[GENE or PROTEIN](#) [METABOLITE](#) [ORGAN](#) [SYMPTOM or DISEASE](#)

[PHENOMENON](#) [PROCEDURE](#) [INDICATOR](#)

[Acronym](#) [other](#)

Journal: Biochem. Biophys. Res. Commun. 1983 Nov;116(3):1049-55

Author(s): Robb RJ, Kutny RM, Panico M, Morris H, DeGrado WF, Chowdhry V

Mesh Heading(s): Amino Acid Sequence, Cell Line, Glycoproteins, Glycoproteins -- genetics, Hexosamines, Hexosamines -- analysis, Human Interleukin-2 -- genetics, Peptide Fragments, Peptide Fragments -- analysis, Protein Processing, Post-Translational, Spectrum Analysis, Immature T-Lymphocytes, Trypsin

Acronym(s): [No acronyms discovered]

Named Entities:

NE form: [glycosylation](#)

NE type: NATURAL_PHENOM

CUI Number: [C0017982,C0376322](#)

NE form: [polypeptide](#)

NE type: METABOLITE

ID Number: [KEGG:C00403\[toDB\]](#)

NE form: [N-acetyl-D-galactosamine](#)

NE type: METABOLITE

MEDIE

- Semantic information extraction
 - extracts nuggets of knowledge from MEDLINE
 - interactive semantic retrieval from sentences
 - segments documents into sections, conclusion, methodology, etc

Specify the subject

subject

p53

Verb (base form)

activate

object

search
clear
[advanced search](#)

Specify the verb

Click to search!

What is MEDIE?

MEDIE is an intelligent search engine to retrieve biomedical correlations from MEDLINE, based on indexing by Natural Language Processing and Text Mining techniques. You can find abstracts/sentences in MEDLINE by specifying semantics of correlations; for example, "[What activates p53](#)" and "[What causes colon cancer](#)".

Currently, 18,018,361 MEDLINE articles are in our database.

Cat No:

What does p53 activate?

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A GCL query is submitted to a GCL server. See the following table for the details of GCL. If you want to see examples of GCL queries, just click "See Examples".

[The customization of the number of results](#) is available as in Semantic Search.

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subject	verb (base form)	object
p53	activate	

search clear advanced search

Results 1-10 for p53 activate 0.21 seconds (searched 0.24% of Medline)
» show query

sentence article table show 10 results subject verb object gene disease

show next » Click to change the view

1. [Oscillations by the p53-Mdm2 feedback loop.](#) XML
Galit Lahav, pp. 28-38, Volume 641, Advances in experimental medicine and biology, 2008 [PMID:18783169]
p53 also activates the transcription of **Mdm2**, which in turns target **p53** for degradation, therefore creating a negative feedback loop on **p53**.

2. [ERK and JNK mediates p53 activation in spontaneous and autophagic L929 cell death](#) XML

the growth inhibitory effects of Triphala is mediated by the activation of ERK and p53 ...

3. [Triphala inhibits both in vitro and in vivo xenograft growth of pancreatic tumor cells by inducing apoptosis](#) XML
Yan Shi, Ravi P Sahu, Sanjay K Srivastava, pp. 294, Volume 8, BMC cancer, 2008 [PMID:18847491]
Our data also suggests that the growth inhibitory effects of Triphala is mediated by the activation of ERK and **p53** and shows potential for the treatment and/or prevention of human pancreatic cancer.

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subject	verb (base form)	object
p53	activate	

[search](#) [clear](#) [advanced search](#)

Results 1-10 for p53 activate
» Show query

Perform advanced search

sentence article table show 10 results subject verb object gene disease

show next »

title	subject entities	verb entities	object entities
Oscillations by the p53-Mdm2 feedback loop. »XML	p53	activates	the transcription of Mdm2
ERK and JNK mediate TNFalpha-induced p53 activation in apoptotic and autophagic L929 cell death. »XML	TNFalpha-induced MAPKs mediate p53 activation in apoptotic and autophagic cell death, as well as autophagy	amplify	apoptosis
Regulation and pathological role of p53 in cisplatin nephrotoxicity. »XML	p53	leading	the development of effective renoprotective strategies during cancer therapy
Triphala inhibits both in vitro and in vivo xenograft growth of pancreatic tumor cells by inducing apoptosis. »XML	by the activation of ERK and p53	mediated	the growth inhibitory effects of Triphala
Pharmacogenetics and pharmagenomics, trends in normal and pathological aging studies: focus on p53. »XML	p53	activate	an apoptotic program
p53 family in development. »XML	Imbalance of p53 protein family	contribute	a significant proportion of congenital developmental abnormalities in humans
Involvement of p53 and Raf/ MEK / ERK pathways in hematopoietic drug resistance. »XML	Dominant-negative (DN) p53 genes	increased	the resistance to chemotherapeutic drugs MDM2 and MEK inhibitors

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subject verb (base form) object

p53	activate	
enable ontology search	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
treat as base forms	<input type="checkbox"/>	<input checked="" type="checkbox"/>
search category	<input checked="" type="checkbox"/> gene <input checked="" type="checkbox"/> product <input checked="" type="checkbox"/> disease	<input checked="" type="checkbox"/> gene <input checked="" type="checkbox"/> product <input checked="" type="checkbox"/> disease
verb modifiers		
additional keywords		
author		
journal title		
MeSH keywords		
sentence types	<input type="checkbox"/> title <input checked="" type="checkbox"/> conclusion <input type="checkbox"/> method <input type="checkbox"/> objective <input type="checkbox"/> result	help

enable ontology search
treat as base forms
search category
verb modifiers
additional keywords
author
journal title
MeSH keywords
sentence types

Results 1-10 for p53 activate 6.68 seconds (searched 54.44% of Medline)
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show next »

1. Oncogenic mutation of the p53 gene derived from head and neck cancer prevents cells from undergoing apoptosis after DNA damage. [»XML](#)
Hitoshi Kawamata, Fumie Omotehara, Koh-Ichi Nakashiro, Daisuke Uchida, Yasuhiro Shinagawa, Masatsugu Tachibana, Yutaka Imai, Takahiro Fujimori, pp. 1089-97, Volume 30, Issue 5, International journal of oncology, 2007 [PMID:17390010]
A mutant-p53 (Glu17Lys, His193Leu) or a truncated p53 (Delta121) did not activate the reporters containing p53 responsive elements from p21waf1, BAX, MDM2, p53AIP1, and PUMA genes at all.

Done

Search only the conclusion sentences

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MEDIE — See what causes cancer? MEDIE is a demo system presented by Tsujii Laboratory

subject verb (base form) object

p53 activate

search clear advanced search

Results 1-10 for ...

» show more

1. ERK and JNK mediate TNFalpha-induc... on in apoptotic and autophagic L929 cell death. »XML

Yan Cheng, Feng Qiu, Shin-ichi Tashiro, Satoshi Onodera, Takashi Matsunaga, pp. 483-8, Volume 376, Issue 3, Biochemical and biophysical research communications, 2008 [PMID:18796294]

In conclusion, these results demonstrate that TNFalpha-induced MAPKs mediate p53 activation in apoptotic and autophagic cell death, as well as autophagy may amplify apoptosis when associated with a death signaling pathway.

2. Our data also suggests that ...

3. Triphala inhibits both in vitro and in vivo growth of pancreatic tumor cells by inducing apoptosis. »XML

Yan Shi, Ravi P Sahu, Sanjay K Srivastava, pp. 294, Volume 8, BMC Cancer, 2008 [PMID:18847491]

Our data also suggests that the growth inhibitory effects of Triphala is mediated by the activation of ERK and p53 and shows potential for the treatment and/or prevention of human pancreatic cancer.

4. p53 family in development. »XML

Nadia Danilova, Kathleen M Sakamoto, Shuo Lin, pp. 919-31, Volume 125, Issue 11-12, Mechanisms of development, YYYY [PMID:18835440]

Imbalance of p53 protein family may contribute to a significant proportion of congenital developmental abnormalities in humans.

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Our data also suggests that the growth inhibitory effects of Triphala is mediated by the activation of ERK and p53 and shows potential for the treatment and/or prevention of human pancreatic cancer.

4. [p53 family in development. »XML](#)
Nadia Danilova, Kathleen M Sakamoto, Shuo Lin, pp. 919-31, Volume 125, Issue 11-12, Mechanisms of development, YYYY [PMID:18835440]
Imbalance of p53 protein family may contribute to a significant proportion of congenital developmental abnormalities in humans.

5. [Gambogic acid mediates apoptosis as a p53 inducer through down-regulation of mdm2 in wild-type p53-expressing cancer cells. »XML](#)
Hongyan Gu, Xiaotang Wang, Shuyun Rao, Jia Wang, Jie Zhao, Fang Li Ren, Rong Mu, Yong Yang, Qi Qi, Wei Liu, Na Lu, Hua Ling, Qidong You, Qinglong Guo, pp. 3298-305, Volume 7, Issue 10, Molecular cancer therapeutics, 2008 [PMID:18852133]

It is **Click a gene name to show links to external databases**

6. [Modulation of the DNA-damage response to HZE particles by shielding. »XML](#)
Bipasha Mukherjee, Cristel Vanessa Camache, Nozomu Tomizuka, Jack Miller, Sandeep Burma, pp. 1717-30, Volume 7, Issue 10, DNA repair, 2008 [PMID:18672098]
Interestingly, activation of the tumor suppressor p53 in Fe-irradiated cells is uniquely biphasic and culminates in the induction of high levels of p21 (Waf1/Cip1), p16 (INK4a) and TP53 (Homo sapiens) -galactosidase activity.

7. [Combined effects of the p53 and p73 G4C2-to-A4T14 polymorphisms on the risk of HPV16-associated oral cancer in never-smokers. »XML](#)
Xingming Chen, Erich M Sturgis, Adeeb Iqbal, Ming Tang, Qinyi Wei, Guojun Li, pp. 120-5, Volume 29, Issue 11, Carcinogenesis, 2008 [PMID:18701437]
These findings suggest that the TrEMBL variants of p53 and p73 significantly increase the risk of HPV16-associated oral cancer, especially among never-smokers.

8. [Differential effect of camptothecin treatment on topoisomerase II alpha expression in ML-1 and HL-60 leukemia cell lines. »XML](#)
J Nair, F Traganos, Y C Tse-Dinh, pp. 4183-8, Volume 20, Issue 6B, Anticancer research, YYYY [PMID:11205246]
These results demonstrated that induction of p53 by camptothecin treatment can lead to a decreased level of TOP2 alpha and should be considered in design of combination therapy.

9. [Intrinsically unstructured domains of Arf and Hdm2 form bimolecular oligomeric structures in vitro and in vivo. »XML](#)
Sivashankar G Sivakolundu, Amanda Nourse, Simon Moshiach, Brian Bothner, Chimere Ashley, John Satumba, Jill Lahti, Richard W Kriwacki, pp. 240-54, Volume 384, Issue Done



Conclusion

- Text Mining is an enabling technology for knowledge discovery, an integral part of medical informatics
- Helps you to see the forest from the trees...