Way2Drug

cheminformatics platform for drug repurposing

Third International School-Seminar "From Empirical to Predictive chemistry"

Druzhilovskiy Dmitry

Institute of Biomedical Chemistry

119121, Moscow, Russia, Pogodinskaya street 10/8

Russian Science Foundation

विज्ञान एवं प्रौद्योगिकी विभाग
DEPARTMENT OF SCIENCE & TECHNOLOGY

(RSF-DST № 16-45-02012-INT/RUS/RSF/12)

Way2Drug available online

India Russia Ukraine Mexico China United States Egypt

Kazakhstan Brazil Other

Free availability
24/7/365

Authorization/privacy

22 users
2818 prediction

91 country

642 238 molecules

18 200 users

Users relationships

Cross-browser and cross-platform support

Statistics of December 22nd 2017.

Web platform Way2Drug

We have proposed the concept of local conformity from which activity of drug-like compounds is based on the recognition of the ligand atoms of the target atoms.

Using this concept, we have developed a consistent system of atom-centered neighborhoods of atoms descriptors including MNA, QNA, and LMNA, and have implemented them in several SAR/QSAR/QSPR modeling approaches. It's significant to note that all procedures on the basis of this portal use only structural formula for obtaining results.

Way2Drug – Drug Repositioning

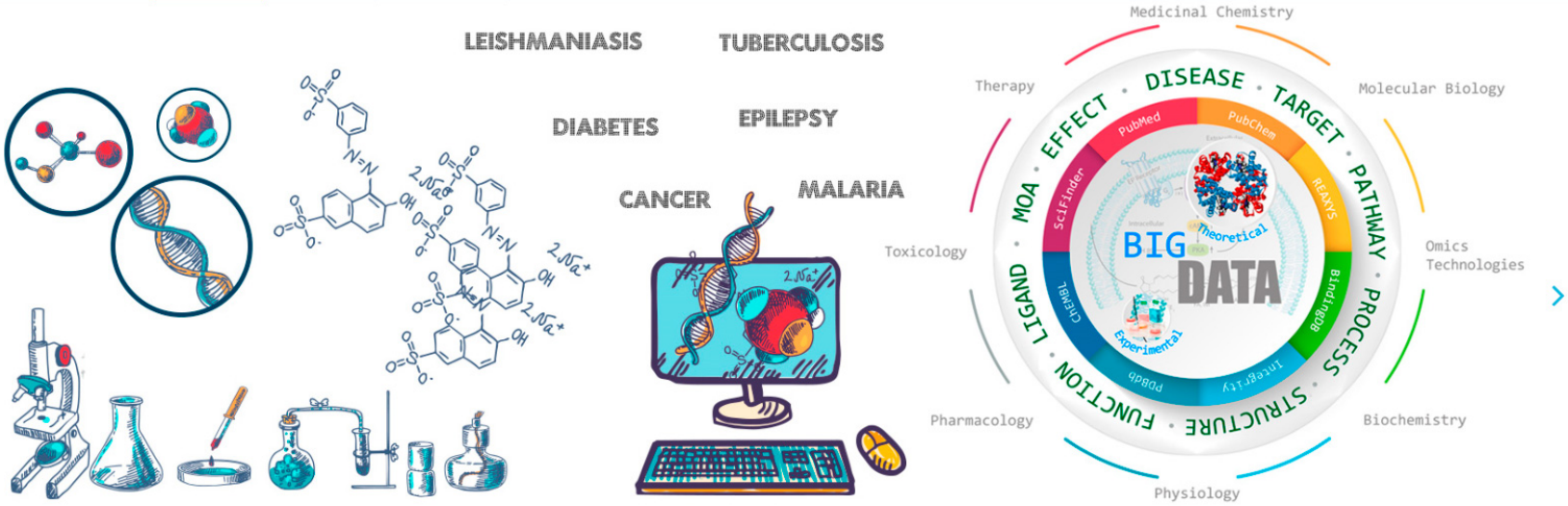
Way2Drug PREDICTIVE SERVICES
Understanding Chemical-Biological Interactions

Molecular Property Diagnostic Suite (MPDS^{TB})
An Open Source Chemoinformatics Portal

A Knowledge Based Approach to Drug Repurposing for Socially Important and Rare Diseases.

RSF - DST Project # 16-45-02012 - INT/RUS/RSF/12

HOME | ABOUT | SERVICES | Hello, D Dr LOG OUT



Global research

Discovery of new safe and potent medicines based on cutting-edge knowledge of a certain pathology at the molecular, cellular, tissue and organism levels, and the most

Referential ideas

Integration of the currently available biomedical and chemical data, extraction of the useful information and generation of new knowledge in the field of chemical-biological

New services

Computational predictions based on perpetually updated information, which overcome the limits of the current knowledge and allow to expand predictive functionalities of

Collaboration

Providing framework for effective interaction of researchers working in the multidisciplinary field of drug design & discovery, to combine their complementary background,

IBMC

Way2Drug – Drug Repositioning

Way2Drug PREDICTIVE SERVICES
Understanding Chemical-Biological Interactions
www.way2drug.com

Orphan diseases

A disease is considered rare* when no more than **1 out of 2000** people suffer from it

Estimates indicate **>300 million** people living with a rare disease worldwide

Tests for **3500** rare diseases are now available...

...but only about **400 rare diseases** have therapies

80% of rare diseases have a genetic component

50% of those affected by rare diseases are children

Reported rates of medication adherence range from **58-65%**

There are **6,000 to 7,000** rare diseases

DIABETES

DIABETES IS ON THE RISE

422 MILLION adults have diabetes

3.7 MILLION deaths due to diabetes and high blood glucose

1.5 MILLION deaths caused by diabetes

Epilepsy

Epilepsy is a condition that affects the brain and causes repeated seizures

65 MILLION people worldwide currently live with epilepsy.

200,000 people, per year are diagnosed with epilepsy

TUBERCULOSIS (TB) FACTS

TB is a serious disease. It can infect many body parts, but is most common in the lungs.

1,500,000 died from the disease*

9,000,000 people fell ill with TB

TB is a **leading cause of death** in patients with **HIV.**

MALARIA FACTS

Malaria is a serious disease that is **PREVENTABLE** and **TREATABLE.**

97 countries and territories had ongoing malaria transmission in 2015.[1]

every **2** minutes a child dies from malaria in Sub-Saharan Africa.[4]

Cancer Facts

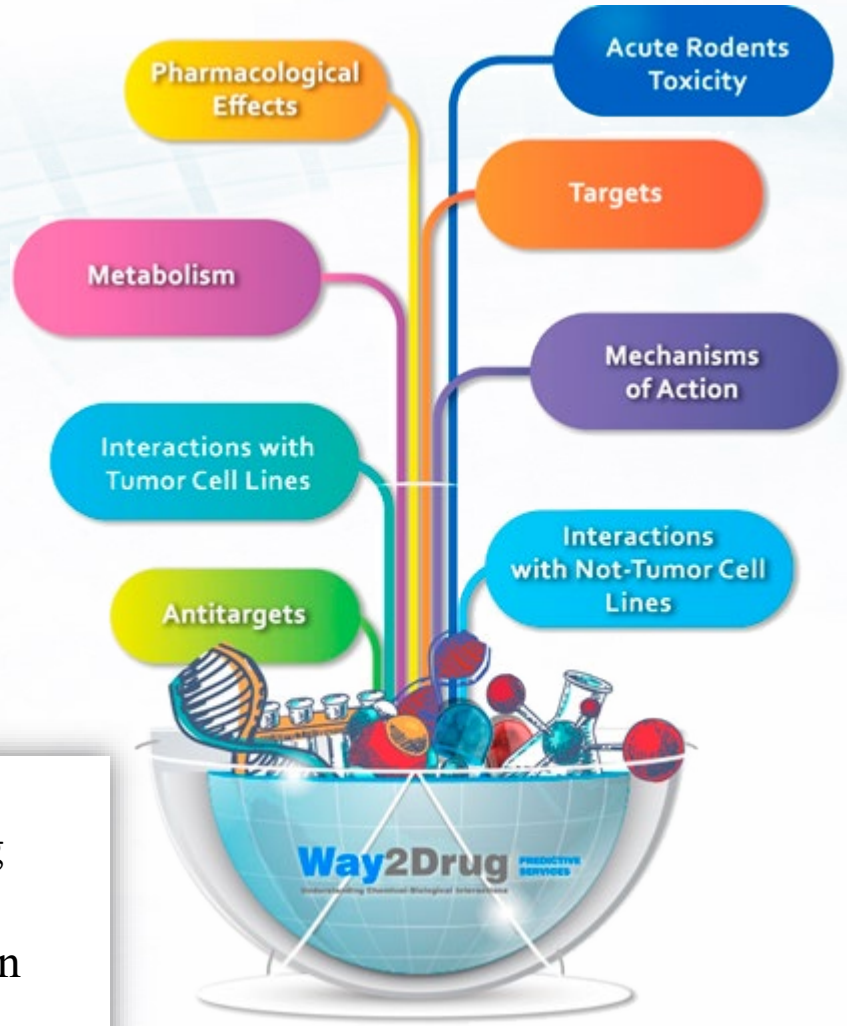
approximately 14 million new cases

The disease accounts for 7.4 million deaths worldwide.

It's the leading cause of death worldwide, causing around 13% of all deaths worldwide

Tuberculosis | **Leishmaniasis** | **Malaria** | **Diabetes** | **Cancer** | **Epilepsy**

Way2Drug – Drug Repositioning



- development of computer methods for searching promising pharmacological targets and designing their ligands
- integration the developed methods into a common web platform
- validation using examples of searching for new drugs

Pharmacological Targets

Show 10 entries

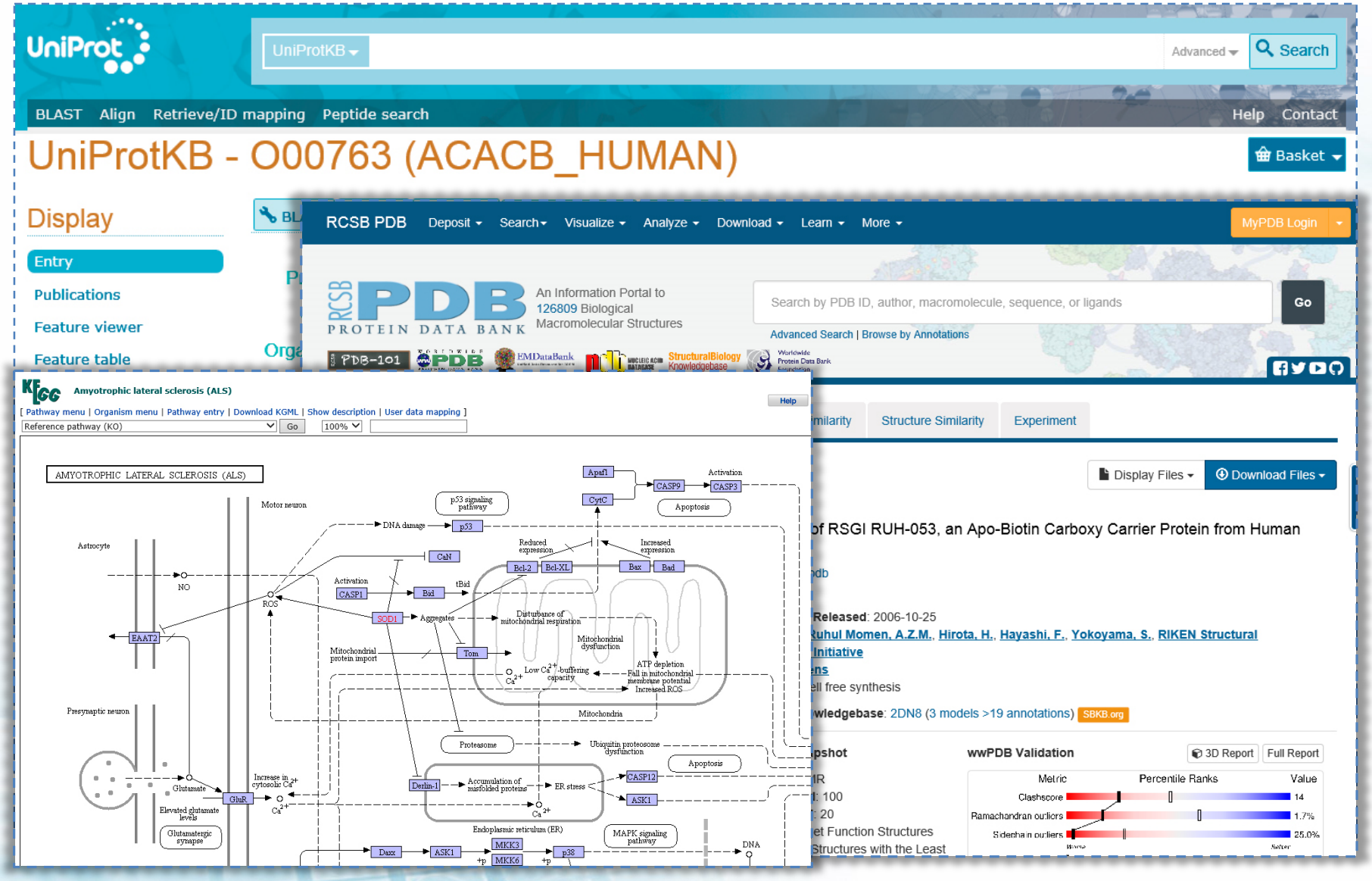
Pharmacological Targets

Search:

Target's name	UniProt	PDB	Kegg	Pharmacotheraputic application		
				PreClinical	Clinical	Launched
1-deoxy-D-xylulose 5-phosphate reductoisomerase	Q8IKG4	PDB			Tuberculosis	Malaria
1-phosphatidylinositol 4,5-bisphosphate phosphodiesterase gamma-1	P19174	PDB	Kegg		Cancer	
11beta-Hydroxysteroid Dehydrogenase (nonspecified subtype)	P24385	PDB	Kegg			Diabetes Cancer
14-3-3 protein epsilon	P62258	PDB	Kegg	Cancer		
15-hydroxyprostaglandin dehydrogenase (NAD+) (isoform 1)	P15428	PDB			Cancer	
17beta-Hydroxysteroid dehydrogenase (nonspecified subtype)	P24864	PDB	Kegg		Cancer Diabetes	
2-amino-3-carboxymuconate-6-semialdehyde	Q8TDX5	PDB			Diabetes	
3-oxoacyl-(acyl-carrier protein) reductase	Q8I2S7	PDB			Cancer Leishmaniasis Malaria	
3-phosphoinositide-dependent protein kinase 1 (isoform 1)	O15530	PDB	Kegg		Diabetes	Cancer
4F2 cell-surface antigen heavy chain	P08195	PDB		Cancer		
Target's name	**UniProt**	**PDB**	**Kegg**	**Pharmacotheraputic application**		
				PreClinical	**Clinical**	**Launched**

Showing 1 to 10 of 2,322 entries

Pharmacological Targets

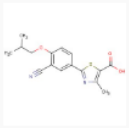
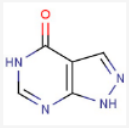
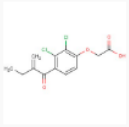
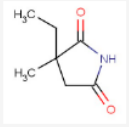


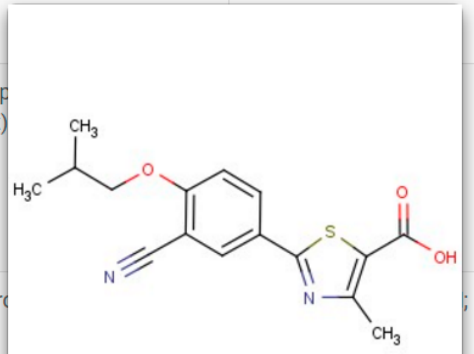
http://www.way2drug.com/dr

FDA approved drugs (1035 drugs)

FDA approved drugs

Show 10 entries Search:

Structure	Generic Name	Brand Name	Mechanism of Action	Pharmacotheraputic application	PASSOnline prediction	FDA link	Chembl link
	Adenuric Febric Feburic Uloric	Febuxostat (USAN; Rec INN)	Xanthine oxidase inhibitor Xanthine dehydrogenase inhibitor(CHEMBL1929)	Gout Hyperuricemia Cancer therapy associated disorders Angina pectoris, stable Hematologic-blood cancer	PA SS	101V0R1N2E	chembl1164729
	Lopurin Zylop (sodium salt)		Xanthine dehydrogenase inhibitor(CHEMBL1929)	Heart failure Urolithiasis Asphyxia neonatorum Nephropathy, diabetic Gout Hyperu	PA SS	63CZ7GJN5I	chembl1467
	Edecrin Hydr		Wnt signaling inhibitor Sodium-(potassium)-chloride cotransporter 2 inhibitor(CHEMBL1874)	Hypert			
	Suxinutin Zar		Voltage-gated T-type calcium channel blocker(CHEMBL2362995)	Epileps			



Close

PASS Online prediction for Febuxostat (USAN; Rec INN)

Pa	Pi	Activity
0,936	0,001	Xanthine oxidase inhibitor
0,878	0,002	Gout treatment
0,821	0,002	Uric acid excretion stimulant
0,631	0,010	Antidiabetic
0,563	0,008	Mediator release inhibitor
0,556	0,005	Lipoprotein disorders treatment
0,636	0,093	Ubiquinol-cytochrome-c reductase inhibitor

Cancer (234 drugs) | **Malaria (12 drugs)** | **Tuberculosis (20 drugs)** | **Epilepsy (41 drugs)** | **Diabetes (84 drugs)**

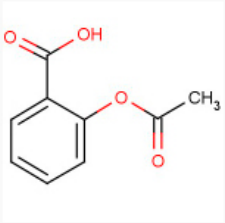
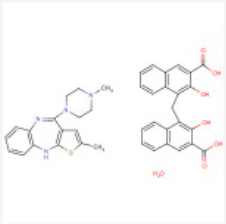
http://www.way2drug.com/dr

Similarity
SimMNA|SimQNA

Show 10 entries

Similarity MNA & QNA

Search:

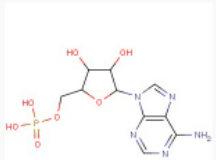
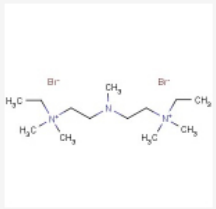
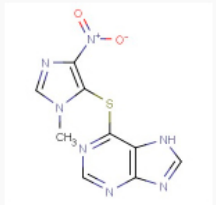
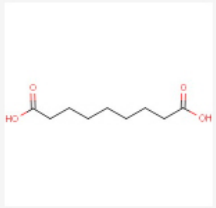
Structure	Brand Name	Generic Name	Mechanism of Action	Pharmacotheraputic application	Similarity MNA	Similarity QNA
	Asacard Aspirin Cardioaspirin Durlaza Ecotrin Nu-Seals Aspirin	Acetylsalicylic acid (BAN; USAN; JAN)	Cyclooxygenase inhibitor	Pain Stroke Polyposis coli, adenomatous Myocardial infarction Fever Hematologic Diseases Cognitive disorders Fatigue Thrombosis Ulcer, peptic Cancer, colorectal Angina pectoris, stable Cancer	1.000	1.000
	Zypadhera Zyprexa LAI Zyprexa Relprevv	Olanzapine pamoate (USAN)	Dopamine D2 antagonist Signal transduction modulator 5 Hydroxytryptamine 2A antagonist	Schizophrenia	0.417	0.692
	Metopiron Metopirone	Metyrapone (BAN; USAN; Rec INN; JAN)		Cushing's syndrome	0.231	0.549

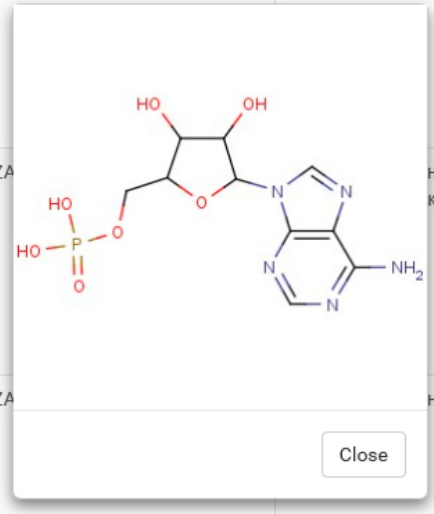
Pharmaceutical Substances Registered in Russia

Show 10 entries

Pharmaceutical Substances Registered in Russia

Search:

Structure	Trade name	Substance name	Comments
	Фосфаден	ADENOSINE PHOSPHATE	Торговое название: Фосфаден Международное название: Аденозина фосфат Страна: Россия . дата актуализации - 17.05.1999 (РЛС)
	Пентамин	AZA	ние: Пентамин Международное название: Азаметония бромид Страна: Россия . В колько препаратов, несколько дат регистрации.
	Азатиоприн	AZA	ние: Азатиоприн Международное название: Азатиоприн Страна: Россия
	СКИНОРЕН	AZELAIC ACID	мазь . Торговое название Скинорен (Skinoren) Страна-производитель Германия Фирма-производитель Schering AG - 10.11.1998 . . .

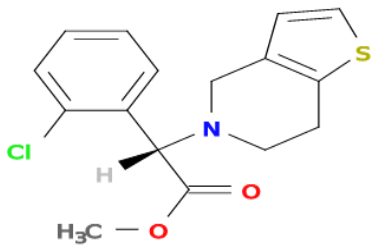


Molecule Properties Prediction by Molecular Property Diagnostic Suite

- Prediction molecular properties;
- Heat Map of the MPDS predicted characteristics.

Molecular Property Diagnostic Suite

MPDS ID: 25-12-047870



Molecular Formula:
$C_{16}H_{16}ClNO_2S$

IUPAC Name:
1-[2-(5-bromo-8-hydroxyquinolin-2-yl)ethyl]pyrrolidin-1-ium

Remarks:

Remarks here...

Name/Synonyms:

Name/Synonyms here...

Molecular Properties:

Mol. Wt.	321.06	LogP	0.94
HBD	0	LogS	-4.27
HBA	3	pKa	pKa1: ; pKa2: ; pKa3: 4.77; pKa4: -7.74
Molar refractivity	43.95	Polar surface area	57.78
Heavy atoms count	21	Rings count	3.00
Rotatable bonds	6.00	Polarizability	1.78

MPDS ID: 25-12-047881
Molecular Formula:$C_{16}H_{13}ClD_3NO_2S$
IUPAC Name:trideuteriomethyl (2S)-2-(2-chlorophenyl)-2-(6,7-dihydro-4H-thieno[3,2-c]pyridin-5-yl)acetate
LogP=0.94
LogS=-4.27
HBA=3
HBD=0
pKa=pKa1: ; pKa2: ; pKa3: 4.77; pKa4: -7.74
Molar refractivity=43.95
Polar surface area=57.78
Heavy atoms count=21
Rings count=3.00
Rotatable bonds=6.00
Polarizability=1.78

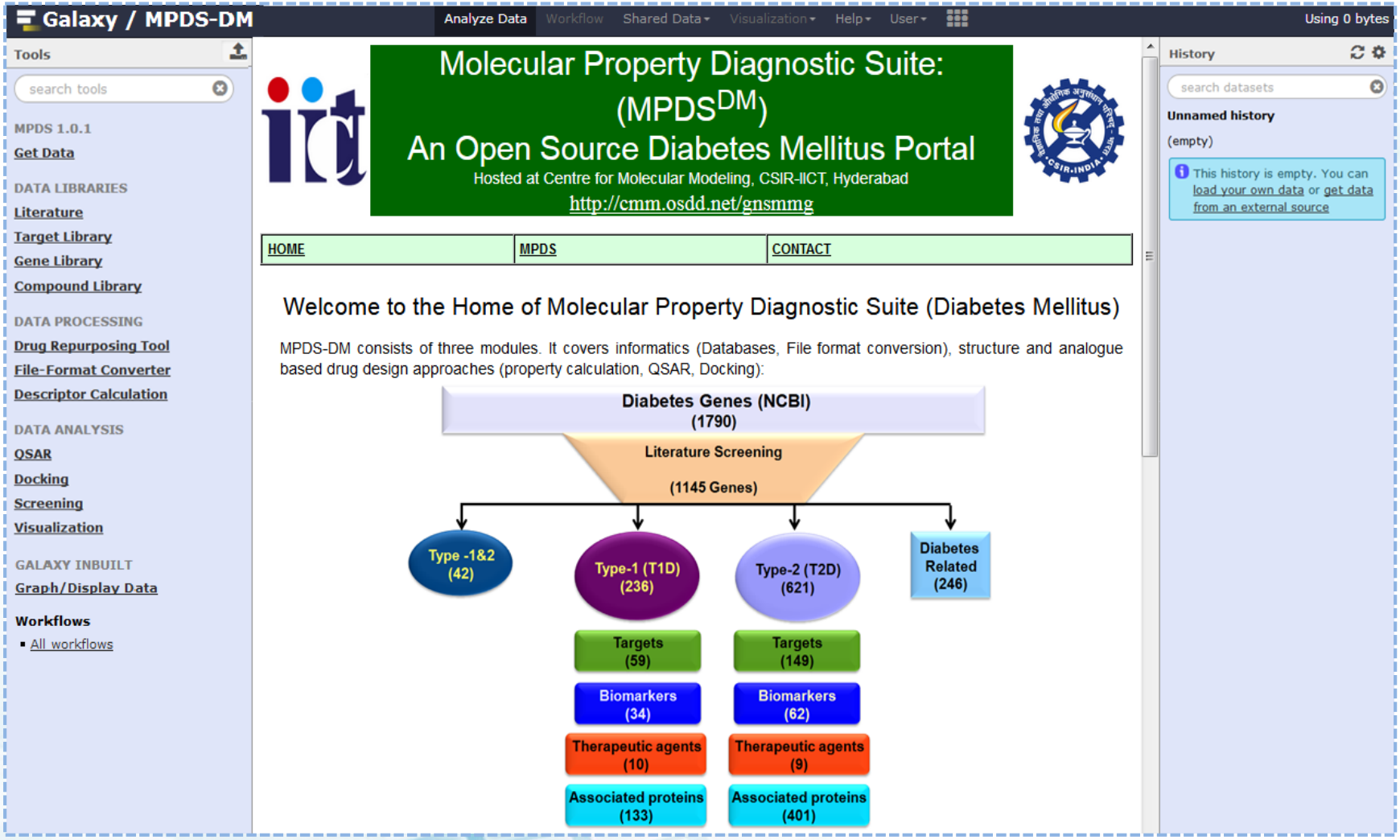
Parameter	Value	Lipinski rule of five	Ghose Filters	CMC-like rules	MDDR like rule
LogP	0.94	●	●	●	
HBA	3	●			
HBD	0	●			
refract	43.95		●	●	
n_rotatable	6.00				●
n_rings	3.00				●
molwt	321.06	●	●	●	

MPDS website is hosted at Centre for Molecular Modelling
CSIR-IICT, Hyderabad, India
http://mpds.osdd.net/

http://www.way2drug.com/dr

Molecular Property Diagnostic Suite

MPDS^{DM}



CSIR-IICT, Hyderabad, India
http://mpds-diabetes.in/

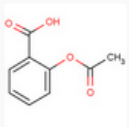
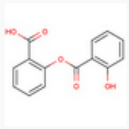
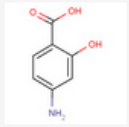
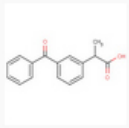
http://www.way2drug.com/dr

Similarity
FDA PCP Search

Show 10 entries

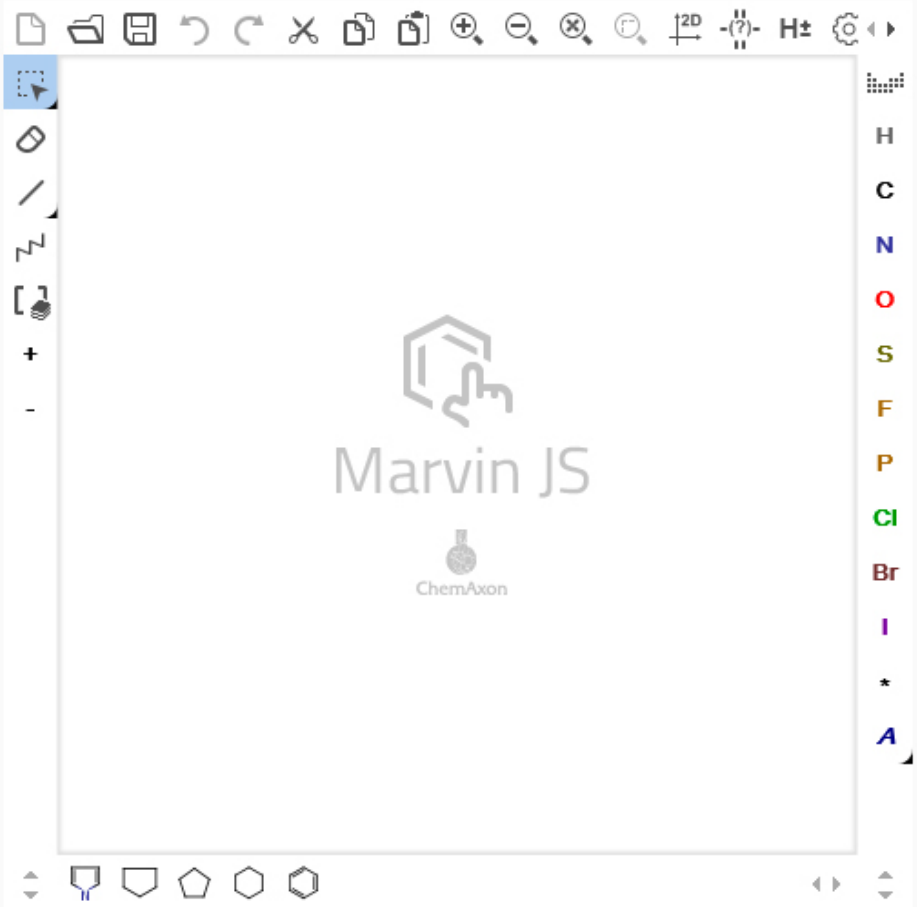
FDA PCP Search

Search:

Structure	Brand Name	Generic Name	Chembl ID	mw	logp	HBA	HBD	TPSA	nRB	nAromRing	nHB	Similarity MNA	Similarity QNA
	Asacard Aspirin Cardioaspirin Durlaza Ecotrin Nu-Seals Aspirin	Acetylsalicylic acid (BAN; USAN; JAN)	25	171.98	2.021	3	0	43.37	3	1	3	1.000	1.000
	Disalcid Salflex	Salsalate (Prop INN; USAN; BAN)		247.97	3.811	3	0	43.37	4	2	3	0.633	0.449
	GranuPAS PASER Pamisyl Para-aminosalicylic acid Lucane Salf-Pas	4-Aminosalicylic acid para-Aminosalicylic acid	1169	145.99	0.469	3	0	17.07	1	1	3	0.417	0.315
	Epatec Fastum Ibifen Impracor Keplat Ketocid Ketoselect	Ketoprofen (BAN; USAN; Rec INN; JAN)	571	239.98	4.988	3	0	34.14	4	2	3	0.417	0.437

PASS Total:
selection of prediction features

Draw a structure:



To recieve results, please, enter:

Your e-mail

Choose activities/properties which you want to predict:

- [ ] Select/unselect all

- [ ] PASS Online(all activities)
- [ ] PASS Online (Effects)
- [ ] PASS Online(Mechanism)
- [ ] PASS Online(Metabolism)
- [ ] PASS Online(Transport)
- [ ] PASS Online (Adverse_Effects&Toxicity)
- [ ] SOMP (Site of metabolism prediction)
- [ ] GUSAR (Antitarget)
- [ ] GUSAR (Acute Rat Toxicity)
- [ ] GUSAR (Enviromental Toxicity)
- [ ] DIGEP-Pred (mRNA Level)
- [ ] DIGEP-Pred (Protein Level)
- [ ] BBB

And finally:

Click here to predict

http://www.way2drug.com/dr

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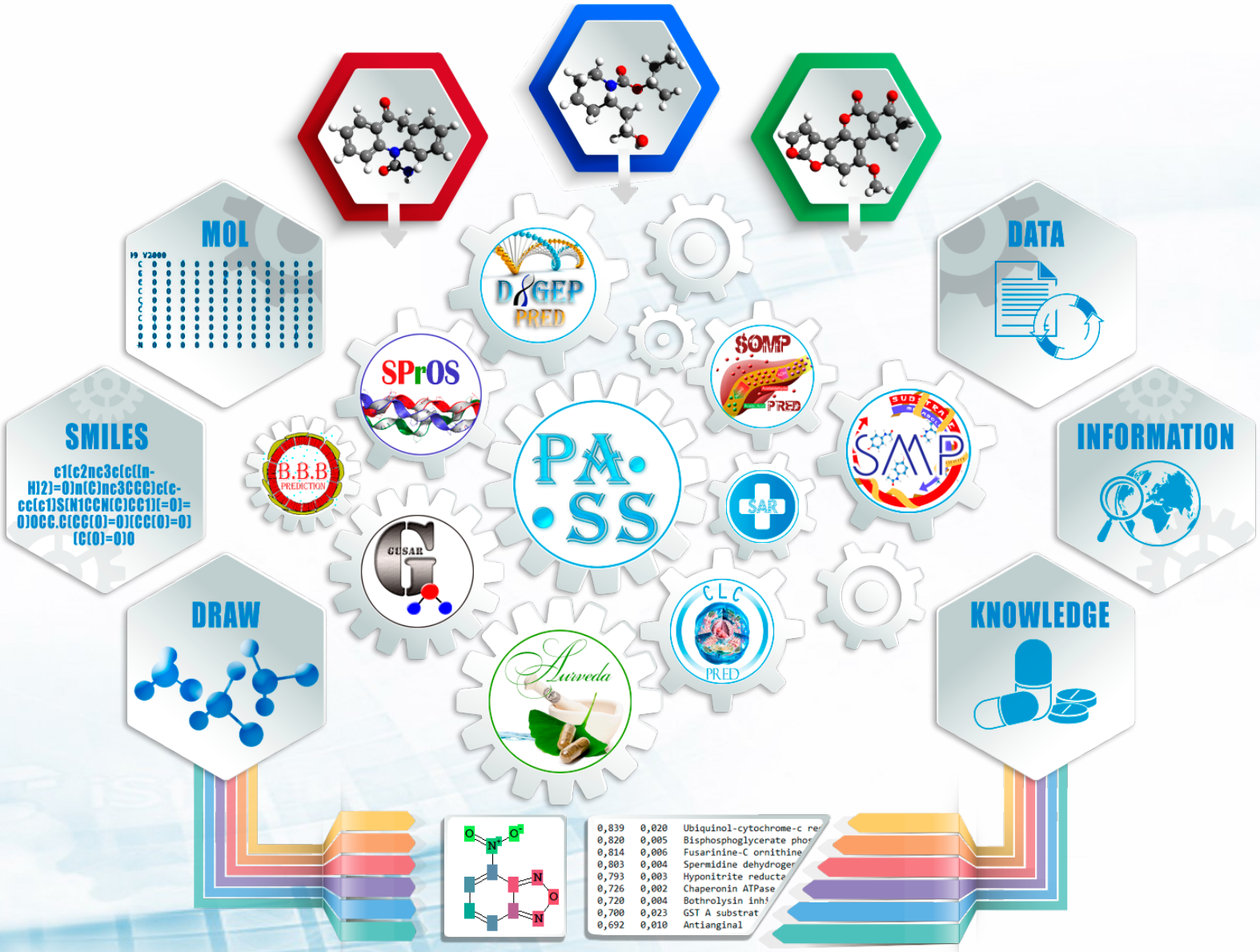
Way2Drug PREDICTIVE SERVICES
Understanding Chemical-Biological Interactions
www.way2drug.com

PASS Total: main prediction tools



http://www.way2drug.com/dr

PASS Selector

Antidiabetic
Antidiabetic (type 1)
Antidiabetic (type 2)
Antidiabetic symptomatic
Antituberculosic
Kegg link
all activity

PAS

×CLOSE

Pa>Pi Pa>0,3 Pa>0,7

0,847	0,005	Superoxide dismutase inhibitor
0,783	0,004	Transketolase inhibitor
0,646	0,008	Erythropoiesis stimulant
0,575	0,014	APOA1 expression enhancer
0,576	0,033	Calcium channel (voltage-sensitive) activator
0,519	0,014	Caspase 8 stimulant
0,496	0,006	TRPA1 agonist
0,486	0,007	Monophenol monooxygenase inhibitor
0,453	0,036	Caspase 3 stimulant
0,412	0,006	Alcohol dehydrogenase inhibitor
0,361	0,019	Dihydroorotase inhibitor
0,337	0,007	Glutamine-tRNA ligase inhibitor
0,395	0,066	Fibroblast growth factor agonist
0,368	0,047	CF transmembrane conductance regulator

Homo sapiens(P00441)

Click to Unirpot

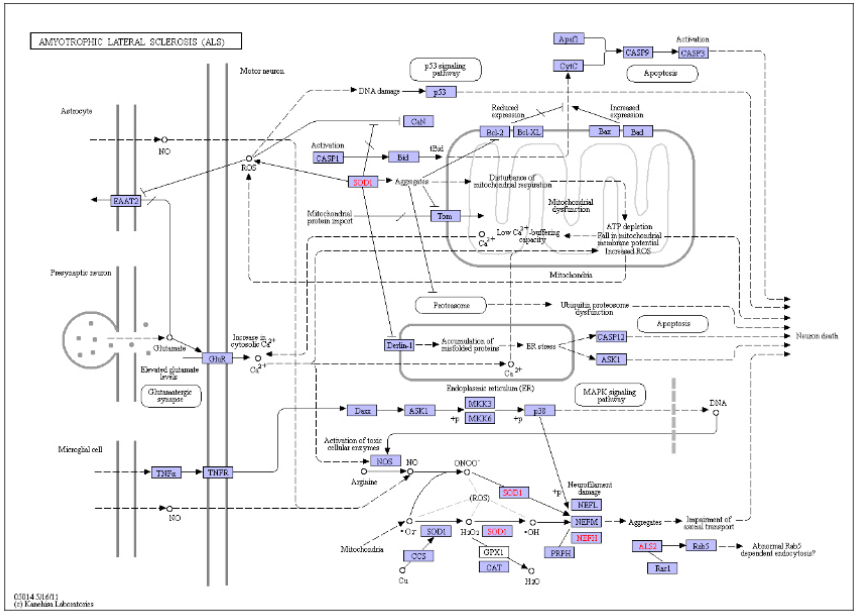
Peroxisome

Amyotrophic lateral sclerosis (ALS)

Huntington's disease

Prion diseases

Click to view kegg db



Mus musculus

Rattus norvegicus

Homo sapiens

Antidiabetic
Antidiabetic (type I)
Antidiabetic (type II)
Antidiabetic symptomatic
Antituberculosic

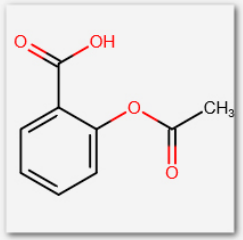
http://www.way2drug.com/dr

SAR Creator

SAR Creator

ADD STRUCTURE | VIEW STRUCTURES | VIEW/CREATE SDF FILES | I NEED HELP

Structure



SMILES

CC(=O)Oc1ccccc1C(=O)O

CHEMBL ID

CHEMBL25

INCHI Key

BSYNRYMUTXBXSQ-UHFFFAOYSA-N

Structure | Compound's name | Activity | Group | Save

http://www.way2drug.com/dr

Summary:

- database includes approved drugs registered by U.S. Food and Drug Administration;
- database includes more than 1400 substances of medicines registered in the Russian Federation;
- knowledge base includes pharmacological targets, the impact on which is used/studied for the treatment of cancer, diabetes, tuberculosis, etc ..;
- hypertext links between more than 1200 pharmacological targets, the impact on which is predicted by the PASS Online program, with the UniProt, KEGG, PDB databases;
- assessing new therapeutic potential of known medicines using heat map of the MPDS predicted characteristics ;
- SAR Creator software allows you to create online training sets for (Q) SAR models;
- the web services provide a prediction of interactions with ~ 80% of molecular targets that are studied in the target pharmacotherapeutic area.

IBMC

CSIR-IICT
CSIR-Indian Institute of Chemical Technology

Acknowledgements

IBMC, Moscow, Russia

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Pavel Pogodin, M.Sc.
Khalimat Murtazalieva, Student
Vladislav Bezhentsev, Student
Daria Veselova, Student
Polina Savosina, Student

CDIR-IICT, Hyderabad, India

Narahari Sastry, Prof, Ph.D.
Karunakar Tanneeru, Ph.D.
Anamika Singh Gaur
R. Srinithi

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