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NATURAL PRODUCTS

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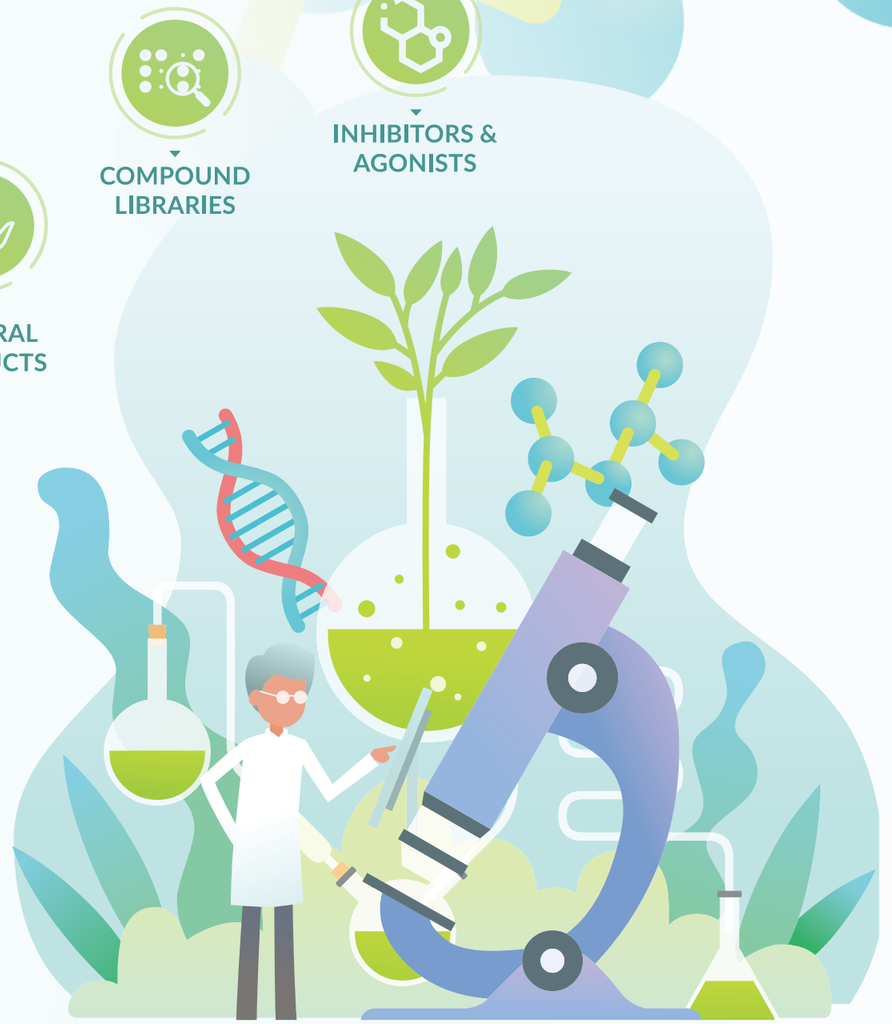
NATURAL PRODUCTS

RECOMBINANT PROTEINS

TECHNICAL SERVICE



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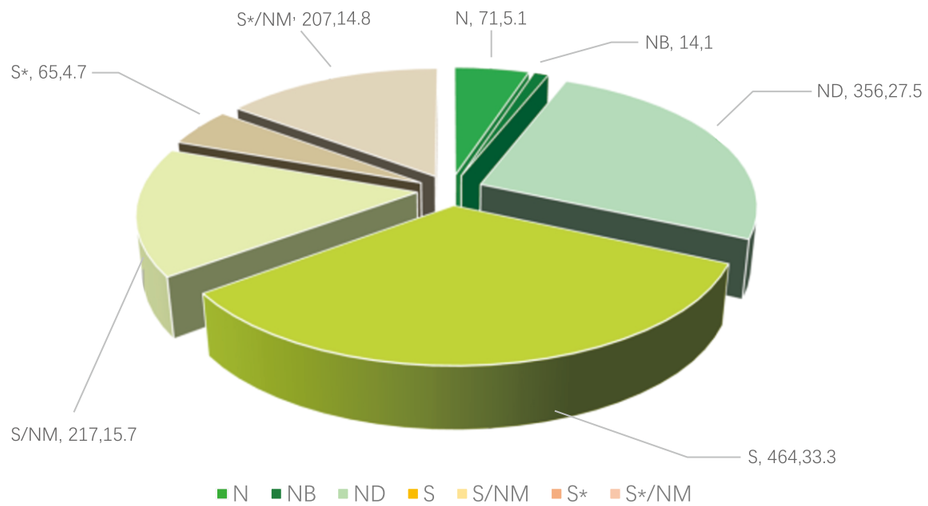
CONTENT

Natural Products

Natural products are chemical substances produced by living organisms (typically plants, animals, and microorganisms) in nature that have pharmacological or biological activity. Natural products play a crucial role in the discovery of lead compounds.

For example, artemisinin, a sesquiterpene lactone compound containing a peroxide group extracted from Artemisia annua, has saved millions of lives worldwide as a new antimalarial drug. [1]

According to statistics, nearly 66% of new drugs approved by the FDA between 1981 and 2019 are derived from natural products, their derivatives, or related compounds. [2]

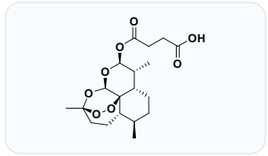


All small-molecule approved drugs; n = 1394.

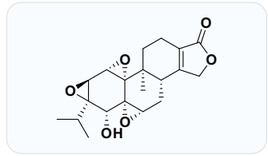
Natural Products With Different Structures

1、Terpenoids

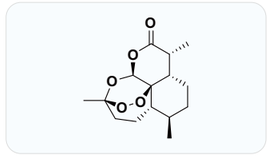
Terpenoids are a large class of compounds formed by the polymerization of isoprene units, characterized by diverse skeletons and bioactivity. These compounds are fundamentally based on five-carbon units, with extensive applications in the field of medicinal chemistry. Studies have shown that terpenoids possess various physiological functions, including anti-inflammatory, antimalarial, antitumor, and blood pressure-lowering effects.



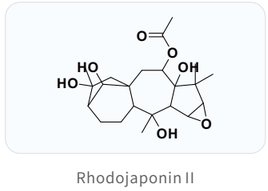
Artesunate



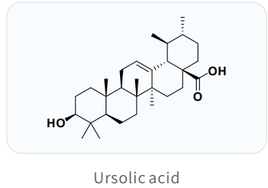
Triptolide



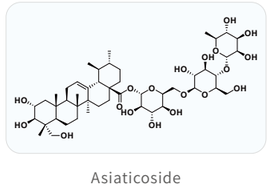
Artemisinin



Rhodojaponin II



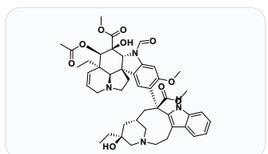
Ursolic acid



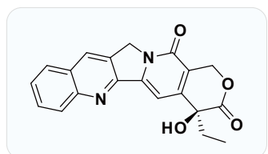
Asiaticoside

2、Alkaloids

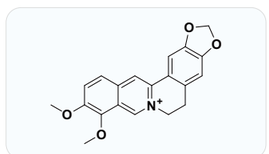
Alkaloids are a kind of natural compounds that contain basic nitrogen atoms, widely found in bacteria, fungi, plants, and animals. They are categorized into several subclasses based on C-N skeleton structure, such as pyrrole, pyridine, quinoline, and indole. Alkaloids exhibit a wide range of pharmacological activities, including antibacterial, antiviral, antitumor, antioxidant, anti-inflammatory, neuroprotective, and cardioprotective effects.



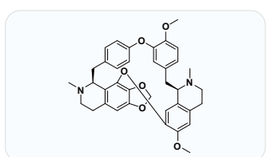
Vincristine



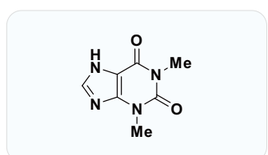
Camptothecin



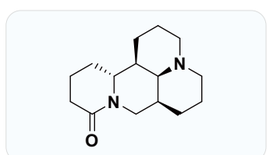
Berberine



Cepharanthine



Theophylline

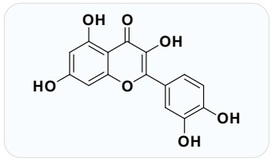


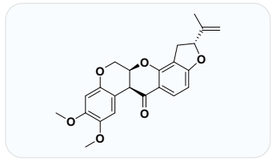
Matrine

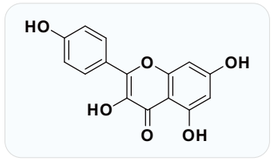
3、Flavonoids

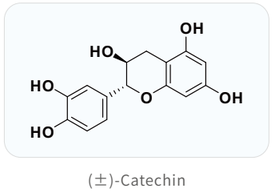
Flavonoids are a type of secondary metabolites widely found in plants, characterized by a basic structure consisting of two aromatic rings (Ring A and Ring B) and one oxygen-containing heterocycle (Ring C). Based on the oxidation state of Ring C and the linkage pattern between Ring A and B, flavonoids can be classified into various subcategories, such as flavonols, flavones, flavanones, and isoflavones.

In nature, flavonoids are mostly found in the form of glycosides or carbon sugars, with a smaller proportion occurring in a free state. Studies have shown that flavonoids possess various biological activities, including antioxidant, anti-inflammatory, anti-obesity, antifungal, anticancer, cardiovascular protective, and antiviral effects.

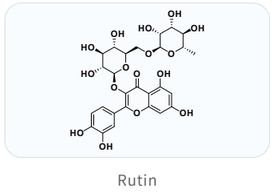

Quercetin


Rotenone


Kaempferol

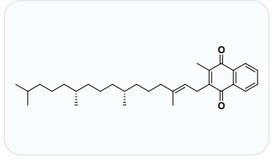

(±)-Catechin

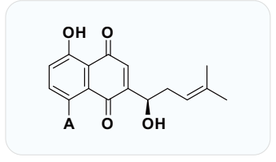

Luteolin

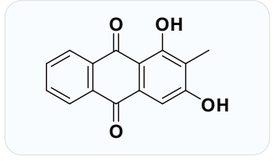

Rutin

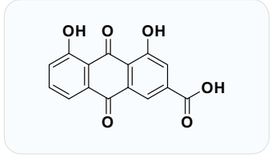
4、Quinones

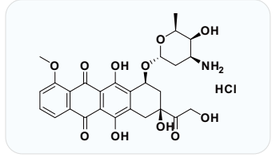
Quinones are effective ingredients in many herbs such as rhubarb, polygonum multiflorum, corydalis, cassia seed, aloe, and salvia. They are primarily classified into four types: benzoquinone, naphthoquinone, anthraquinone, and perinaphthoquinone. Quinones exhibit a wide range of bioactivities, including antimalarial, antitumor, and insecticidal effects.

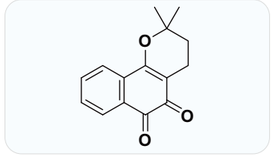

Vitamin K1


Shikonin


Rubiadin

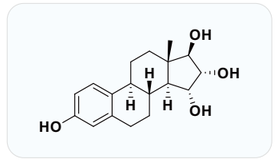

Rhein

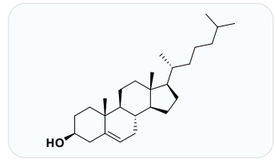

Doxorubicin HCl

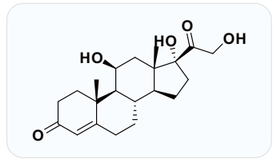

β-Lapachone

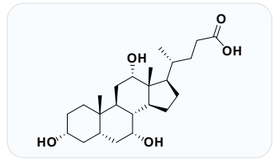
5、Steroids

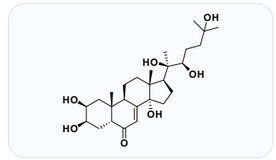
Steroids are a class of compounds derived from a four-ring steroid structure and are widely present in both animals and plants. The human body not only synthesizes cholesterol but also absorbs it from food. Steroids are produced from cholesterol metabolism and degradation. Steroids primarily serve two functions in organisms: first, as components of cell membranes, regulating membrane fluidity; and second, as signaling molecules. Hundreds of steroids have been found in plants, animals, and fungi.

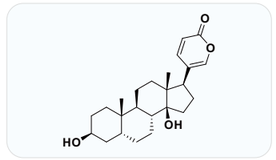

Estetrol


Cholesterol


Hydrocortisone

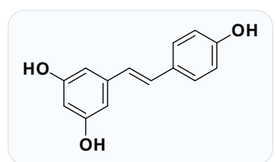

Cholic Acid

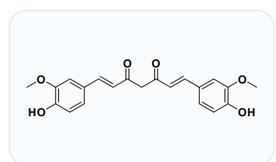

Crustecdysone

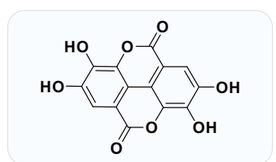

Bufalin

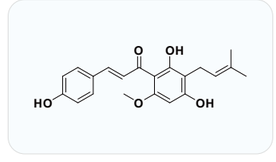
6、Phenols

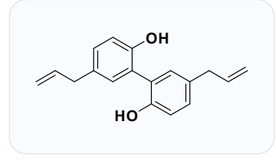
Phenols are a group of organic compounds that contain one or more hydroxyl groups (-OH) attached to an aromatic ring. They are widely found in various plants, including those from the Ericaceae, Rosaceae, Vitaceae, Asteraceae, Lamiaceae, and Bignoniaceae families. Due to the high reactivity of their hydroxyl groups and their excellent free radical scavenging ability, phenolic compounds exhibit significant antioxidant activity. Additionally, natural polyphenolic compounds also possess various biological activities, including anticancer and anti-inflammatory effects.

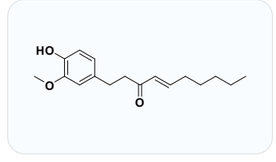

Resveratrol


Curcumin


Ellagic acid


Xanthohumol

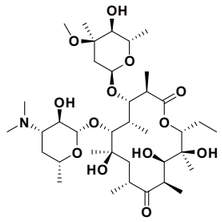

Magnolol


Shogaol

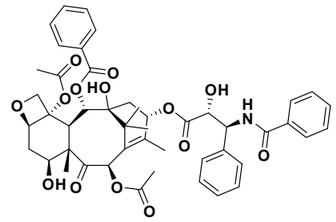
Application of Natural Products

1、Pharmacy

Many important drugs are directly discovered from natural products or derived from them.



Erythromycin
CAS:114-07-8



Paclitaxel
CAS: 33069-62-4

Erythromycin

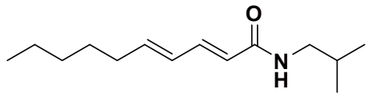
Erythromycin is a macrolide antibiotic produced by actinomycetes, commonly used to treat various infections.

Paclitaxel

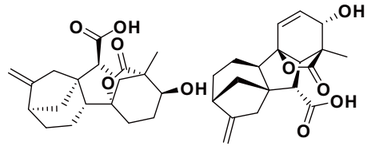
Extracted from the bark of the Pacific yew. It is an effective drug used to treat various cancers, including ovarian and breast cancer.

2、Agriculture

The application of natural products in agriculture is not only diverse but also eco-friendly. They are commonly used as biopesticides and plant growth regulators.



Pellitorine
CAS: 18836-52-7



Gibberllin A7
CAS: 510-75-8

Yarrow Extract

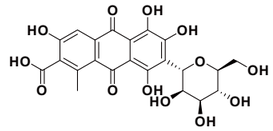
The main active component is pellitorine, which can serve as a natural insecticide, environmentally friendly.

Fungal Extracts

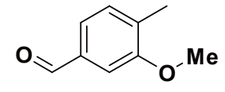
Gibberellins, a class of plant hormones that promote cell elongation and division in plants, increasing plant height and fruit size.

3、Food Industry

Natural products are widely applied in the food industry. These ingredients are highly safe and free from side effects, and are often used as food additives and components in health supplements.



Carmine
CAS: 1390-65-4



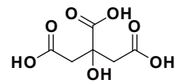
Vanillin
CAS: 121-33-5

Pigments

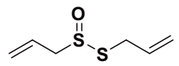
Carmine is a natural red pigment extracted from cochineal insects, widely used to enhance the color of food.

Flavorings

Vanilla extract is not only used to add aroma to food but also to enhance the overall flavor.



Citric acid
CAS: 77-92-9



Allicin
CAS: 539-86-6

Preservative

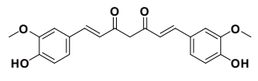
Citric acid is a common natural preservative used to extend the shelf life of food while adding a tart flavor.

Functional Foods

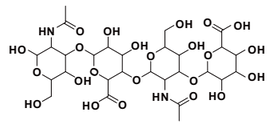
Tea polyphenols have excellent antioxidant activity; Allicin (from garlic) may benefit heart health.

4、Beauty and Skincare

In the field of beauty and skincare, the application of natural products is becoming increasingly widespread. Due to natural origin, eco-friendliness and high safety, they are highly favored by consumers.



Curcumin
CAS: 458-37-7



Hyaluronic acid
CAS: 9004-61-9

Curcumin

Curcumin is an active component derived from turmeric roots with powerful anti-inflammatory and antioxidant properties. It helps reduce inflammation, balance skin pigmentation, and is suitable for improving uneven skin tone and treating acne.

Hyaluronic Acid

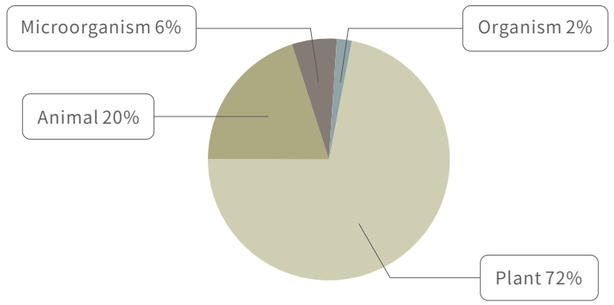
Hyaluronic Acid plays a key role in skin repair, cancer diagnosis, and wound healing. Due to its excellent moisturizing properties, it is an important ingredient in skincare products, helping to maintain smooth and plump skin.

TargetMol's Natural Products

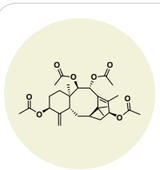
TargetMol has been dedicated to developing high-purity natural product monomers for over a decade, with significant expertise in the separation, extraction, and purification of herbs. TargetMol offers over 180,000 natural products and their derivatives, suitable for a variety of research purposes, including reference standards, high-throughput screening, virtual screening. HNMR, HPLC, and GC are validated to ensure accurate product structures and high purity.

1、Rich Sources

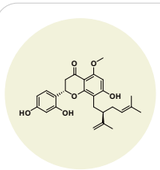
A wide diverse range of plant sources is crucial for ensuring the quality of natural products. TargetMol has collected detailed information on plants from 196 families and 887 genera, and has cataloged nearly 10,000 corresponding natural product monomers.



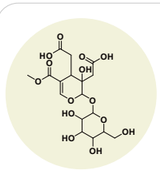
【Rich Sources】



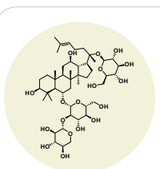
TN6763
Taxusin
Source: Taxus



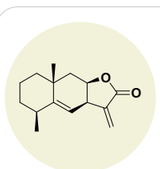
T5S0993
Kurarinone
Source: Sophora



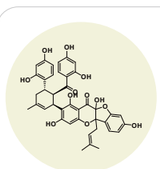
TN1073
Nuezhenidic acid
Source: Ligustrum



T2961
Notoginsenoside R1
Source: Panax



T2896
Alantolactone
Source: Inula

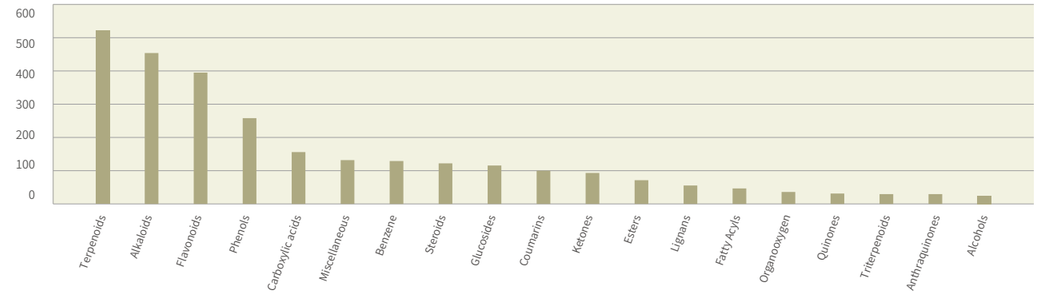


T4S1615
Sanggenon C
Source: Morus

2、Diverse Structures

The structures and functions of natural products have been selected and optimized over long evolutionary processes. These compounds exhibit high structural diversity through various chemical processes such as redox reactions, scaffold rearrangements, and cyclization. Their unique chemical structures enable natural products to specifically interact with biological targets, demonstrating significant biological activity.

TargetMol offers over 16,000 natural product monomers, covering a wide range of typical structural types, including flavonoids, alkaloids, quinones, lignans, and anthocyanins from plants, as well as polysaccharides, enzymes, antibiotics, and amino acids from microorganisms. The detailed and comprehensive classifications allow researchers to select the appropriate natural products based on their needs.

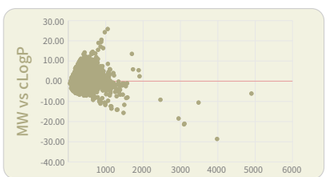


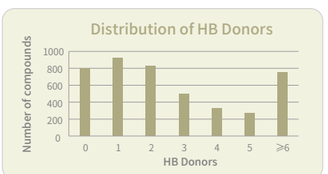
3、Optimal Drug-like Properties

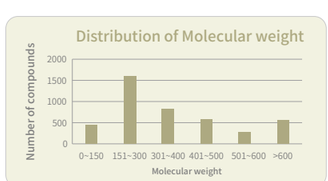
In drug R&D, drug-likeness is a key indicator used to guide drug screening and design, aiming to identify compounds with potential bioactivity. Optimizing drug-likeness not only helps scientists discover new drug candidates or improve the structure of existing drugs, enhancing their pharmacological properties, biological activity, and safety, but also effectively reduces R&D costs and risks, shortens development cycles, and improves R&D efficiency.

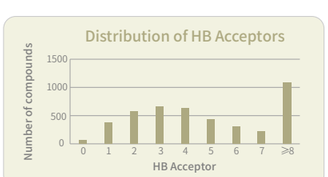
TargetMol's natural products meet the Rule of 5 (RO5), demonstrating exceptional drug-likeness and therapeutic potential. They serve as high-quality tools for drug screening and cell induction studies, offering scientists the possibility to rapidly screen and optimize drug candidates during the drug development process.

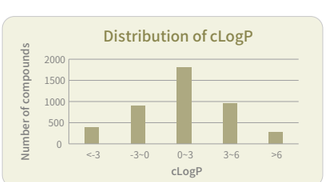
% of compounds compliant with Lipinski' s Rules	
PhysChem Properties	% Compounds
Hbond donors <5	83%
HBond acceptors <10	85%
cLogP<5	90%
MW<500	81%











Popular Natural Products

ID	Name	Description
T6116	Bleomycin Sulfate	Bleomycin Sulfate is a glycopeptide antibiotic and an inhibitor of DNA synthesis. It has antitumor activity.
T6740	Bafilomycin A1	Bafilomycin A1 belongs to the macrolide class of antibiotics and is an inhibitor of the late phase of autophagy. It also induces apoptosis.
T6758	Anisomycin	Anisomycin is an antibiotic isolated from various Streptomyces species. It interferes with protein and DNA synthesis by inhibiting peptidyl transferase or the 80S ribosome system.
TN6763	Taxusin	Taxusin is a natural product form Taxus wallichiana.
T10065L	2',3'-cGAMP Sodium	2',3'-cGAMP sodium is a second messenger in cellular innate immunity and is catalyzed by cGAMP synthase under DNA binding conditions. 2',3'-cGAMP sodium binds to STING to form a dimer, inducing the production and expression of interferon-β and other cytokines.
T1020	Doxorubicin Hydrochloride	Doxorubicin hydrochloride belongs to the anthracycline class of antibiotics and is an inhibitor of human DNA topoisomerase I/II (IC50=0.8/2.67 μM). Doxorubicin hydrochloride exhibits cytotoxicity and antitumor activity.
T0968	Paclitaxel	Paclitaxel is a natural product and a microtubule polymer stabilizer. Paclitaxel has anti-tumor activity and causes cell death by inducing mitotic arrest, apoptosis, and cell autophagy.
T11855	Lipopolysaccharides	Lipopolysaccharides (LPS) is a unique component of the cell wall of Gram-negative bacteria and is a highly immunogenic antigen that can enhance immune responses and can be used for inflammation model construction.
T1537	Rapamycin	Rapamycin is a natural product of macrolides, an mTOR inhibitor with specificity (HEK293 cells: IC50=0.1 nM). Rapamycin has immunosuppressive activity and induces autophagy.
TQ0198	Phorbol 12-myristate 13-acetate	Phorbol 12-myristate 13-acetate (PMA) belongs to the phorbol ester group of natural products and is an activator of PKC, SphK, and NF-κB. Phorbol 12-myristate 13-acetate induces THP1 cell differentiation.
T6564	Leupeptin Hemisulfate	Leupeptin hemisulfate is a protease inhibitor with cell membrane-permeable, reversible, competitive, and oral activities.
T2939	Forskolin	Forskolin is a natural product, an adenylate cyclase activator (EC50=0.5 μM). Forskolin produces positive inotropic effects in the heart, and has platelet anticoagulant and antihypertensive effects.
T2219	Puromycin Dihydrochloride	Puromycin dihydrochloride is a cinnamamide adenosine antibiotic and an inhibitor of protein synthesis. Puromycin dihydrochloride inhibits protein synthesis by binding to RNA and has antitumor and antitrypanosomal activity.
T1879	3-Methyladenine	3-Methyladenine is a PI3K inhibitor that selectively inhibits class IB PI3Kγ (IC50=60 μM) and class III VPS34 (IC50=25 μM). 3-Methyladenine inhibits autophagy.
T6270	Trichostatin A	Trichostatin A is a histone deacetylase inhibitor (IC50=1.8 nM) that is reversible and specific. Trichostatin A leads to the hyperacetylation of core histones, which regulates chromatin structure.
T7040	Angiotensin II Human	Angiotensin II human is a biologically active peptide, a vasoconstrictor. It interacts with AT1R and AT2R to regulate blood pressure, stimulate sympathetic nerves, and increase aldosterone biosynthesis and renal activity in humans.
T6213	Vinorelbine Ditartrate	Vinorelbine ditartrate (KW-2307) is a natural alkaloid and an anti-mitotic agent. Vinorelbine ditartrate has anti-tumor activity, inhibiting cell proliferation and inducing apoptosis.
T6680	Staurosporine	Staurosporine is a protein kinase inhibitor with ATP-competitive and non-selective inhibitory activity (IC50=6/15/2/3/3000 nM) against PKC, PKA, c-Fgr, phosphorylase kinase and TAOK2. Staurosporine also induces apoptosis.
T4931	Dihydroxyfumaric Acid Hydrate	Dihydroxyfumaric acid is a known generator of superoxide anions and by hydroxyl free radicals.
T4721	β-Nicotinamide Mononucleotide	β-nicotinamide mononucleotide is a natural nucleotide and a key intermediate in the synthesis of coenzyme I (NAD+).
T6S0923	Hypericin	Hypericin is a natural anthraquinone compound, an extract of Hypericum perforatum.
T5771	Hypocrellin A	Hypocrellin A is PKC inhibitor, has light-induced antitumor,antifungal and antiviral activities.
T2896	Alantolactone	Alantolactone, a sesquiterpene lactone, has potential activity against triple-negative breast Y MDA-MB-231 cells by suppressing the signal transducer and activator of transcription 3 (STAT3) signaling pathway.
T8716	Physalin F	Physalin F is a natural blocker of CaV2.3 (R-type) and CaV2.2 (N-type) voltage-gated calcium channels.

TargetMol's Natural Product Libraries

With rich experience in the field of natural products, TargetMol has established over 30 natural product libraries. These libraries encompass more than 4,500 natural product monomers suitable for high-throughput screening and over 16,000 for virtual screening, derived from more than 3,000 herbs, animals, plants, and microorganisms. Natural product research faces two major challenges:

How to isolate and purify sufficient quantities of natural product monomers for research;

Once promising monomers are identified, how to optimize their structures to improve drug-like properties.

To address these challenges, TargetMol offers:

1、High-Quality Natural Product Libraries

TargetMol's Natural Product Library features a diverse selection of structurally unique and highly active natural products derived from plants, animals, microorganisms, and marine organisms. These products include flavonoids, alkaloids, glycosides, phenols and other structural types, covering over 500 different scaffolds and more than 1,000 target receptors. Most of the components reach reference standard purity. They are characterized by high purity, excellent quality, novel structures, and diverse activities, making them suitable for high-throughput screening, high-content screening, new drug development, and pharmacological research.

Natural Product Library for HTS —— L6000

Clear Sources: A unique collection of active natural products sourced from plants, animals, and microorganisms, with detailed information of the plant species and their precise English and Latin names.

Good Structural Diversity: Includes various compound structure types, such as flavonoids and alkaloids, etc.

Comprehensive Information: Provides detailed descriptions from chemical structures to solubility, from signaling pathways to specific targets and their bioactivities.

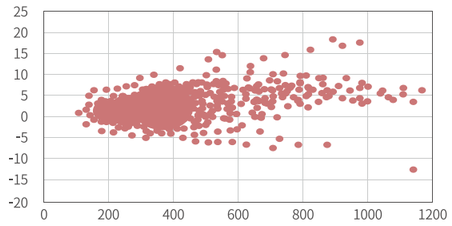
Highly Customizable: Offers customization service based on the source, category, research field, and drug market of natural products.

Analysis of Drug-likeness

% of compounds compliant with Lipinski' s Rules

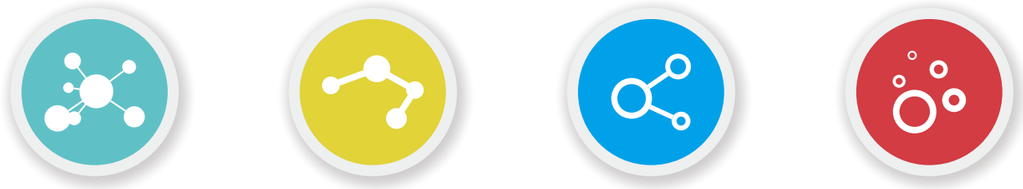
PhysChem Properties	% Compounds
<5 HBond donors	73
<10 HBond acceptors	80
cLogP<5	91
MW<500	79

cLogP vs MW



2、Optimized Natural Product Derivatives Libraries

Natural products are not only a valuable treasure for drug discovery but also a continuous source of novel structures and innovative ideas. Between 1998 and 2004, 21 derivatives of natural products successfully reached the market. In the following five years, another 19 natural product derivatives were approved. These natural products and their derivatives have not only enriched the drug library but are also widely used as effective tools for studying and modulating protein functions.



Natural Product Derivatives Library —— NY1000

- The library consists of more than 3745 members belonging 22 scaffolds (average 180 compounds per scaffold);
- The library includes the following sub-libraries: Cytisine-based sub-library, Matrine-based sub-library, Podophyllotoxin-based sub-library, Sub-library based on naturally occurring privileged BBS such ashydroxy-prolines, triptamine, nor-tropolone etc;
- Over 75% of derivatives comply with the Rule of 5 (RO5) and Veber's Rule;
- Reactive compounds and toxic substances are rigorously excluded;
- HNMR and HPLC validated to ensure high purity and quality;
- All products are supplied and delivered quickly.

Drug-like natural compound library —— DF4600

- A curated collection of 527 natural product compounds with novel structures and excellent research value;
- Compliant with the Rule of 5 (RO5), exhibiting good drug-likeness and high drug development potential;
- HNMR and HPLC validated to ensure high purity and quality.

3、Database for Virtual Screening

Natural products have long been a valuable source for exploring new molecules and therapeutic mechanisms. With the rapid advancement of scientific research, especially the development of high-throughput screening and virtual screening technologies, the demand for natural products and their derivatives has significantly increased. However, traditional natural product extraction and synthesis processes are not only time-consuming and labor-intensive but also often limited by the availability of raw materials and the complexity of synthesis, restricting their application in large-scale screening.

TargetMol has developed the Natural Product Derivatives Library for CADD (L6030), which contains over 163,000 derivatives. They not only retain the key bioactive structures of natural product scaffolds but also enhance their application potential through structural diversification. This library is highly suitable for virtual screening and expands the selection range in the screening process.

Additionally, to address the challenge of obtaining physical natural products during the transition from virtual screening to experimental validation, TargetMol introduces Selectable Natural Product Library (L6020).

Selectable Natural Product Library —— L6020

- A unique collection of over 16,000 natural products with diverse structures and sources covering various plant, animal, and microbe species;
- Free SDF data available for each compound structure in this library, an effective tool for virtual screening;
- All products are supplied and delivered quickly;
- NMR and HPLC/LCMS validated to ensure high purity and quality.

4、More Natural Product Libraries

Classified by Structure

ID	NAME	QUANTITY
L6100	Polyphenolic Natural Product Library	600+
L6110	Alkaloid Natural Product Library	500+
L6120	Flavonoid Natural Product Library	500+
L6130	Terpene Natural Product Library	600+

Classified by Source

ID	NAME	QUANTITY
L6400	Marine Natural Product Library	100+
L6500	Microbial Natural Product Library	600+
L4600	Selected Plant-Sourced Compound Library	3,000+
L2500	Human Endogenous Metabolite Library	400+
L2501	Human Endogenous Metabolite Compound Library Plus	1,200+

Classified by Disease

ID	NAME	QUANTITY
L6600	Anti-Gastroenteritis Natural Product Library	200+
L6610	Anti-infective Natural Product Library	1,000+
L6620	Antiparasitic Natural Product Library	200+
L6700	Anti-Tumor Natural Product Library	1,700+
L6710	Anti-Inflammatory Traditional Chinese Medicine Compound Library	1,000+
L6720	Anti-COVID-19 Traditional Chinese Medicine Compound Library	1,000+

Characteristic Natural Product Libraries

ID	NAME	QUANTITY
L6020	Selectable Natural Product Library	16,000+
L6150	Covalent Natural Product Library	500+
L6160	RO5 Drug-like Natural Product Library	2,000+
L6900	Rare Natural Product Library	600+
L6170	Flavor Compound Library	400+

Others

ID	NAME	QUANTITY
L6210	Tibetan medicine Compound Library	700+
L6300	Food as Medicine Compound Library	1,400+
L6800	Chinese Pharmacopoeia Natural Product Library	2,000+
L6810	Traditional Chinese Medicine Monomer Library	2,900+

Advantages of TargetMol's Natural Product Libraries

Diverse
Sources & Structures

Good
Drug-likeness

Rich
Bioactivity

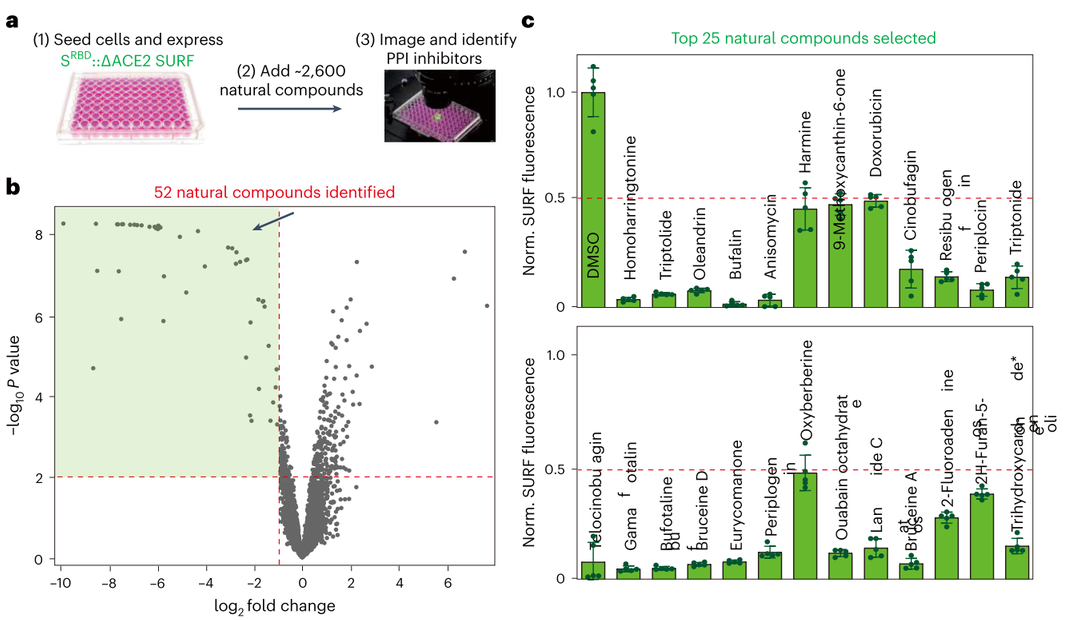
Sustainable
Biological Origins

Application Cases

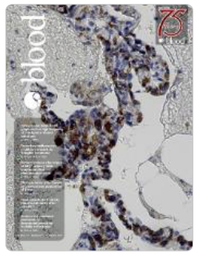
Nature microbiology vol. 8,1 (2023): 121-134. IF:28.3

A library of natural compounds containing 2,592 compounds (TargetMol, no. L6000) [redacted] were used for HTS. For each screening, HEK293T cells were transfected with S^{RBD}::ΔACE2 SURF using polyethylenimine and seeded onto 96-well plates at ~5,000 cells per well, 6 h after transfection. One day after seeding, compounds were

Researchers utilized a novel fluorescent reporter molecule named SURF to monitor in real-time the interaction between the Spike protein of the SARS-CoV-2 coronavirus and the host receptor ACE2 in live cells. Through high-throughput screening of the **TargetMol Natural Product Library**, the study identified three natural compounds that effectively block the replication of SARS-CoV-2 and its Delta and Omicron variants in Vero cells and human primary nasal epithelial cells. Among them, bruceine A (T2S2046) and gamabufotalin (T4A2456) exhibited significant antiviral activity, reducing viral titers in the lungs and brains of mice, decreasing lung inflammation, and thereby inhibiting disease progression.



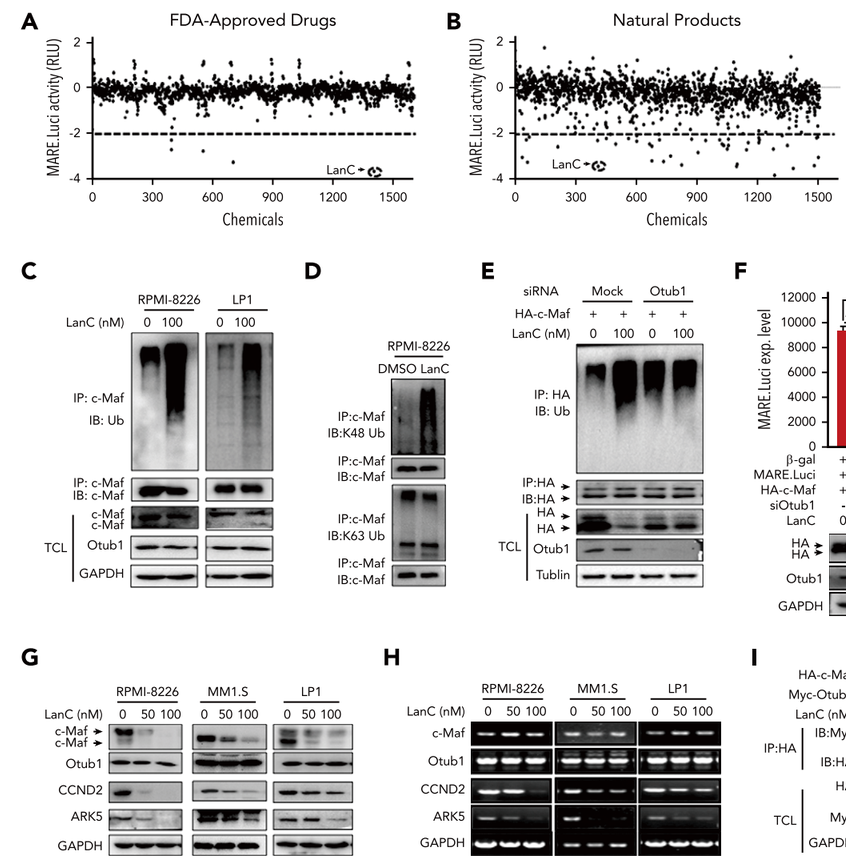
Blood vol. 137,11 (2021): 1478-1490. IF:20.3



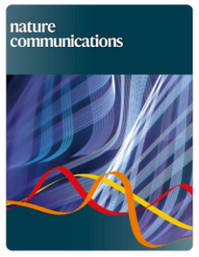
Chemicals, antibodies, and plasmids

[redacted]. Lanatoside C (LanC), the US Food and Drug Administration (FDA)-approved drug library, and the Natural Products Library were obtained from Targetmol (Wellesley Hills, MA). The Maf plasmids were obtained as described previously.[8,11]

In a study targeting multiple myeloma (MM), researchers conducted a luciferase screening experiment using **TargetMol's FDA-approved drug library (L4200) and natural product library (L6000)**. They discovered that the natural product Lanatoside C (LanC) can prevent the deubiquitination of c-Maf and disrupt the interaction between Otub1 and c-Maf, thereby inducing apoptosis in MM cells expressing c-Maf. This effectively inhibited the growth of MM and extended the survival of the model mice. The study confirms that the Otub1/c-Maf axis is a potential therapeutic target for MM.

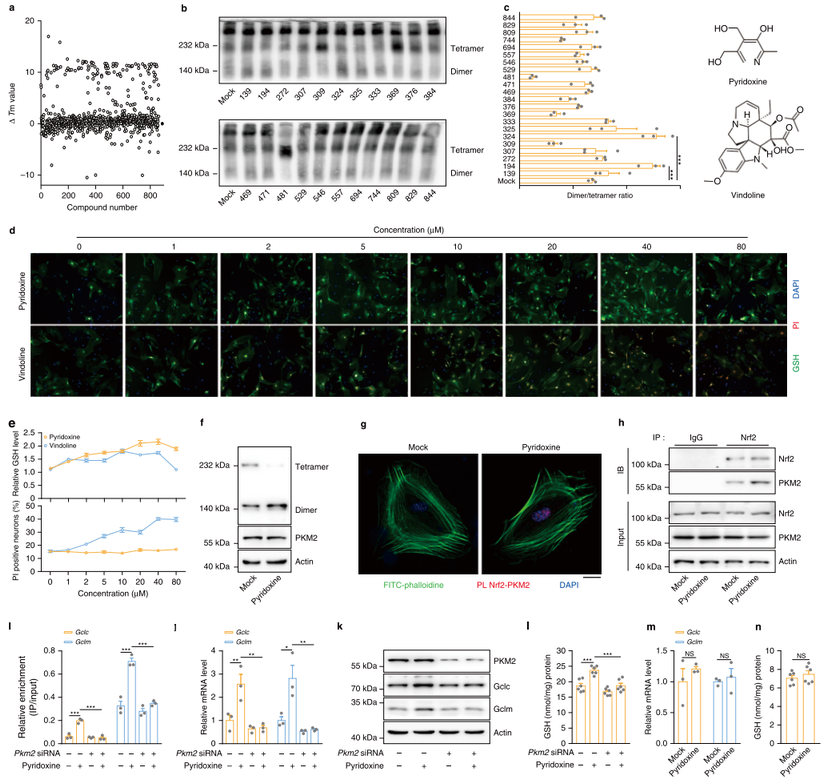


Nat Commun. 2020 Feb 18;11(1):941. IF:14.7



Pyridoxine facilitates GSH synthesis via the PKM2-Nrf2 pathway. First, we performed an initial screen of 863 natural products purchased from TargetMol by intrinsic tryptophan differential scanning fluorimetry (nanoDSF) to explore molecules that may directly bind with PKM2. According to the shifts in Tm values, we selected 22 molecules based on the highest ΔTm values

Here Researchers report that the astrocytic dopamine D2 receptor (DRD2) regulates GSH synthesis via PKM2-mediated Nrf2 transactivation. In addition,Researchers performed an initial screen of 863 natural products from TargetMol by intrinsic tryptophan differential scanning fluorimetry (nanoDSF) to explore molecules that may directly bind with PKM2, and further verified their ability to dimerize PKM2 by BN-PAGE. They find that pyridoxine can dimerize PKM2 to promote GSH biosynthesis. Further experiments show that pyridoxine supplementation increases the resistance of nigral dopaminergic neurons to 1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine (MPTP)-induced neurotoxicity in wild-type mice as well as in astrocytic Drd2 conditional knockout mice.It is concluded that dimerizing PKM2 may be a potential target for PD treatment.



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Natural product library

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