Anti-apoptosis mechanism of triptolide based on network pharmacology in focal segmental glomerulosclerosis rats

Running title: Triptolide inhibited apoptosis in FSGS rats

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Abstract

Triptolide (TPL), the active component of Tripterygium wilfordii, exhibits anti-cancer and antioxidant functions. We aimed to explore the anti-apoptosis mechanism of TPL based on network pharmacology and in vivo and in vitro research validation using a rat model of focal segmental glomerulosclerosis (FSGS). The chemical structures and pharmacological activities of the compounds reported in T. wilfordii were determined and used to perform the network pharmacology analysis. The Traditional Chinese Medicine Systems Pharmacology Database (TCMSP) was then used to identify the network targets for 16 compounds from Tripterygium wilfordii. Our
results showed that 47 overlapping genes obtained from the GeneCards and OMIM databases were involved in the occurrence and development of FSGS and used to construct the protein-protein interaction (PPI) network using the STRING database. Hub genes were identified via the MCODE plug-in of the Cytoscape software. *IL4* was the target gene of TPL in FSGS and was mainly enriched in the cell apoptosis term and p53 signaling pathway, according to Gene Ontology (GO) and Kyoto Encyclopedia of Genes and Genomes (KEGG) pathway enrichment analyses. TPL inhibited FSGS-induced cell apoptosis in rats and regulated IL4, nephrin, podocin, and p53 protein levels via using CCK8, TUNEL, and western blot assays. The effects of IL4 overexpression, including inhibition of cell viability and promotion of apoptosis, were reversed by TPL. TPL treatment increased the expression of nephrin and podocin and decreased p53 expression in rat podocytes. In conclusion, TPL inhibited podocyte apoptosis by targeting IL4 to alleviate kidney injury in FSGS rats.

**Keywords:** triptolide; network pharmacology; IL4; apoptosis; FSGS.

**Introduction**

Focal segmental glomerulosclerosis (FSGS) is a clinical pathological syndrome, and its typical pathological feature is sclerosing lesions in the focal glomeruli and in the glomerular segment. The clinical manifestations of FSGS patients are massive proteinuria, hematuria, hypertension, and progressive decrease in renal function. The condition of 3.6% of patients with end-stage renal disease developed from FSGS [1, 2]. Currently, the main clinical therapies for FSGS are immunologic drugs, glucocorticoids, and blockers of the renin angiotensin system; however, their therapeutic effects are not satisfactory. [3]. TPL is the most active and effective diterpene lactone epoxide compound isolated from Tripterygium. [4]. TPL has anti-inflammatory, anti-tumor, and immunologic effects on many diseases [4]. TPL inhibits the secretion of many cytokines, adhesion molecules, and chemokines and affects the functions of various cells, including dendritic cells and renal tubular epithelial cells [5, 6]. TPL has been reported to alleviate the progression of glomerulosclerosis and the excretion rate of urinary albumin to inhibit the progression of diabetic neuropathy [6]. However, the effects and mechanism of TPL in FSGS are still unclear. We explored the mechanism of FSGS-mediated podocyte pathogenesis.
based on the FSGS rat model. This study has great significance for the diagnosis, prevention, and treatment of FSGS.

In the past, research on Chinese herbal extracts focused on a particular aspect and on finding the biological characteristics explaining the pharmacological effect with respect to this aspect [7]; however, this approach is usually one-sided. It is important to explore the relation between the acquired proof and the research results. With the development of bioinformatics and network pharmacology, proposal of a theory and proving this theory through experiments has become the main method to explore the mechanism of Chinese herb compounds [8].

Network pharmacology is based on high-throughput omics data analysis, virtual computer computing and network database retrieval, and it combines systems biology with multidirectional pharmacology [9]. The mechanism of drug action was researched via the construction and analysis of biological networks. The systematic and holistic nature of network pharmacology is consistent with the characteristics of Chinese herbs, which exhibit multi-components, multi-targets, and systematic regulation. It has been widely used to explore the pharmacological basis of Chinese medicine and the drug mechanism and to interpret drug compatibility [10, 11]. Network pharmacology has been recognized by many Chinese medicine researchers [12]. The multi-component and multi-target network research mode breaks the traditional research mode of a single ingredient and a single target, providing a new method for comprehensive analysis of the mechanism of the compounds [13]. In the early stage, a total of 47 target genes and the corresponding 16 active constituents of Tripterygium were used to construct the ingredient-target network. This study mainly explores the mechanism of TPL in FSGS through bioinformatics and functional experiments.

Materials and Methods

Construction of the Potential Compound Database for Tripterygium

Using the Traditional Chinese Medicine Systems Pharmacology Database and Analysis Platform (http://lsp.nwu.edu.cn/tcmsp.php, TCMSP), each candidate's drug ability was analyzed according to its oral bioavailability (OB) and drug-likeness (DL) indices recommended by the TCMSP. OB refers to the degree and rate of drug
absorption into the circulatory system, which is an important indicator for objectively
evaluating the intrinsic quality of drugs. The higher the OB of the compound, the
more likely it is to be developed for clinical application. DL is the sum of the
pharmacokinetic properties and safety, which arises from the interactions among the
physicochemical properties and structural factors, including solubility, permeability,
and stability. It can be used to optimize compounds, analyze the results of drug
activity, predict in vivo pharmacokinetics, direct structure modifications, etc. As the
TCMSP recommends, molecules with OB≥30% and DL≥0.18 were considered to
exhibit relatively better pharmacological properties and were screened out as
candidate compounds for further analysis.

Construction of the Disease-Target-Compound Network

To comprehensively understand the molecular mechanisms, disease-compound-target
networks were constructed using the Cytoscape visualization software 3.7.1. All
target genes related to FSGC were obtained from the GeneCards database
(https://www.genecards.org/). All the candidate compounds of Tripterygium were
retrieved from the TCMSP to obtain the associated targets. Next, disease, compounds,
and targets were inputted into the software, and a disease-compound-target interaction
network was constructed. In the process of constructing the network, the layout
algorithm (attribute circle layout) was applied. We can set the geometric position of
every node and visually display the network topology using color, graphics, and
symbols, making reasonable arrangements for every node and creating a clear visual
effect. Degree and betweenness centrality are two important parameters of the
topology structure, which were used to evaluate the essentiality of each target and
compound.

PPI network construction and module analysis

Search Tool for the Retrieval of Interacting Genes (STRING, https://string-db.org) is
an online tool and used to construct the PPI network with confidence network edges
and a medium confidence of 0.400 as the product criteria. Cytoscape 7.1.0 was used
to perform the visualization of PPI network. The Molecular Complex Detection
(MCODE) plug-in was used to screen the significant modules in the PPI network with
a degree cut-off = 2, node score cut-off = 0.2, k-core = 2, and maximum depth = 100.
The corresponding proteins in the central nodes and highly degree were potential core
proteins encoded by key candidate genes that have important physiological regulatory functions.

**GO terms and KEGG pathway enrichment analysis**

The Database for Annotation, Visualization and Integrated Discovery (DAVID) database was used to perform GO enrichment analysis and KEGG pathway enrichment analysis. The GO terms were classified into three categories: Biological process (BP); cellular component (CC); and molecular function (MF). P<0.01 was considered to indicate a statistically significant difference.

**Animals**

A total of 40 Sprague Dawley (SD) rats (male, weighing 160-180 g) were provided by Yison Bio co.LTD (Shanghai, China). Animals were housed individually in polycarbonate cages with wood chip bedding and were maintained in an air-conditioned animal room (temperature: 24 ℃, relative humidity: 55±5%) on a 12 h light/dark cycle. Each animal experiment was carried out following the local Care for Laboratory Animals guidelines formulated by the Animal Experimental Center. The Ethics Committee had approved the studies using laboratory animals at the Guangxing Affiliated Hospital of Zhejiang Chinese Medical University.

**FSGS model Establishment**

All rats were randomly divided into a sham operation group (Sham), model group (FSGS), a group administered 80 mg/(kg·d) of Tripterygium by gavage (TPL(80)+FSGS), and a group administered 160 mg/(kg·d) of Tripterygium by gavage (TPL(160)+FSGS) (n=10 rats/group). One day before the operation, the TPL (80 or 160)+FSGS groups were administered TPL (Purifa Technology Development Co. Ltd., Chengdu, Sichuan, China) 80 or 160 mg/(kg d) by gavage; the Sham and FSGS groups were given isovolumic normal saline till the end of the experiment. The animals were intraperitoneally anesthetized with pentobarbital sodium (60 mg/kg body weight) and then placed on a homeothermic pad to maintain a core body temperature of 37 ℃ to establish the FSGS model. The rats were first subjected to unilateral nephrectomy (left side) on day 1 and then injected in the caudal vein with adriamycin 5 mg/kg (on day 7) and adriamycin 3 mg/kg (on day 28) dissolved in 0.9% saline at a dilution of 2 mg/ml. Meanwhile, the kidneys of the control rats were exposed without dissecting the kidney tissue, followed by layer-by-layer suturing.
These rats were then injected with saline on days 7 and 28 through the tail vein after the sham operation. Eight weeks post-surgery, blood samples were obtained from the tail veins, and the animals were euthanized. Following adequate anesthesia with pentobarbital sodium (180 mg/kg body weight), the organs were removed, frozen, or fixed in 4% paraformaldehyde. The serum and whole kidneys were harvested for biochemical, histological, and molecular analyses. The urinary protein levels of the rats were quantified before the end of the experiment. Animals with >100 mg/24 h urinary protein indicated successful establishment of the model, and they were included in subsequent experiments.

**Histological analyses**

The kidney tissues were fixed with 4% paraformaldehyde and embedded in paraffin. For histological analysis of lesions, 3 μm thick tissue sections were deparaffinized and stained with hematoxylin and eosin (HE) and periodic acid-Schiff (PAS). To calculate the degree of focal glomerular sclerosis, 40 to 60 glomeruli from each stained specimen were examined. The degree of sclerosis in each glomerulus was subjectively graded on a scale of 0 to 4 as follows: Grade 0, no change; Grade 1, sclerotic area less than or equal to 25% of the glomerulus or the presence of distinct adhesion between the capillary tuft and Bowman’s capsule; Grade 2, sclerosis of 25 to 50% of the total glomerular area; Grade 3, sclerosis of 50 to 75% of the total glomerular area; and Grade 4, sclerosis of more than 75% of the glomerulus. The glomerular sclerosis index (GSI) was calculated using the following formula:

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GSI = \frac{(1 \times N1) + (2 \times N2) + (3 \times N3) + (4 \times N4)}{(N0+N1+N2+N3+N4)},
\]

where N is the number of glomeruli for each grade of sclerosis.

**Terminal dUTP nick-end labeling (TUNEL) staining**

An apoptosis detection kit (Promega, Madison, WI) was used to detect apoptosis according to a previously described method [14]. In brief, renal sections were subjected to TUNEL staining in accordance with the manufacturer’s instructions. Later, IF microscopy was used to analyze the samples using a Zeiss Axiovert 200 M fluorescent microscope equipped with an AxioCamMR3 camera. Six fields (magnification 400×) were randomly selected from every section from 10 different rats, and cells with positive TUNEL staining were analyzed.
Glucose treatment and cell culture

Rat glomerular podocytes were provided by Yubo Bio-Technique Co. Ltd (Shanghai, China), which were then cultivated according to a previously described method. Rat podocytes were cultivated in RPMI 1640 (Sigma-Aldrich, U.S.A.) containing streptomycin (100 μg/ml), penicillin (100 U/ml) (Solarbio, Beijing, China), and 10% fetal bovine serum (FBS, Gibco, NY, Grand Island). Subsequently, the cells were cultivated in a 5% CO₂ incubator (Heraeus, Japan) at 33 °C with interferon-γ (IFN-γ, 40 units/ml, Sigma, St Louis, MO, U.S.A.). Later, to induce differentiation, the podocytes were maintained at 37 °C for 2 weeks in the absence of interferon.

Podocytes (3 × 10⁵ cells/ml) were plated into 6-well plates in the presence of complete medium. After 24 h of standing, the podocytes were subjected to 24 and 48 h of TPL treatment at different concentrations (0, 5, 10, 20, 40, and 80 μmol/ml) before they were collected for subsequent analysis.

Transient transfection of plasmid DNA or siRNA

The previously described human IL4 plasmid DNA at full length [15] was utilized to increase IL4 expression in cells via using transient transfection. pcDNA3.1-Myc/His EV plasmid (Life technologies) and On-Target Plus scramble RNA (Dharmacon)
were used as transient transfection controls. Sequences for IL4 overexpression was

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ACAU UACU GCCUGAAGGGUGAAUUAACGC.
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**Counting Kit-8 (CCK-8) assay**

Cells were grown into the 96-well plates at the density of $1 \times 10^5$ cells/well, followed by 24 and 48 h of culture. Afterwards, cell viability was detected via using the CCK-8 kit (Dojindo Molecular Technologies, Gaithersburg, MD, U.S.A.). Then, cells in each group were cultivated for additional 24 and 48 h, respectively. Next, the CCK8 solution (10 μl) was added into cell at 37°C for 4 h. The absorbance was determined at 450 nm for obtaining the cell growth curve by the iMark microplate absorbance reader (Bio-Rad Laboratories, Inc., Hercules, CA, U.S.A.). Each experiment was carried out in triplicate.

**Apoptosis detected by flow cytometry using Annexin V-FITC/PI staining**

Cell apoptosis was examined using the Annexin V-FITC/PI kit. Briefly, the cells were subjected to 0.25% trypsin digestion (Thermo Fisher Scientific, Waltham, MA, U.S.A.), followed by two washes with cold PBS; resuspension with 5 μl of PI, 5 μl of annexin V-FITC, and 500 μl of binding buffer; and incubation under 15 min of ambient temperature in the dark. Typically, Annexin V-FITC can bind to phosphatidylserine located on the outer apoptotic cell membrane, whereas PI can penetrate and stain cells with impaired membranes before binding to and labeling DNA. Data were collected using a flow cytometer (BD FACSCalibur; BD Biosciences, Franklin Lakes, NJ, U.S.A.) and analyzed by FlowJo. Clumped cells were excluded from the FSC-H/FSC-A dot plot for selecting the single cells. Cells in the annexin V-FITC-/PI+, annexin V-FITC+/PI+, and annexin V-FITC+/PI− quadrants were regarded as apoptotic cells.

**Western blotting**

Cells were subjected to lysis within the RIPA buffer (Beyotime, Shanghai, China) to collect the lysates in tubes, followed by 20 min of centrifugation at 4 °C at 12,000 g. Later, all supernatants were extracted, and protein content was measured by the BCA Protein Quantitative Kit (Beyotime, Shanghai, China). Then, Western blotting had been carried out in accordance with the instruction. Afterwards, 20 μg protein was subjected to 10% SDS-PAGE for separation, followed by transfer onto the PVDF...
membranes (Millipore, Billerica, MA, U.S.A.). Later, the membranes were blocked using 5% skimmed milk for 1 h, followed by overnight incubation with anti-IL-4 (dilution 1:8000, Abcam, Cambridge, MA, U.S.A., ab69811), nephrin (Abcam, ab227806; diluted at 1:1,200), podocin (Abcam, ab50339; diluted at 1:1,000), phospho-(p)-Stat6 (BioVision, U.S.A., 3476-100; diluted at 1:1,000), and GAPDH (Abcam, Cambridge, MA, U.S.A., ab181602; dilution 1:1,000) rabbit anti-human antibodies, at 4 °C, separately. Afterwards, cells were subjected to 1 h incubation with HRP-labeled secondary antibody (goat anti-rabbit antibody, Abcam, Cambridge, MA, U.S.A., ab116282; dilution 1:2,000), prior to ECL detection. The Immobilon Western Chemiluminescent kit (WBKLS0100; Millipore, U.S.A.) was used to reveal the reactive bands using Roche Cobas e601 automated chemiluminescence image analysis system (Roche, U.S.A.).

Reverse transcription-quantitative polymerase chain reaction (RT-qPCR) assay

The GAPDH and IL-4 mRNA expression was detected through RT-qPCR. Total cellular RNA was isolated by TRIzol (Invitrogen, Carlsbad, CA, U.S.A.) in accordance with manufacturer protocols. Afterwards, cDNA was synthesized by reverse transcription of RNA according to the reactions below: RNase-free dH2O, total RNA (500 ng), and 5×PrimeScript RT Master Mix (2 μl) were added until the final volume became 10 μl. The Prism 7500 (ABI, Foster City, CA, U.S.A.) was employed for real-time PCR following the standard protocol of SYBR green assay.

Primers used in this study were shown below: IL-4-F: 5'-GATCACAAAGTACTGGTCCTGG-3'. Notably, GAPDH served as a normal control, with the primers of 5'-CACCTGTTGCTGTAGCCAAA-3' (reverse) and 5'-TGACTTCAACACGACACCCA-3' (forward). Later, qPCR was carried out in triplicate using 7500 Real-Time PCR ABI system (ABI, U.S.A.) at a format of the 96-well plate. The reaction volume of 20 μl was prepared for PCR, which included forward primer (0.8 μl, 10 μM), RNase-free dH2O (7.4 μl), reverse primer (0.8 μl, 10 μM), 2×FastStart Universal SYBR Green Master (10 μl, ROX; Invitrogen, Guangzhou, China), and cDNA (1 μl). Besides, the PCR conditions were as follows, 10 min at 95 °C, followed by 15 sec at 95 °C for 40 cycles, and 1 min at 60 °C. The sequence detection software (1.6.3, Applied Biosystems, ABI, U.S.A.) was used for data analysis. Relative GAPDH or IL-4 mRNA level was measured and standardized according to 2-ΔΔCt method based on GAPDH.
Statistical analyses

SPSS 15.0 (http://spss.en.softonic.com/) was employed for all statistical analyses. Differences between two groups were analyzed through independent sample t-test, whereas those among several groups were examined by one-way analysis of variance (ANOVA). Rate was compared by chi-square test. The statistically significant level was set as $P<0.01$ or $P<0.05$.

Results

Identification of Active Compounds in Tripterygium wilfordii

Using TCMSP databases (http://lsp.nwsuaf.edu.cn/tcmsp.php), 144 compounds of Tripterygium were retrieved. According to the criteria of $DL \geq 0.18$ and $OB \geq 30\%$, a total of 51 chemical ingredients were selected (Table 1). TPL was verified as an active ingredient of $T. wilfordii$.

Construction of the Disease-Target-Compound Network and PPI Network

The TCMSP and GeneCards databases were used to predict the potential targets for each compound in FSGS. As a result, 123 target genes from the GeneCards database were verified to be involved in FSGS (Table 2), and 695 target genes of Tripterygium from the TCMSP database were verified (Table 3). After importing data into Cytoscape, a disease-compound-target network was constructed (Figure 1A). In addition, 47 overlapping target genes from two databases (TCMSP and GeneCards) were used to construct the PPI network. $IL4$ obtained from the most significant module of the PPI network was verified as a key by using the MCODE plug-in of Cytoscape software, and it was found to be involved in FSGS (Figure 1B, 1C, and 1D).

Enrichment Analysis of GO and KEGG

Forty-seven overlapping targets were screened for further investigation using the DAVID (http://david.ncifcrf.gov/) online tool. GO annotation results showed that the top 30 biological processes (BP) included cell apoptosis, proliferation of cells, positive signal transduction regulation, extracellular stimulus response, and cell death (Figure 2A). The results of KEGG enrichment analysis showed that the 47 overlapping targets were markedly enriched within 32 pathways, including the p53
signal transduction pathway, apoptosis, and the JAK-STAT signal transduction pathway (Figure 2B). IL4 was mainly enriched in BP terms, including programmed cell death regulation, endogenous stimulus response, apoptosis regulation, positive cell proliferation regulation, and positive nitrogen compound metabolic process regulation. Based on the KEGG enrichment results, IL4 participated in the T-cell receptor signal transduction pathway, allograft rejection, intestinal IgA production immunologic network, the JAK-STAT signal transduction pathway, autoimmune thyroid disease, the Fc epsilon RI signal transduction pathway, and the interaction between cytokines and cytokine receptors.

**TPL alleviated kidney injury by inhibiting cell apoptosis in FSGS rats, and IL4 was upregulated in kidney tissues of FSGS rats**

FSGS rat models were established using external jugular vein cannulation; subsequently, the levels of BUN, 24-h urine protein, Scr, ALB, and TC were determined. Our results showed that the BUN, 24-h urine protein, TC, and Scr levels in FSGS animals were evidently decreased, while the ALB levels were significantly increased after the FSGS rats were administered TPL gavage (at 80 or 160 μg/(kg·d)) (Figure 3A-3E). HE staining results showed that TPL significantly decreased the glomerulosclerosis index (GSI) in FSGS rats (Figure 3F and 3G). The apoptosis level was determined by TUNEL assay in the kidney tissues of FSGS rats. We found that FSGS promoted apoptosis in kidney tissues. However, TPL treatment suppressed the apoptosis of cells within the renal tissues of FSGS rats (Figure 4A). Therefore, we further detected the protein levels of IL4, nephrin, and podocin and the phosphorylation level of Stat6 using western blotting. According to our results, TPL treatment decreased IL4 protein levels and stat6 activation, and increased the protein levels of nephrin and podocin in FSGS rats (Figure 4C-4G).

**TPL reversed the function of IL4 overexpression, promoting cell apoptosis**

According to the results, 0-80 μmol/ml TPL had no influence on cell viability and apoptosis (Figure 5A-5C). Western blotting results showed that 0-80 μmol/ml TPL minimally affected IL4, nephrin, and podocin expression and stat6 activation (Figure 5D). However, IL4 overexpression inhibited the viability and promoted apoptosis of podocytes. TPL inhibited IL4 overexpression-mediated cell apoptosis (Figure 6A-6C).
Furthermore, TPL decreased IL4 protein levels, increased nephrin and podocin protein levels, and inhibited the phosphorylation of Stat6 in podocytes (Figure 6D).

**Discussion**

The occurrence of FSGS is related to a variety of mechanisms. Podocyte injury is the central link of FSGS [16, 17]. Glomerular sclerosis is the final pathological change in FSGS caused by the excessive accumulation of the glomerular extracellular matrix (ECM). Podocytes are an important part of the glomerulus and are the final barriers that block the filtration of plasma macromolecules. Apoptosis, fusion, and shedding of podocytes induced the occurrence and development of FSGS. TPL has been reported to have a protective effect on kidney damage [18]. Therefore, we constructed the Disease-Target-Compound network in the current study through the TCM network pharmacology to confirm the relationship between TPL and FSGS. It was further confirmed by constructing a PPT network that IL4 was a target gene of TPL and FSGS. According to KEGG and GO enrichment analyses, IL4 was closely related to apoptosis and was enriched in the JAK-STAT signal pathway. Thus, we proposed two hypotheses: 1. TPL can protect against FSGS kidney injury by inhibiting apoptosis; 2. The protective effect of TPL on FSGS-induced kidney damage may be achieved by targeting IL4.

IL-4 is an anti-inflammatory factor that belongs to the interleukin family [19]. It has been reported that IL4 can inhibit apoptosis of liver cancer cells, and blockage of the IL4/IL4R/STAT6 axis can promote apoptosis of Hodgkin lymphoma cells [20]. However, IL4 may also be involved in the disease as a pro-inflammatory factor [21]. The expression level of IL4 is high in kidney tissue with acute kidney injury [22]. Therefore, the effect of IL4 on FSGS should be more extensively investigated. IL4 activates stat6 by acting on the JAK-STAT signal pathway. Our results demonstrated that IL4 expression and the phosphorylation level of stat6 were upregulated in kidney tissues of FSGS rats. This suggests that the IL/STAT6 signaling pathway is aberrantly activated in FSGS. TPL reduced apoptosis in the kidney tissue of FSGS rats while significantly inhibiting the expression of IL4 and the activation of stat6.

Nephrin and podocin are podocyte proteins that have been widely used to identify kidney injury [23, 24]. It has been reported that podocin and nephrin levels were downregulated in a kidney injury model to promote podocyte apoptosis, thereby
aggravating kidney damage. Podocin and nephrin expression levels were remarkably
downregulated in the kidney tissue of FSGS rats. Similarly, TPL could upgrade the
podocin and nephrin expression levels. This indicated that TPL attenuated glomerular
sclerosis in FSGS rats by reducing podocyte apoptosis. To further investigate the
mechanism of action of TPL on renal protection in FSGS rats, we carried out a study
at the cellular level.

First, we need to investigate if 0-80 µmol/ml of TPL is toxic to podocyte. The
functional experiment proved that TPL at low concentrations did not affect cell
activity; cell apoptosis; the expression of IL4, nephrin, and podocin; and the
activation of stat6, which excluded the threat of TPL for cells. The results showed that
a high expression of IL4 inhibited cell viability, promoted apoptosis, increased
phosphorylation of stat3, and inhibited the expression of nephrin and podocin. This
suggested that a high expression of IL4 promoted apoptosis and aggravated
glomerular sclerosis. TPL can reverse IL4-mediated podocyte apoptosis and reduce
glomerular sclerosis.

In conclusion, upregulation of IL4 in kidney tissue of FSGS rats activated stat6 and
promoted podocyte apoptosis to aggravate glomerular sclerosis. TPL can alleviate
glomerular sclerosis in FSGS rats by inhibiting the activation of the IL4/stat6
signaling pathway and podocyte apoptosis. This finding can offer a theoretical
foundation for the application of TPL in treating FSGS.

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Availability of data and materials

The datasets used and/or analyzed during the present study are available from the
corresponding author on reasonable request.

Ethics approval and consent to participate
Authors' contributions

Yayu Li and Xue Jiang wrote the main manuscript and analyzed the data. Yayu Li, Xue Jiang and Litao Song performed the experiments. Yayu Li, Mengdie Yang and Jing Pan designed the study. All authors read and approved the final manuscript.

Competing interests

The authors declare that they have no competing interests.

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**Figure legends**

**Figure 1.** Constructing the Network of Disease-Compound-Target and PPI network. (A) The triptergium-target network of FSGS; (B) 47 overlapped target genes were from two databases (TCMSP and GeneCards); (C) 47 overlapped target genes were used to constructed PPI network and hub genes in PPI network; (D) Module and key gene were analysis and screened by using the MCODE plug-in Cytoscape software.

**Figure 2.** Analysis of GO and KEGG Enrichment. (A) 47 overlapped genes were analysis by GO annotation, which showed that the top 30 biological processes (BP); (B) 47 overlapped genes was analysis by KEGG, which enriched in 32 pathways.

**Figure 3.** TPL alleviated kidney injure in FSGS rats. FSGS rat models were established by using external jugular vein cannulation, (A) 24 h urine protein (B) BUN (C)Scr (D) TC and (E) ALB levels were detected; (F) TPL could significantly decrease glomerulosclerosis index (GSI) of FSGS rats; (G) The pathomorphology of kidney in FSGS rats was showed by HE staining. Data are presented as the mean ± standard deviation. *P*<0.05 versus Sham group, *P*<0.05 versus FSGS group, and *P*<0.05 versus TPL(80)+FSGS group.

**Figure 4.** TPL reduced cell apoptosis in FSGS rats. FSGS rat models were established by using external jugular vein cannulation, (A and B) Apoptosis level was determined by TUNEL assay in kidney tissues of FSGS rats. (C) The protein levels of IL4, nephrin and podocin, and phosphorylation level of Stat6 by western blotting analysis.
(D-G) Histogram showed the statistical value. GAPDH was used as a load control.

Data are presented as the mean ± standard deviation. $P < 0.05$ versus Sham group, $P < 0.05$ versus FSGS group, and $P < 0.05$ versus TPL(80)+FSGS group.

**Figure 5.** TPL has no influence on the cell viability and apoptosis. (A) 0-80 μmol/ml of TPL little effected the viability of podocytes by CCK8 assay; (B and C) 0-80 μmol/ml of TPL little effected the apoptosis level of podocytes by flow cytometry assay; (D) The protein levels of IL4, nephrin and podocin, and phosphorylation level of Stat6 by western blotting analysis. GAPDH was used as a load control. Data are presented as the mean ± standard deviation. $P < 0.05$ versus Sham group, $P < 0.05$ versus FSGS group, and $P < 0.05$ versus TPL(80)+FSGS group.

**Figure 6.** TPL reversed the function of IL4 overexpression promoting cell apoptosis. (A) IL4 protein and mRNA levels were detected by western blot and RT-PCR assays; (B) The viability of podocytes by CCK8 assay in cell with IL4; (C) The apoptosis level of podocytes by flow cytometry assay in cell with IL4; (D) The protein levels of nephrin and podocin, and phosphorylation level of Stat6 by western blotting analysis. GAPDH was used as a load control. Data are presented as the mean ± standard deviation. $P < 0.05$ versus vector group, and $P < 0.05$ versus IL4 group.
Table 1 Information for 51 chemical ingredients of tripterygium

| Mol ID       | Molecule Name                                           | OB (%) | DL  |
|--------------|--------------------------------------------------------|--------|-----|
| MOL000221    | Mairin                                                 | 55.38  | 0.78|
| MOL000296    | hederagenin                                            | 36.91  | 0.75|
| MOL000358    | beta-sitosterol                                         | 36.91  | 0.75|
| MOL000422    | kaempferol                                             | 41.88  | 0.24|
| MOL000449    | Stigmasterol                                           | 43.83  | 0.76|
| MOL002058    | 40957-99-1                                             | 57.2   | 0.62|
| MOL003182    | (+)-Medioresinol di-O-beta-D-glucopyranoside          | 60.69  | 0.62|
| MOL003184    | 81827-74-9                                             | 44.8   | 0.53|
| MOL003185    | (1R,4aR,10aS)-5-hydroxy-1-(hydroxymethyl)-7-isopropyl-8-methoxy-1,4a-dimethyl-4,9,10,10a-tetrahydro-3H-phenanthren-2-one | 48.84  | 0.38|
| MOL003187    | triptolide                                             | 51.29  | 0.68|
| MOL003188    | Tripchlorolide                                         | 78.72  | 0.72|
| MOL003189    | WILFORLIDE A                                           | 35.66  | 0.72|
| MOL003192    | Triptonide                                             | 67.66  | 0.7|
| MOL003196    | Tryptophenolide                                        | 48.5   | 0.44|
| MOL003198    | 5 alpha-Benzoyl-4 alpha-hydroxy-1 beta,8 alpha-dinicotinoyl-dihydro-agarofuran | 35.26  | 0.72|
| MOL003199    | 5,8-Dihydroxy-7-(4-hydroxy-5-methyl-coumarin-3)-coumarin | 61.85  | 0.54|
| MOL003206    | Canin                                                  | 77.41  | 0.33|
| MOL003208    | Celafurine                                             | 72.94  | 0.44|
| MOL003209    | Celallocimnine                                         | 83.47  | 0.59|
| MOL003210    | Celapanine                                             | 30.18  | 0.82|
| MOL003211    | Celaxanthin                                            | 47.37  | 0.58|
| MOL003217    | Isoxanthohumol                                         | 56.81  | 0.39|
| MOL003222    | Salazinic acid                                         | 36.34  | 0.76|
| MOL003224    | Tripdiotolide                                          | 56.4   | 0.67|
| MOL003225    | Hypodiolide A                                          | 76.13  | 0.49|
| MOL003229    | Triptinin B                                            | 34.73  | 0.32|
| MOL003231    | Triptoditerpenic acid B                                | 40.02  | 0.36|
| MOL003232    | Triptofordin B1                                        | 39.55  | 0.84|
| MOL003233    | Triptofordin B2                                        | 107.71 | 0.76|
| MOL003234    | Triptofordin C2                                        | 30.16  | 0.76|
| MOL003235    | Triptofordin D1                                        | 32     | 0.75|
| MOL003236    | Triptofordin D2                                        | 30.38  | 0.69|
| MOL003238    | Triptofordin F1                                        | 33.91  | 0.6|
| MOL003239    | Triptofordin F2                                        | 33.6   | 0.67|
| MOL003241    | Triptofordin F4                                        | 31.37  | 0.67|
| MOL003242    | Triptofordinine A2                                     | 30.78  | 0.47|
| MOL003244    | Triptonide                                             | 68.45  | 0.68|
| MOL003245    | Triptonoditerpenic acid                                | 42.56  | 0.39|
| MOL003248    | Triptonoterpene                                        | 48.57  | 0.28|
| MOL003266    | 21-Hydroxy-30-norhopan-22-one                          | 34.11  | 0.77|
| MOL003267    | Wilformine                                             | 46.32  | 0.2|
| MOL003278    | salaspermic acid                                       | 32.19  | 0.63|
| MOL003279    | 99694-86-7                                             | 75.23  | 0.66|
| MOL003280  | TRIPTONOLIDE | 49.51 | 0.49 |
|------------|--------------|-------|------|
| MOL003283  | (2R,3R,4S)-4-(4-hydroxy-3-methoxy-phenyl)-7-methoxy-2,3-dimethylol-tetralin-6-ol | 66.51 | 0.39 |
| MOL004443  | Zhebeiresinol | 58.72 | 0.19 |
| MOL005828  | nobiletin | 61.67 | 0.52 |
| MOL007415  | [(2S)-2-[[((2S)-2-(benzoylamino)-3-phenylpropanoylamino)-3-phenylpropyl] acetate | 58.02 | 0.52 |
| MOL007535  | (5S,8S,9S,10R,13R,14S,17R)-17-[(1R,4R)-4-ethyl-1,5-dimethylhexyl]-10,13-dimethyl-2,4,5,7,8,9,11,12,14,15,16,17-dodecahydro-1H-cyclopenta[a]phenanthrene-3,6-dione | 33.12 | 0.79 |
| MOL009386  | 3,3’-bis-(3,4-dihydro-4-hydroxy-6-methoxy)-2H-1-benzopyran | 52.11 | 0.54 |
| MOL011169  | Peroxyergosterol | 44.39 | 0.82 |
| Gene Symbol | Description |
|-------------|-------------|
| INF2        | Inverted Formin, FH2 And WH2 Domain Containing |
| TRPC6       | Transient Receptor Potential Cation Channel Subfamily C Member 6 |
| CD2AP       | CD2 Associated Protein |
| ACTN4       | Actinin Alpha 4 |
| NPHS1       | NPHS1, Nephrin |
| NPHS2       | NPHS2, Podocin |
| PAX2        | Paired Box 2 |
| WT1         | Wilms Tumor 1 |
| CRB2        | Crumbs 2, Cell Polarity Complex Component |
| MYO1E       | Myosin IE |
| APOL1       | Apolipoprotein L1 |
| ANLN        | Anillin Actin Binding Protein |
| PLCe1       | Phospholipase C Epsilon 1 |
| PTPRO       | Protein Tyrosine Phosphatase, Receptor Type O |
| NUP107      | Nucleoporin 107 |
| ARHGA24     | Rho GTPase Activating Protein 24 |
| SMARCAL1    | SWI/SNF Related, Matrix Associated, Actin Dependent Regulator Of Chromatin, Subfamily A Like 1 |
| COQ6        | Coenzyme Q6, Monooxygenase |
| LAMB2       | Laminin Subunit Beta 2 |
| COL4A3      | Collagen Type IV Alpha 3 Chain |
| NUP93       | Nucleoporin 93 |
| COQ8B       | Coenzyme Q8B |
| SYNPO       | Synaptopodin |
| TGFB1       | Transforming Growth Factor Beta 1 |
| CLCN5       | Chloride Voltage-Gated Channel 5 |
| MYH9        | Myosin Heavy Chain 9 |
| LOC10798529 | Uncharacterized LOC107985291 |
| COL4A4      | Collagen Type IV Alpha 4 Chain |
| SGPL1       | Sphingosine-1-Phosphate Lyase 1 |
| NUP205      | Nucleoporin 205 |
| PLAUR       | Plasminogen Activator, Urokinase Receptor |
| ACE         | Angiotensin I Converting Enzyme |
| COL4A5      | Collagen Type IV Alpha 5 Chain |
| CDKN1C      | Cyclin Dependent Kinase Inhibitor 1C |
| KIRREL2     | Kirre Like Nephrin Family Adhesion Molecule 2 |
| CDKN1A      | Cyclin Dependent Kinase Inhibitor 1A |
| EMP2        | Epithelial Membrane Protein 2 |
| CDKN1B      | Cyclin Dependent Kinase Inhibitor 1B |
| ILK         | Integrin Linked Kinase |
| CD80        | CD80 Molecule |
| SLC37A4     | Solute Carrier Family 37 Member 4 |
| CTNNB1      | Catenin Beta 1 |
| ITGA3       | Integrin Subunit Alpha 3 |
| SCARB2      | Scavenger Receptor Class B Member 2 |
| AGRN        | Agrin |
ALG1  ALG1, Chitobiosylphosphodolichol Beta-Mannosyltransferase
PLEKHH2  Pleckstrin Homology, MyTH4 And FERM Domain Containing H2
MPV17  Mitochondrial Inner Membrane Protein MPV17
ALB  Albumin
WDR73  WD Repeat Domain 73
REN  Renin
NARS2  Asparaginyl-TRNA Synthetase 2, Mitochondrial
SEC61A1  Sec61 Translocon Alpha 1 Subunit
ZNF592  Zinc Finger Protein 592
ITGB4  Integrin Subunit Beta 4
IL1B  Interleukin 1 Beta
OSGEP  O-Sialoglycoprotein Endopeptidase
TP53RK  TP53 Regulating Kinase
TPRKB  TP53RK Binding Protein
LAGE3  L Antigen Family Member 3
G6PC  Glucose-6-Phosphatase Catalytic Subunit
VPS33A  VPS33A, CORVET/HOPS Core Subunit
LPL  Lipoprotein Lipase
ICAM1  Intercellular Adhesion Molecule 1
CDH17  Cadherin 17
MAGI2  Membrane Associated Guanylate Kinase, WW And PDZ Domain Containing 2
ARHGDIA  Rho GDP Dissociation Inhibitor Alpha
DNA11  Dynemin Axonemal Intermediate Chain 1
ANKFY1  Ankyrin Repeat And FYVE Domain Containing 1
BSND  Barttin CLCNK Type Accessory Beta Subunit
MAX  MYC Associated Factor X
FAH  Fumarylacetoacetate Hydrolase
VHL  Von Hippel-Lindau Tumor Suppressor
LYZ  Lysozyme
AFP  Alpha Fetoprotein
RET  Ret Proto-Oncogene
MDH2  Malate Dehydrogenase 2
SDHB  Succinate Dehydrogenase Complex Iron Sulfur Subunit B
SDHA  Succinate Dehydrogenase Complex Flavoprotein Subunit A
MUC1  Mucin 1, Cell Surface Associated
FH  Fumarate Hydratase
KIF1B  Kinesin Family Member 1B
SDHC  Succinate Dehydrogenase Complex Subunit C
SDHD  Succinate Dehydrogenase Complex Subunit D
COQ2  Coenzyme Q2, Polyprenyltransferase
PLEC  Plectin
SDHAF2  Succinate Dehydrogenase Complex Assembly Factor 2
TMEM127  Transmembrane Protein 127
ELP1  Elongator Complex Protein 1
ACHE  Acetylcholinesterase (Cartwright Blood Group)
TJP1  Tight Junction Protein 1
KIRREL1  Kirre Like Nephrin Family Adhesion Molecule 1
NEDE  Nephropathy, Progressive, With Deafness
| Gene Symbol | Gene Name                          |
|-------------|-----------------------------------|
| PDGFA       | Platelet Derived Growth Factor Subunit A |
| CD40LG      | CD40 Ligand                        |
| ENTPD5      | Ectonucleoside Triphosphate Diphosphohydrolase 5 |
| GAPVD1      | GTPase Activating Protein And VPS9 Domains 1 |
| NUMBL       | Numb Like, Endocytic Adaptor Protein |
| KANK2       | KN Motif And Ankyrin Repeat Domains 2 |
| CD79A       | CD79a Molecule                     |
| BRAF        | B-Raf Proto-Oncogene, Serine/Threonine Kinase |
| NDN         | Necdin, MAGE Family Member         |
| AXDND1      | Axonemal Dynein Light Chain Domain Containing 1 |
| PLCE1-AS1   | PLCE1 Antisense RNA 1              |
| LMX1B       | LIM Homeobox Transcription Factor 1 Beta |
| WT1-AS      | WT1 Antisense RNA                  |
| PODXL       | Podocalyxin Like                   |
| INS         | Insulin                            |
| VIM         | Vimentin                           |
| NAGLU       | N-Acetyl-Alpha-Glucosaminidase     |
| ACTB        | Actin Beta                         |
| NR5A1       | Nuclear Receptor Subfamily 5 Group A Member 1 |
| LOC10536940 | Uncharacterized LOC105369403      |
| 3           |                                    |
| ITGB1       | Integrin Subunit Beta 1            |
| UTRN        | Utrophin                           |
| ALG13       | ALG13, UDP-N-Acetylglucosaminyltransferase Subunit |
| CLDN1       | Claudin 1                          |
| CCN2        | Cellular Communication Network Factor 2 |
| OCRL        | OCRL, Inositol Polyphosphate-5-Phosphatase |
| CMIP        | C-Maf Inducing Protein             |
| ACTL7B      | Actin Like 7B                      |
| NNXF5       | Nuclear RNA Export Factor 5        |
| CUBN        | Cubilin                            |
| LCAT        | Lecithin-Cholesterol Acylationtransferase |
| AGTR1       | Angiotensin II Receptor Type 1     |
| LRP2        | LDL Receptor Related Protein 2     |
| TNF         | Tumor Necrosis Factor              |
| BAX         | BCL2 Associated X, Apoptosis Regulator |
| TLR4        | Toll Like Receptor 4               |
| ITGB3       | Integrin Subunit Beta 3            |
| DAG1        | Dystroglycan 1                     |
| CCL2        | C-C Motif Chemokine Ligand 2       |
| NGF         | Nerve Growth Factor                |
| CYCS        | Cytochrome C, Somatic              |
| VTN         | Vitronectin                        |
| SMAD3       | SMAD Family Member 3               |
| NOTCH1      | Notch 1                            |
| WNT1        | Wnt Family Member 1                |
| CCNA2       | Cyclin A2                          |
| NTRK2       | Neurotrophic Receptor Tyrosine Kinase 2 |
| DBH         | Dopamine Beta-Hydroxylase          |
| Gene  | Description |
|-------|-------------|
| SMARCA4 | SWI/SNF Related, Matrix Associated, Actin Dependent Regulator Of Chromatin, Subfamily A, Member 4 |
| SMARCA2 | SWI/SNF Related, Matrix Associated, Actin Dependent Regulator Of Chromatin, Subfamily A, Member 2 |
| IDS   | Iduronate 2-Sulfatase |
| PYGL  | Glycogen Phosphorylase L |
| GUSB  | Glucuronidase Beta |
| GALK1 | Galactokinase 1 |
| APRT  | Adenine Phosphoribosyltransferase |
| ALAD  | Aminolevulinate Dehydratase |
| PAX6  | Paired Box 6 |
| SOX9  | SRY-Box 9 |
| CLCN7 | Chloride Voltage-Gated Channel 7 |
| ALDOB | Aldolase, Fructose-Bisphosphate B |
| HYAL1 | Hyaluronidase 1 |
| PHKA2 | Phosphorylase Kinase Regulatory Subunit Alpha 2 |
| HEXA  | Hexosaminidase Subunit Alpha |
| HPD   | 4-Hydroxyphenylpyruvate Dioxygenase |
| ARSB  | Arylsulfatase B |
| APOC2 | Apolipoprotein C2 |
| GALNS | Galactosamine (N-Acetyl)-6-Sulfatase |
| CLCNKB| Chloride Voltage-Gated Channel Kb |
| AMH   | Anti-Mullerian Hormone |
| GNS   | Glucosamine (N-Acetyl)-6-Sulfatase |
| SGSH  | N-Sulfoglucosamine Sulfohydrolase |
| FGF9  | Fibroblast Growth Factor 9 |
| CLCN4 | Chloride Voltage-Gated Channel 4 |
| IDUA  | Iduronidase, Alpha-L- |
| TIA1  | TIA1 Cytotoxic Granule Associated RNA Binding Protein |
| INPP5B| Inositol Polyphosphate-5-Phosphatase B |
| CLCNKA| Chloride Voltage-Gated Channel Ka |
| CLDN16| Claudin 16 |
| G6PC3 | Glucose-6-Phosphatase Catalytic Subunit 3 |
| BAZ1A | Bromodomain Adjacent To Zinc Finger Domain 1A |
| GSTZ1 | Glutathione S-Transferase Zeta 1 |
| CIAO1 | Cytosolic Iron-Sulfur Assembly Component 1 |
| ELP3  | Elongator Acetyltransferase Complex Subunit 3 |
| SMARCA1 | SWI/SNF Related, Matrix Associated, Actin Dependent Regulator Of Chromatin, Subfamily A, Member 1 |
| GABRE | Gamma-Aminobutyric Acid Type A Receptor Epsilon Subunit |
| USP19 | Ubiquitin Specific Peptidase 19 |
| ELP2  | Elongator Acetyltransferase Complex Subunit 2 |
| TIMM8B| Translocase Of Inner Mitochondrial Membrane 8 Homolog B |
| CPSF7 | Cleavage And Polyadenylation Specific Factor 7 |
| ASTN1 | Astrotactin 1 |
| LHX9  | LIM Homeobox 9 |
| SRY   | Sex Determining Region Y |
| ZNF274| Zinc Finger Protein 274 |
| ARSH  | Arylsulfatase Family Member H |
| Gene      | Description                                      |
|-----------|--------------------------------------------------|
| MFRP      | Membrane Frizzled-Related Protein                |
| TECPR2    | Tectonin Beta-Propeller Repeat Containing 2      |
| YIPF3     | Yip1 Domain Family Member 3                      |
| ZFY       | Zinc Finger Protein Y-Linked                     |
| FAM47E    | Family With Sequence Similarity 47 Member E      |
| LOC10050632 | Uncharacterized LOC100506321                |
| LAMB1     | Laminin Subunit Beta 1                          |
| PCNA      | Proliferating Cell Nuclear Antigen               |
| MT-ND2    | Mitochondrially Encoded NADH:Ubiquinone Oxidoreductase Core Subunit 2 |
| MT-CO1    | Mitochondrially Encoded Cytochrome C Oxidase I   |
| MT-CO2    | Mitochondrially Encoded Cytochrome C Oxidase II  |
| CTS1      | Cathepsin L                                     |
| SERPINE1  | Serpin Family E Member 1                        |
| EZR       | Ezrin                                            |
| IFI27     | Interferon Alpha Inducible Protein 27            |
| AKT1      | AKT Serine/Threonine Kinase 1                    |
| CCND1     | Cyclin D1                                       |
| BMP6      | Bone Morphogenetic Protein 6                    |
| LMNA      | Lamin A/C                                       |
| CR1       | Complement C3b/C4b Receptor 1 (Knops Blood Group) |
| SMAD2     | SMAD Family Member 2                            |
| AGT       | Angiotensinogen                                  |
| CLU       | Clusterin                                       |
| CCNB1     | Cyclin B1                                       |
| PPARG     | Peroxisome Proliferator Activated Receptor Gamma |
| TIMP2     | TIMP Metallopeptidase Inhibitor 2                |
| IL6       | Interleukin 6                                   |
| EDN1      | Endothelin 1                                    |
| DNM1      | Dynamin 1                                       |
| CDH2      | Cadherin 2                                      |
| JAG1      | Jagged 1                                        |
| MME       | Membrane Metalloendopeptidase                   |
| CAMK2B    | Calcium/Calmodulin Dependent Protein Kinase II Beta |
| FYN       | FYN Proto-Oncogene, Src Family Tyrosine Kinase   |
| LRP5      | LDL Receptor Related Protein 5                  |
| PTK2      | Protein Tyrosine Kinase 2                       |
| LRP6      | LDL Receptor Related Protein 6                  |
| VCL       | Vinculin                                        |
| ITGAV     | Integrin Subunit Alpha V                        |
| KRT8      | Keratin 8                                       |
| PLCG1     | Phospholipase C Gamma 1                         |
| DKK1      | Dickkopf WNT Signaling Pathway Inhibitor 1       |
| CD151     | CD151 Molecule (Raph Blood Group)                |
| NCK1      | NCK Adaptor Protein 1                           |
| YWHAQ     | Tyrosine 3-Monoxygenase/Tryptophan 5-Monoxygenase Activation Protein Theta |
| IRF6      | Interferon Regulatory Factor 6                   |
| PARVA     | Parvin Alpha                                    |
| KIRREL3   | Kirre Like Nephrin Family Adhesion Molecule 3   |
MKI67  Marker Of Proliferation Ki-67
LAMA5  Laminin Subunit Alpha 5
TLN1   Talin 1
LIMS1  LIM Zinc Finger Domain Containing 1
FAT1   FAT Atypical Cadherin 1
MIR4758 MicroRNA 4758
MIR6852 MicroRNA 6852
IL2    Interleukin 2
PON1   Paraoxonase 1
FN1    Fibronectin 1
IL2RA  Interleukin 2 Receptor Subunit Alpha
IL10   Interleukin 10
NOS2   Nitric Oxide Synthase 2
CABIN1 Calcinurin Binding Protein 1
FGF2   Fibroblast Growth Factor 2
LCN2   Lipocalin 2
LAMC1  Laminin Subunit Gamma 1
CDK2   Cyclin Dependent Kinase 2
APOE   Apolipoprotein E
PLA2G7 Phospholipase A2 Group VII
HIF1A  Hypoxia Inducible Factor 1 Subunit Alpha
PAFAH1B1 Platelet Activating Factor Acetylhydrolase 1b Regulatory Subunit 1
F2R    Coagulation Factor II Thrombin Receptor
GNA12  G Protein Subunit Alpha 12
TTR    Transthyretin
MMP14  Matrix Metallopeptidase 14
ACTN1  Actinin Alpha 1
ATP7A  ATPase Copper Transporting Alpha
IGFBP3 Insulin Like Growth Factor Binding Protein 3
ATP6AP2 ATPase H+ Transporting Accessory Protein 2
GNE    Glucosamine (UDP-N-Acetyl)-2-Epimerase/N-Acetylmannosaminosamine Kinase
S100A4 S100 Calcium Binding Protein A4
ENPEP  Glutamyl Aminopeptidase
ZMPSTE24 Zinc Metallopeptidase STE24
AMBP   Alpha-1-Microglobulin/Bikunin Precursor
NPNT   Nephronecin
CDK4   Cyclin Dependent Kinase 4
PLAU   Plasminogen Activator, Urokinase
RARA   Retinoic Acid Receptor Alpha
MTHFR  Methylenetetrahydrofolate Reductase
VLDLR  Very Low Density Lipoprotein Receptor
CYP11B2 Cytochrome P450 Family 11 Subfamily B Member 2
EYA1   EYA Transcriptional Coactivator And Phosphatase 1
GPX3   Glutathione Peroxidase 3
LTBP1  Latent Transforming Growth Factor Beta Binding Protein 1
IGFBP1 Insulin Like Growth Factor Binding Protein 1
PTPRU  Protein Tyrosine Phosphatase, Receptor Type U
MAGI1  Membrane Associated Guanylate Kinase, WW And PDZ Domain Containing 1
| Gene Symbol | Gene Name |
|-------------|-----------|
| RAP1GAP     | RAP1 GTPase Activating Protein |
| NPHP4       | Nephrocystin 4 |
| PDGFB       | Platelet Derived Growth Factor Subunit B |
| SLC12A1     | Solute Carrier Family 12 Member 1 |
| FBXW7       | F-Box And WD Repeat Domain Containing 7 |
| FABP1       | Fatty Acid Binding Protein 1 |
| THBD        | Thrombomodulin |
| CLCF1       | Cardiotrophin Like Cytokine Factor 1 |
| CHKA        | Choline Kinase Alpha |
| IFNA2       | Interferon Alpha 2 |
| ECT2        | Epithelial Cell Transforming 2 |
| COG2        | Component Of Oligomeric Golgi Complex 2 |
| PDSS2       | Decaprenyl Diphosphate Synthase Subunit 2 |
| FMN1        | Formin 1 |
| SDK1        | Sidekick Cell Adhesion Molecule 1 |
| MIR186      | MicroRNA 186 |
| MIR193A     | MicroRNA 193a |
| MTOR        | Mechanistic Target Of Rapamycin Kinase |
| HMGCRC      | 3-Hydroxy-3-Methylglutaryl-CoA Reductase |
| MMP2        | Matrix Metallopeptidase 2 |
| TGFBR1      | Transforming Growth Factor Beta Receptor 1 |
| A2M         | Alpha-2-Macroglubulin |
| TFAM        | Transcription Factor A, Mitochondrial |
| NRF1        | Nuclear Respiratory Factor 1 |
| IGFBP2      | Insulin Like Growth Factor Binding Protein 2 |
| SMAD1       | SMAD Family Member 1 |
| IGF1R       | Insulin Like Growth Factor 1 Receptor |
| IGF1        | Insulin Like Growth Factor 1 |
| IRS1        | Insulin Receptor Substrate 1 |
| SRC         | SRC Proto-Oncogene, Non-Receptor Tyrosine Kinase |
| SLC2A1      | Solute Carrier Family 2 Member 1 |
| APOC1       | Apolipoprotein C1 |
| GAPDH       | Glyceraldehyde-3-Phosphate Dehydrogenase |
| GIPR        | Gastric Inhibitory Polypeptide Receptor |
| F2RL3       | F2R Like Thrombin Or Trypsin Receptor 3 |
| DGKQ        | Diacylglycerol Kinase Theta |
| VEGFA       | Vascular Endothelial Growth Factor A |
| TIMP1       | TIMP Metallopeptidase Inhibitor 1 |
| RHOA        | Ras Homolog Family Member A |
| MIF         | Macrophage Migration Inhibitory Factor |
| IL4         | Interleukin 4 |
| MAPK14      | Mitogen-Activated Protein Kinase 14 |
| DDIT3       | DNA Damage Inducible Transcript 3 |
| RBP4        | Retinol Binding Protein 4 |
| SP1         | Sp1 Transcription Factor |
| FOS         | Fos Proto-Oncogene, AP-1 Transcription Factor Subunit |
| LDLR        | Low Density Lipoprotein Receptor |
| TNFSF11     | TNF Superfamily Member 11 |
| Gene    | Description                                      |
|---------|--------------------------------------------------|
| SOD1    | Superoxide Dismutase 1                           |
| TTC21B  | Tetratricopeptide Repeat Domain 21B              |
| RAC1    | Rac Family Small GTPase 1                       |
| ANGPTL4 | Angiopoietin Like 4                              |
| SMAD7   | SMAD Family Member 7                             |
| MAPK1   | Mitogen-Activated Protein Kinase 1               |
| MPO     | Myeloperoxidase                                  |
| ACE2    | Angiotensin I Converting Enzyme 2                |
| MYC     | MYC Proto-Oncogene, BHLH Transcription Factor    |
| ABCB1   | ATP Binding Cassette Subfamily B Member 1        |
| HGF     | Hepatocyte Growth Factor                         |
| B2M     | Beta-2-Microglobulin                             |
| MAPK3   | Mitogen-Activated Protein Kinase 3               |
| ENG     | Endoglin                                         |
| PPARA   | Peroxisome Proliferator Activated Receptor Alpha |
| BCL2    | BCL2, Apoptosis Regulator                        |
| HMOX1   | Heme Oxygenase 1                                 |
| CCL5    | C-C Motif Chemokine Ligand 5                    |
| IL15    | Interleukin 15                                   |
| HPX     | Hemopexin                                       |
| ESR1    | Estrogen Receptor 1                              |
| EGF     | Epidermal Growth Factor                          |
| CASP3   | Caspase 3                                        |
| NR3C1   | Nuclear Receptor Subfamily 3 Group C Member 1    |
| NRPI    | Neuropilin 1                                    |
| TNFRSF11A| TNF Receptor Superfamily Member 11a             |
| CD2     | CD2 Molecule                                     |
| GREM1   | Gremlin 1, DAN Family BMP Antagonist             |
| MIR30A  | MicroRNA 30a                                     |
| CXCR4   | C-X-C Motif Chemokine Receptor 4                 |
| JAK3    | Janus Kinase 3                                   |
| TLR3    | Toll Like Receptor 3                             |
| FTH1    | Ferritin Heavy Chain 1                           |
| NOTCH2  | Notch 2                                          |
| SIRT1   | Sirtuin 1                                        |
| EPAS1   | Endothelial PAS Domain Protein 1                 |
| GGT1    | Gamma-Glutamyltransferase 1                      |
| ABCA1   | ATP Binding Cassette Subfamily A Member 1        |
| CASP9   | Caspase 9                                        |
| NFATC1  | Nuclear Factor Of Activated T Cells 1            |
| YAP1    | Yes Associated Protein 1                         |
| GFER    | Growth Factor, Augmenter Of Liver Regeneration   |
| CEBPA   | CCAAT Enhancer Binding Protein Alpha              |
| LIPC    | Lipase C, Hepatic Type                           |
| HSP90B1 | Heat Shock Protein 90 Beta Family Member 1       |
| SMAD6   | SMAD Family Member 6                             |
| ATF3    | Activating Transcription Factor 3               |
| PROM1   | Prominin 1                                       |
| Gene Symbol | Description                                |
|-------------|--------------------------------------------|
| AGTR2       | Angiotensin II Receptor Type 2              |
| LGALS1      | Galectin 1                                 |
| NRP2        | Neuropilin 2                               |
| SP3         | Sp3 Transcription Factor                    |
| DDN         | Dendrin                                    |
| CD24        | CD24 Molecule                              |
| MIR30D      | MicroRNA 30d                               |
| MET         | MET Proto-Oncogene, Receptor Tyrosine Kinase|
| PRKCD       | Protein Kinase C Delta                      |
| CTSD        | Cathepsin D                                |
| CASP8       | Caspase 8                                  |
| FAS         | Fas Cell Surface Death Receptor             |
| TF          | Transferrin                                |
| ALOX5       | Arachidonate 5-Lipoxygenase                |
| KRT18       | Keratin 18                                 |
| RELA        | RELA Proto-Oncogene, NF-KB Subunit          |
| BDNF        | Brain Derived Neurotrophic Factor           |
| CTLA4       | Cytotoxic T-Lymphocyte Associated Protein 4 |
| LTA4H       | Leukotriene A4 Hydrolase                   |
| NLRP3       | NLR Family Pyrin Domain Containing 3       |
| HSPA5       | Heat Shock Protein Family A (Hsp70) Member 5|
| HSPG2       | Heparan Sulfate Proteoglycan 2             |
| CXCL12      | C-X-C Motif Chemokine Ligand 12            |
| SPP1        | Secreted Phosphoprotein                    |
| TRPV5       | Transient Receptor Potential Cation Channel Subfamily V Member 5 |
| COL4A6      | Collagen Type IV Alpha 6 Chain             |
| PDGFD       | Platelet Derived Growth Factor D           |
| IL13        | Interleukin 13                             |
| IL9         | Interleukin 9                              |
| HBEGF       | Heparin Binding EGF Like Growth Factor      |
| LTC4S       | Leukotriene C4 Synthase                    |
| TRAF1       | TNF Receptor Associated Factor 1            |
| WWC1        | WW And C2 Domain Containing 1              |
| VASP        | Vasodilator Stimulated Phosphoprotein      |
| EPO         | Erythropoietin                             |
| HHIP        | Hedgehog Interacting Protein               |
| GNPTAB      | N-Acetylglucosamine-1-Phosphate Transferase Subunits Alpha And Beta |
| ADAM19      | ADAM Metallopeptidase Domain 19            |
| CAPZA1      | Capping Actin Protein Of Muscle Z-Line Subunit Alpha 1 |
| ATL1        | Atlastin GTPase 1                          |
| PFN2        | Profilin 2                                 |
| PDLIM1      | PDZ And LIM Domain 1                       |
| STK16       | Serine/Threonine Kinase 16                 |
| IL7         | Interleukin 7                              |
| TRPC1       | Transient Receptor Potential Cation Channel Subfamily C Member 1 |
| SNX9        | Sorting Nexin 9                            |
| UBD         | Ubiquitin D                                |
| EPB41L5     | Erythrocyte Membrane Protein Band 4.1 Like 5|
| Gene Symbol | Description |
|-------------|-------------|
| PDLIM2      | PDZ And LIM Domain 2 |
| ETV7        | ETS Variant 7 |
| ACTL7A      | Actin Like 7A |
| MIR10A      | MicroRNA 10a |
| MIR135A1    | MicroRNA 135a-1 |
| MIR135B     | MicroRNA 135b |
| MIR217      | MicroRNA 217 |
| MIR378A     | MicroRNA 378a |
| MIR135A2    | MicroRNA 135a-2 |
| MT-TL1      | Mitochondrially Encoded TRNA Leucine 1 (UUAG) |
| HNP1        | Hypertensive Nephropathy |
| AGER        | Advanced Glycosylation End-Product Specific Receptor |
| GLA         | Galactosidase Alpha |
| CXCL8       | C-X-C Motif Chemokine Ligand 8 |
| AKR1B1      | Aldo-Keto Reductase Family 1 Member B |
| JUN         | Jun Proto-Oncogene, AP-1 Transcription Factor Subunit |
| NOS3        | Nitric Oxide Synthase 3 |
| COL4A2      | Collagen Type IV Alpha 2 Chain |
| KNG1        | Kininogen 1 |
| MMP9        | Matrix Metallopeptidase 9 |
| TGFB2       | Transforming Growth Factor Beta Receptor 2 |
| DES         | Desmin |
| PRKCB       | Protein Kinase C Beta |
| DCN         | Decorin |
| VCAM1       | Vascular Cell Adhesion Molecule 1 |
| HRAS        | HRas Proto-Oncogene, GTPase |
| CASP1       | Caspase 1 |
| IFNGR1      | Interferon Gamma Receptor 1 |
| NR1H2       | Nuclear Receptor Subfamily 1 Group H Member 2 |
| CFB         | Complement Factor B |
| ANTXR2      | ANTXR Cell Adhesion Molecule 2 |
| MSR1        | Macrophage Scavenger Receptor 1 |
| CASP4       | Caspase 4 |
| HLA-DRB1    | Major Histocompatibility Complex, Class II, DR Beta 1 |
| IL12A       | Interleukin 12A |
| COX5A       | Cytochrome C Oxidase Subunit 5A |
| HP          | Haptoglobin |
| PRTN3       | Proteinase 3 |
| OLR1        | Oxidized Low Density Lipoprotein Receptor 1 |
| HLA-DQB1    | Major Histocompatibility Complex, Class II, DQ Beta 1 |
| EREG        | Epiregulin |
| DIAF2       | Diaphanous Related Formin 2 |
| AZGP1       | Alpha-2-Glycoprotein 1, Zinc-Binding |
| AREG        | Amphiregulin |
| PTAFR       | Platelet Activating Factor Receptor |
| TLE4        | Transducin Like Enhancer Of Split 4 |
| IL12B       | Interleukin 12B |
| BPI         | Bactericidal Permeability Increasing Protein |
| Gene Symbol | Description |
|-------------|-------------|
| SCGB1A1     | Secretoglobin Family 1A Member 1 |
| IFNA1       | Interferon Alpha 1 |
| SEMA4C      | Semaphorin 4C |
| ADCK2       | AarF Domain Containing Kinase 2 |
| MIR196A2    | MicroRNA 196a-2 |
| MIR490      | MicroRNA 490 |
| SMAD4       | SMAD Family Member 4 |
| EDNRA       | Endothelin Receptor Type A |
| PLAT        | Plasminogen Activator, Tissue Type |
| E2F1        | E2F Transcription Factor 1 |
| ITHI4       | Inter-Alpha-Trypsin Inhibitor Heavy Chain Family Member 4 |
| MIR21       | MicroRNA 21 |
| MMP1        | Matrix Metallopeptidase 1 |
| CAT         | Catalase |
| MAPK10      | Mitogen-Activated Protein Kinase 10 |
| PARP1       | Poly(ADP-Ribose) Polymerase 1 |
| RB1         | RB Transcriptional Corepressor 1 |
| ESR2        | Estrogen Receptor 2 |
| CD36        | CD36 Molecule |
| GDNF        | Glial Cell Derived Neurotrophic Factor |
| LEP         | Leptin |
| NPPA        | Natriuretic Peptide A |
| MBL2        | Mannose Binding Lectin 2 |
| CST3        | Cystatin C |
| SEMA3A      | Semaphorin 3A |
| THBS1       | Thrombospondin 1 |
| UMOD        | Uromodulin |
| SERPINB7    | Serpin Family B Member 7 |
| AKT2        | AKT Serine/Threonine Kinase 2 |
| NFKB1       | Nuclear Factor Kappa B Subunit 1 |
| STAT3       | Signal Transducer And Activator Of Transcription 3 |
| CDC42       | Cell Division Cycle 42 |
| CYP3A4      | Cytochrome P450 Family 3 Subfamily A Member 4 |
| NFKBIA      | NFKB Inhibitor Alpha |
| MAPK8       | Mitogen-Activated Protein Kinase 8 |
| CD40        | CD40 Molecule |
| C3          | Complement C3 |
| PLG         | Plasminogen |
| MMP7        | Matrix Metallopeptidase 7 |
| PTK2B       | Protein Tyrosine Kinase 2 Beta |
| DDX58       | DExd/H-Box Helicase 58 |
| COL4A1      | Collagen Type IV Alpha 1 Chain |
| PIK3CG      | Phosphatidylinositol-4,5-Bisphosphate 3-Kinase Catalytic Subunit Gamma |
| MYH7        | Myosin Heavy Chain 7 |
| IGF2        | Insulin Like Growth Factor 2 |
| ECE1        | Endothelin Converting Enzyme 1 |
| C5          | Complement C5 |
| COL1A2      | Collagen Type I Alpha 2 Chain |
| Gene Symbol | Gene Name                              |
|------------|----------------------------------------|
| PROS1      | Protein S                              |
| MYH6       | Myosin Heavy Chain 6                   |
| TNC        | Tenascin C                             |
| VCAN       | Versican                               |
| GFPT1      | Glutamine--Fructose-6-Phosphate Transaminase 1 |
| EDN3       | Endothelin 3                           |
| CCR1       | C-C Motif Chemokine Receptor 1         |
| ADIPQ      | Adiponectin, C1Q And Collagen Domain Containing |
| TRIO       | Trio Rho Guanine Nucleotide Exchange Factor |
| FABP4      | Fatty Acid Binding Protein 4           |
| CCR2       | C-C Motif Chemokine Receptor 2         |
| CSF1       | Colony Stimulating Factor 1            |
| BMP7       | Bone Morphogenetic Protein 7           |
| S100A8     | S100 Calcium Binding Protein A8        |
| MLXIPL     | MLX Interacting Protein Like           |
| TNFRSF12A  | TNF Receptor Superfamily Member 12A    |
| PLTP       | Phospholipid Transfer Protein          |
| PDPN       | Podoplanin                             |
| NID1       | Nidogen 1                              |
| FMOD       | Fibromodulin                           |
| NES        | Nestin                                 |
| SLC25A17   | Solute Carrier Family 25 Member 17     |
| TNFSF12    | TNF Superfamily Member 12              |
| USF2       | Upstream Transcription Factor 2, C-Fos Interacting |
| ZFYVE9     | Zinc Finger FYVE-Type Containing 9     |
| PIRRM1     | Pitrilsin Metallopeptidase 1           |
| SMPDL3B    | Sphingomyelin Phosphodiesterase Acid Like 3B |
| CCN1       | Cellular Communication Network Factor 1 |
| PDGFRA     | Platelet Derived Growth Factor Receptor Alpha |
| EGFR       | Epidermal Growth Factor Receptor       |
| PDGFRB     | Platelet Derived Growth Factor Receptor Beta |
| JAK2       | Janus Kinase 2                         |
| KDR        | Kinase Insert Domain Receptor          |
| MAP2K1     | Mitogen-Activated Protein Kinase Kinase 1 |
| MAP2K2     | Mitogen-Activated Protein Kinase Kinase 2 |
| INSR       | Insulin Receptor                       |
| AR         | Androgen Receptor                      |
| AKT3       | AKT Serine/Threonine Kinase 3          |
| PIK3CA     | Phosphatidylinositol-4,5-Bisphosphate 3-Kinase Catalytic Subunit Alpha |
| PTEN       | Phosphatase And Tensin Homolog         |
| STAT1      | Signal Transducer And Activator Of Transcription 1 |
| CDK5       | Cyclin Dependent Kinase 5              |
| ADK        | Adenosine Kinase                       |
| MMP3       | Matrix Metallopeptidase 3              |
| UCHL1      | Ubiquitin C-Terminal Hydrolase L1      |
| CD4        | CD4 Molecule                           |
| CDKIN2A     | Cyclin Dependent Kinase Inhibitor 2A   |
| CTSB       | Cathepsin B                            |
| Gene Symbol | Gene Name                           |
|-------------|-------------------------------------|
| CASP7       | Caspase 7                           |
| ACVRL1      | Activin A Receptor Like Type 1      |
| ADAM17      | ADAM Metallopeptidase Domain 17     |
| PPIB        | Peptidylprolyl Isomerase B          |
| HSPB1       | Heat Shock Protein Family B (Small) Member 1 |
| YWHAE       | Tyrosine 3-Monoxygenase/Tryptophan 5-Monoxygenase Activation Protein Epsilon |
| GATA3       | GATA Binding Protein 3              |
| JAK1        | Janus Kinase 1                       |
| HDAC3       | Histone Deacetylase 3               |
| NTRK1       | Neurotrophic Receptor Tyrosine Kinase 1 |
| NOS1        | Nitric Oxide Synthase 1             |
| CCNE1       | Cyclin E1                           |
| ACACA       | Acetyl-CoA Carboxylase Alpha         |
| CAV1        | Caveolin 1                           |
| PRKCZ       | Protein Kinase C Zeta                |
| SGK1        | Serum/Glucocorticoid Regulated Kinase 1 |
| NR3C2       | Nuclear Receptor Subfamily 3 Group C Member 2 |
| SLC5A1      | Solute Carrier Family 5 Member 1    |
| TFRC        | Transferrin Receptor                |
| TGFBI       | Transforming Growth Factor Beta 2    |
| VWF         | Von Willebrand Factor                |
| FOXO1       | Forkhead Box O1                     |
| CYP3A5      | Cytochrome P450 Family 3 Subfamily A Member 5 |
| FASLG       | Fas Ligand                           |
| CCR5        | C-C Motif Chemokine Receptor 5 (Gene/Pseudogene) |
| CES1        | Carboxylesterase 1                  |
| CNR1        | Cannabinoid Receptor 1               |
| PPARD       | Peroxisome Proliferator Activated Receptor Delta |
| S10P4       | Selectin P                           |
| MMP10       | Matrix Metallopeptidase 10           |
| NR1H3       | Nuclear Receptor Subfamily 1 Group H Member 3 |
| MS4A1       | Membrane Spanning 4-Domains A1      |
| SPHK1       | Sphingosine Kinase 1                 |
| LRP1        | LDL Receptor Related Protein 1       |
| HDAC9       | Histone Deacetylase 9               |
| TGFA        | Transforming Growth Factor Alpha      |
| TRAF3       | TNF Receptor Associated Factor 3     |
| TRAF6       | TNF Receptor Associated Factor 6     |
| TSHR        | Thyroid Stimulating Hormone Receptor |
| ADORA2B     | Adenosine A2b Receptor               |
| BID         | BH3 Interacting Domain Death Agonist |
| CA8         | Carbonic Anhydrase 8                 |
| CDK5R1      | Cyclin Dependent Kinase 5 Regulatory Subunit 1 |
| CFH         | Complement Factor H                  |
| CDK1        | Cyclin Dependent Kinase 1            |
| ANXA5       | Annexin A5                           |
| ANG         | Angiogenin                           |
| ITGB6       | Integrin Subunit Beta 6              |
LNPEP | Leucyl And Cystinyl Aminopeptidase
---|---
SERPINH1 | Serpin Family H Member 1
S100B | S100 Calcium Binding Protein B
TBX3 | T-Box 3
PXN | Paxillin
TGIF1 | TGFβ Induced Factor Homeobox 1
TNFSF13B | TNF Superfamily Member 13b
ZYX | Zyxin
GHI | Growth Hormone 1
CX3CR1 | C-X3-C Motif Chemokine Receptor 1
LGALS3 | Galectin 3
HIPK2 | Homeodomain Interacting Protein Kinase 2
STMN1 | Stathmin 1
HPSE | Heparanase
EGR1 | Early Growth Response 1
CD34 | CD34 Molecule
EEF1A1 | Eukaryotic Translation Elongation Factor 1 Alpha 1
CTNS | Cystinosin, Lysosomal Cystine Transporter
BDKRB2 | Bradykinin Receptor B2
HDAC7 | Histone Deacetylase 7
IQGAP1 | IQ Motif Containing GTPase Activating Protein 1
SALL1 | Spalt Like Transcription Factor 1
MPZ | Myelin Protein Zero
MEFV | MEFV, Pyrin Innate Immunity Regulator
TAT | Tyrosine Aminotransferase
SPI1 | Spi-1 Proto-Oncogene
RAB3A | RAB3A, Member RAS Oncogene Family
USF1 | Upstream Transcription Factor 1
FOXO3 | Forkhead Box O3
DDAH2 | Dimethylarginine Dimethylaminohydrolase 2
FCGR3B | Fc Fragment Of IgG Receptor IIb
IL17A | Interleukin 17A
P2RX4 | Purinergic Receptor P2X 4
PLXNA1 | Plexin A1
TG | Thyroglobulin
TNFRSF6B | TNF Receptor Superfamily Member 6b
CSRP3 | Cysteine And Glycine Rich Protein 3
ACTC1 | Actin, Alpha, Cardiac Muscle 1
C4A | Complement C4A (Rodgers Blood Group)
TAGLN | Transgelin
ID1 | Inhibitor Of DNA Binding 1, HLH Protein
CCL4 | C-C Motif Chemokine Ligand 4
FCAR | Fc Fragment Of IgA Receptor
CAMP | Cathelicidin Antimicrobial Peptide
COL8A2 | Collagen Type VIII Alpha 2 Chain
ST3GAL4 | ST3 Beta-Galactoside Alpha-2,3-Sialyltransferase 4
IL1RL1 | Interleukin 1 Receptor Like 1
WASL | Wiskott-Aldrich Syndrome Like
| gene      | description                                      |
|-----------|--------------------------------------------------|
| CHIA      | Chitinase, Acidic                                |
| BPHL      | Biphenyl Hydrolase Like                         |
| KLF15     | Kruppel Like Factor 15                          |
| PLA2R1    | Phospholipase A2 Receptor 1                      |
| RHOD      | Ras Homolog Family Member D                     |
| SCAP      | SREBF Chaperone                                  |
| PDLIM5    | PDZ And LIM Domain 5                            |
| RPH3A     | Rabphilin 3A                                    |
| HIST1H1B  | Histone Cluster 1 H1 Family Member B             |
| CCL3      | C-C Motif Chemokine Ligand 3                    |
| COL8A1    | Collagen Type VIII Alpha 1 Chain                 |
| PECAM1    | Platelet And Endothelial Cell Adhesion Molecule 1|
| P3H1      | Prolyl 3-Hydroxylase 1                          |
| NUP133    | Nucleoporin 133                                 |
| SNF8      | SNF8, ESCRT-II Complex Subunit                   |
| TSLP      | Thymic Stromal Lymphopoietin                     |
| ACTN3     | Actinin Alpha 3 (Gene/Pseudogene)                |
| LECT2     | Leukocyte Cell Derived Chemotaxin 2              |
| WDR19     | WD Repeat Domain 19                             |
| CSN1S1    | Casein Alpha S1                                 |
| GOLIM4    | Golgi Integral Membrane Protein 4               |
| MPV17L    | MPV17 Mitochondrial Inner Membrane Protein Like |
| WTIP      | WT1 Interacting Protein                         |
| HIST2H3C  | Histone Cluster 2 H3 Family Member C             |
| KRBOX4    | KRAB Box Domain Containing 4                    |
| MIR216A   | MicroRNA 216a                                   |
| MBL3P     | Mannose-Binding Lectin Family Member 3, Pseudogene|
| MolId   | GeneName | MolName                  |
|---------|----------|--------------------------|
| MOL000296 | PGR      | hederagenin              |
| MOL000296 | NCOA2    | hederagenin              |
| MOL000296 | CHRM3    | hederagenin              |
| MOL000296 | CHRM1    | hederagenin              |
| MOL000296 | CHRM2    | hederagenin              |
| MOL000296 | ADRA1B   | hederagenin              |
| MOL000296 | GABRA1   | hederagenin              |
| MOL000296 | GRIA2    | hederagenin              |
| MOL000296 | ADH1B    | hederagenin              |
| MOL000296 | ADH1C    | hederagenin              |
| MOL000296 | LYZ      | hederagenin              |
| MOL000296 | PTGS1    | hederagenin              |
| MOL000296 | SCN5A    | hederagenin              |
| MOL000296 | PTGS2    | hederagenin              |
| MOL000296 | RXRA     | hederagenin              |
| MOL000296 | SLC6A2   | hederagenin              |
| MOL003182 | KCNH2    | (+)-Medioresinol di-O-beta-D-glucopyranoside_qt |
| MOL003182 | SCN5A    | (+)-Medioresinol di-O-beta-D-glucopyranoside_qt |
| MOL003182 | PTGS2    | (+)-Medioresinol di-O-beta-D-glucopyranoside_qt |
| MOL003182 | F7       | (+)-Medioresinol di-O-beta-D-glucopyranoside_qt |
| MOL003184 | PTGS1    | 81827-74-9               |
| MOL003184 | CHRM3    | 81827-74-9               |
| MOL003184 | KCHN2    | 81827-74-9               |
| MOL003184 | CHRM1    | 81827-74-9               |
| MOL003184 | SCN5A    | 81827-74-9               |
| MOL003184 | CHRM5    | 81827-74-9               |
| MOL003184 | PTGS2    | 81827-74-9               |
| MOL003184 | CHRM4    | 81827-74-9               |
| MOL003184 | OPRD1    | 81827-74-9               |
| MOL003184 | PGR      | 81827-74-9               |
| MOL003184 | CHRM2    | 81827-74-9               |
| MOL003184 | ADRA1B   | 81827-74-9               |
| MOL003184 | ADRB2    | 81827-74-9               |
| MOL003184 | OPRM1    | 81827-74-9               |
| MOL003184 | NCOA2    | 81827-74-9               |
| MOL003184 | NCOA1    | 81827-74-9               |
| MOL003185 | CHRM3    | (1R,4aR,10aS)-5-hydroxy-1-(hydroxymethyl)-7-isopropyl-8-methoxy-1,4a-dimethyl-4,9,10,10a-tetrahydro-3H-phenanthren-2-one |
| MOL003185 | CHRM1    | (1R,4aR,10aS)-5-hydroxy-1-(hydroxymethyl)-7-isopropyl-8-methoxy-1,4a-dimethyl-4,9,10,10a-tetrahydro-3H-phenanthren-2-one |
| MOL003185 | PTGS2    | (1R,4aR,10aS)-5-hydroxy-1-(hydroxymethyl)-7-isopropyl-8-methoxy-1,4a-dimethyl-4,9,10,10a-tetrahydro-3H-phenanthren-2-one |
| MOL003185 | OPRD1    | (1R,4aR,10aS)-5-hydroxy-1-(hydroxymethyl)-7-isopropyl-8-methoxy-1,4a-dimethyl-4,9,10,10a-tetrahydro-3H-phenanthren-2-one |
| MOL003185 | ADRA1A   | (1R,4aR,10aS)-5-hydroxy-1-(hydroxymethyl)-7-isopropyl-8-methoxy-1,4a-dimethyl-4,9,10,10a-tetrahydro-3H-phenanthren-2-one |
| MOL003185 | ADRA1B | (1R,4aR,10aS)-5-hydroxy-1-(hydroxymethyl)-7-isopropyl-8-methoxy-1,4a-dimethyl-4,9,10,10a-tetrahydro-3H-phenanthren-2-one |
| MOL003185 | ADRA1D | (1R,4aR,10aS)-5-hydroxy-1-(hydroxymethyl)-7-isopropyl-8-methoxy-1,4a-dimethyl-4,9,10,10a-tetrahydro-3H-phenanthren-2-one |
| MOL003185 | OPRM1 | (1R,4aR,10aS)-5-hydroxy-1-(hydroxymethyl)-7-isopropyl-8-methoxy-1,4a-dimethyl-4,9,10,10a-tetrahydro-3H-phenanthren-2-one |
| MOL003185 | NR3C1 | (1R,4aR,10aS)-5-hydroxy-1-(hydroxymethyl)-7-isopropyl-8-methoxy-1,4a-dimethyl-4,9,10,10a-tetrahydro-3H-phenanthren-2-one |
| MOL003185 | NCOA1 | (1R,4aR,10aS)-5-hydroxy-1-(hydroxymethyl)-7-isopropyl-8-methoxy-1,4a-dimethyl-4,9,10,10a-tetrahydro-3H-phenanthren-2-one |
| MOL003185 | NCOA2 | (1R,4aR,10aS)-5-hydroxy-1-(hydroxymethyl)-7-isopropyl-8-methoxy-1,4a-dimethyl-4,9,10,10a-tetrahydro-3H-phenanthren-2-one |
| MOL003187 | RELA | triptolide |
| MOL003187 | STAT3 | triptolide |
| MOL003187 | VEGFA | triptolide |
| MOL003187 | BCL2 | triptolide |
| MOL003187 | FOS | triptolide |
| MOL003187 | CDKN1A | triptolide |
| MOL003187 | PLAU | triptolide |
| MOL003187 | TNFSF15 | triptolide |
| MOL003187 | JUN | triptolide |
| MOL003187 | CASP3 | triptolide |
| MOL003187 | TP63 | triptolide |
| MOL003187 | MAPK8 | triptolide |
| MOL003187 | PTGS2 | triptolide |
| MOL003187 | STAT1 | triptolide |
| MOL003187 | CXCL8 | triptolide |
| MOL003187 | MCL1 | triptolide |
| MOL003187 | IL2 | triptolide |
| MOL003187 | IFNG | triptolide |
| MOL003187 | IL4 | triptolide |
| MOL003187 | CD80 | triptolide |
| MOL003187 | CD86 | triptolide |
| MOL003187 | CXCR4 | triptolide |
| MOL003187 | BIRC3 | triptolide |
| MOL003187 | CD274 | triptolide |
| MOL003187 | IL23A | triptolide |
| MOL003187 | CCR7 | triptolide |
| MOL003187 | CD1A | triptolide |
| MOL003187 | CD40 | triptolide |
| MOL003187 | CD14 | triptolide |
| MOL003187 | C3 | triptolide |
| MOL003187 | VTCN1 | triptolide |
| MOL003196 | CHRM3 | Tryptophenolide |
| MOL003196 | KCNH2 | Tryptophenolide |
|----------|-------|-----------------|
| MOL003196 | CHRM1 | Tryptophenolide |
| MOL003196 | SCN5A | Tryptophenolide |
| MOL003196 | CHRM5 | Tryptophenolide |
| MOL003196 | PTGS2 | Tryptophenolide |
| MOL003196 | RXRA  | Tryptophenolide |
| MOL003196 | OPRD1 | Tryptophenolide |
| MOL003196 | ADRA1A| Tryptophenolide |
| MOL003196 | PGR   | Tryptophenolide |
| MOL003196 | CHRM2 | Tryptophenolide |
| MOL003196 | ADRA1B| Tryptophenolide |
| MOL003196 | ADRB2 | Tryptophenolide |
| MOL003196 | ADRA1D| Tryptophenolide |
| MOL003196 | OPRM1 | Tryptophenolide |
| MOL003196 | NCOA2 | Tryptophenolide |
| MOL003196 | NCOA1 | Tryptophenolide |
| MOL003199 | NOS2  | 5,8-Dihydroxy-7-(4-hydroxy-5-methyl-coumarin-3)-coumarin |
| MOL003199 | PTGS1 | 5,8-Dihydroxy-7-(4-hydroxy-5-methyl-coumarin-3)-coumarin |
| MOL003199 | KCNH2 | 5,8-Dihydroxy-7-(4-hydroxy-5-methyl-coumarin-3)-coumarin |
| MOL003199 | ESR1  | 5,8-Dihydroxy-7-(4-hydroxy-5-methyl-coumarin-3)-coumarin |
| MOL003199 | AR    | 5,8-Dihydroxy-7-(4-hydroxy-5-methyl-coumarin-3)-coumarin |
| MOL003199 | SCN5A | 5,8-Dihydroxy-7-(4-hydroxy-5-methyl-coumarin-3)-coumarin |
| MOL003199 | PPARG | 5,8-Dihydroxy-7-(4-hydroxy-5-methyl-coumarin-3)-coumarin |
| MOL003199 | PTGS2 | 5,8-Dihydroxy-7-(4-hydroxy-5-methyl-coumarin-3)-coumarin |
| MOL003199 | F7    | 5,8-Dihydroxy-7-(4-hydroxy-5-methyl-coumarin-3)-coumarin |
| MOL003199 | KDR   | 5,8-Dihydroxy-7-(4-hydroxy-5-methyl-coumarin-3)-coumarin |
| MOL003199 | PYGM  | 5,8-Dihydroxy-7-(4-hydroxy-5-methyl-coumarin-3)-coumarin |
| MOL003199 | PRSS1 | 5,8-Dihydroxy-7-(4-hydroxy-5-methyl-coumarin-3)-coumarin |
| MOL003209 | KCNH2 | Celallocinnine |
| MOL003209 | SCN5A | Celallocinnine |
| MOL003217 | NOS2  | Isoxanthohumol |
| MOL003217 | KCNH2 | Isoxanthohumol |
| MOL003217 | ESR1  | Isoxanthohumol |
| MOL003217 | SCN5A | Isoxanthohumol |
| MOL003217 | PTGS2 | Isoxanthohumol |
| MOL003217 | KDR   | Isoxanthohumol |
| MOL003217 | ADRA1B| Isoxanthohumol |
| MOL003217 | ADRB2 | Isoxanthohumol |
| MOL003217 | NCOA2 | Isoxanthohumol |
| MOL003217 | NCOA1 | Isoxanthohumol |
| MOL003217 | PTGS1 | Isoxanthohumol |
| MOL003217 | PPARD | Isoxanthohumol |
| MOL003224 | NR3C2 | Triptinin B |
| MOL003225 | NR3C2 | Hypodiolide A |
| MOL003225 | NR3C1 | Hypodiolide A |
| MOL003229 | CHRM3 | Triptinin B |
| MOL003229 | KCNH2 | Triptinin B |
| MOL003229 | CHRM1 | Triptinin B |
| Accession | Gene   | Description               |
|-----------|--------|---------------------------|
| MOL003229 | SCN5A  | Triptinin B               |
| MOL003229 | CHRM5  | Triptinin B               |
| MOL003229 | PTGS2  | Triptinin B               |
| MOL003229 | RXRA   | Triptinin B               |
| MOL003229 | ADRA1A | Triptinin B               |
| MOL003229 | PGR    | Triptinin B               |
| MOL003229 | CHRM2  | Triptinin B               |
| MOL003229 | ADRA1B | Triptinin B               |
| MOL003229 | ADRB2  | Triptinin B               |
| MOL003229 | ADRA1D | Triptinin B               |
| MOL003229 | OPRM1  | Triptinin B               |
| MOL003229 | NR3C1  | Triptinin B               |
| MOL003229 | RXRB   | Triptinin B               |
| MOL003229 | NCOA2  | Triptinin B               |
| MOL003229 | NCOA1  | Triptinin B               |
| MOL003231 | PTGS1  | Triptoditerpenic acid B   |
| MOL003231 | CHRM3  | Triptoditerpenic acid B   |
| MOL003231 | KCNH2  | Triptoditerpenic acid B   |
| MOL003231 | CHRM1  | Triptoditerpenic acid B   |
| MOL003231 | SCN5A  | Triptoditerpenic acid B   |
| MOL003231 | CHRM5  | Triptoditerpenic acid B   |
| MOL003231 | PTGS2  | Triptoditerpenic acid B   |
| MOL003231 | CHRM4  | Triptoditerpenic acid B   |
| MOL003231 | RXRA   | Triptoditerpenic acid B   |
| MOL003231 | OPRD1  | Triptoditerpenic acid B   |
| MOL003231 | ADRA1A | Triptoditerpenic acid B   |
| MOL003231 | PGR    | Triptoditerpenic acid B   |
| MOL003231 | CHRM2  | Triptoditerpenic acid B   |
| MOL003231 | ADRA1B | Triptoditerpenic acid B   |
| MOL003231 | ADRB2  | Triptoditerpenic acid B   |
| MOL003231 | ADRA1D | Triptoditerpenic acid B   |
| MOL003231 | OPRM1  | Triptoditerpenic acid B   |
| MOL003231 | NR3C1  | Triptoditerpenic acid B   |
| MOL003231 | RXRB   | Triptoditerpenic acid B   |
| MOL003231 | NCOA2  | Triptonoditerpenic acid   |
| MOL003231 | NCOA1  | Triptonoditerpenic acid   |
| MOL003245 | CHRM3  | Triptonoditerpenic acid   |
| MOL003245 | KCNH2  | Triptonoditerpenic acid   |
| MOL003245 | CHRM1  | Triptonoditerpenic acid   |
| MOL003245 | SCN5A  | Triptonoditerpenic acid   |
| MOL003245 | PTGS2  | Triptonoditerpenic acid   |
| MOL003245 | OPRD1  | Triptonoditerpenic acid   |
| MOL003245 | ADRA1B | Triptonoditerpenic acid   |
| MOL003245 | ADRB2  | Triptonoditerpenic acid   |
| MOL003245 | NCOA2  | Triptonoditerpenic acid   |
| MOL003245 | NCOA1  | Triptonoditerpenic acid   |
| MOL003248 | PTGS1  | Triptonoterpene            |
| MOL003248 | CHRM1     | Triptonoterpene     |
| MOL003248 | SCN5A     | Triptonoterpene     |
| MOL003248 | PTGS2     | Triptonoterpene     |
| MOL003248 | RXRA      | Triptonoterpene     |
| MOL003248 | ACHE      | Triptonoterpene     |
| MOL003248 | ADRA1A    | Triptonoterpene     |
| MOL003248 | PGR       | Triptonoterpene     |
| MOL003248 | CHRM2     | Triptonoterpene     |
| MOL003248 | ADRA1B    | Triptonoterpene     |
| MOL003248 | ADRB2     | Triptonoterpene     |
| MOL003248 | ADRA1D    | Triptonoterpene     |
| MOL003248 | OPRM1     | Triptonoterpene     |
| MOL003248 | NR3C1     | Triptonoterpene     |
| MOL003248 | NCOA2     | Triptonoterpene     |
| MOL003248 | NCOA1     | Triptonoterpene     |
| MOL003266 | PGR       | 21-Hydroxy-30-norhopan-22-one |
| MOL003280 | CHRM3     | TRIPTONOLIDE        |
| MOL003280 | CHRM1     | TRIPTONOLIDE        |
| MOL003280 | SCN5A     | TRIPTONOLIDE        |
| MOL003280 | CHRM5     | TRIPTONOLIDE        |
| MOL003280 | PTGS2     | TRIPTONOLIDE        |
| MOL003280 | OPRD1     | TRIPTONOLIDE        |
| MOL003280 | ADRA1A    | TRIPTONOLIDE        |
| MOL003280 | PGR       | TRIPTONOLIDE        |
| MOL003280 | CHRM2     | TRIPTONOLIDE        |
| MOL003280 | ADRB2     | TRIPTONOLIDE        |
| MOL003280 | OPRM1     | TRIPTONOLIDE        |
| MOL003280 | NCOA2     | TRIPTONOLIDE        |
| MOL003280 | NCOA1     | TRIPTONOLIDE        |
| MOL000358 | PGR       | beta-sitosterol     |
| MOL000358 | NCOA2     | beta-sitosterol     |
| MOL000358 | PTGS1     | beta-sitosterol     |
| MOL000358 | PTGS2     | beta-sitosterol     |
| MOL000358 | KCNH2     | beta-sitosterol     |
| MOL000358 | CHRM3     | beta-sitosterol     |
| MOL000358 | CHRM1     | beta-sitosterol     |
| MOL000358 | SCN5A     | beta-sitosterol     |
| MOL000358 | CHRM4     | beta-sitosterol     |
| MOL000358 | ADRA1A    | beta-sitosterol     |
| MOL000358 | CHRM2     | beta-sitosterol     |
| MOL000358 | ADRA1B    | beta-sitosterol     |
| MOL000358 | ADRB2     | beta-sitosterol     |
| MOL000358 | CHRNA2    | beta-sitosterol     |
| MOL000358 | SLC6A4    | beta-sitosterol     |
| MOL000358 | OPRM1     | beta-sitosterol     |
| MOL000358 | GABRA1    | beta-sitosterol     |
| MOL000358 | BCL2      | beta-sitosterol     |
| MOL000358 | BAX       | beta-sitosterol     |
| MOL000358 | CASP9     | beta-sitosterol |
| MOL000358 | JUN       | beta-sitosterol |
| MOL000358 | CASP3     | beta-sitosterol |
| MOL000358 | CASP8     | beta-sitosterol |
| MOL000358 | PRKCA     | beta-sitosterol |
| MOL000358 | PON1      | beta-sitosterol |
| MOL000358 | MAP2      | beta-sitosterol |
| MOL000211 | PGR       | Mairin          |
| MOL000422 | NOS2      | kaempferol      |
| MOL000422 | PTGS1     | kaempferol      |
| MOL000422 | AR        | kaempferol      |
| MOL000422 | PPARG     | kaempferol      |
| MOL000422 | PTGS2     | kaempferol      |
| MOL000422 | NCOA2     | kaempferol      |
| MOL000422 | PRSS1     | kaempferol      |
| MOL000422 | PGR       | kaempferol      |
| MOL000422 | CHRM1     | kaempferol      |
| MOL000422 | ACHE      | kaempferol      |
| MOL000422 | SLC6A2    | kaempferol      |
| MOL000422 | CHRM2     | kaempferol      |
| MOL000422 | ADRA1B    | kaempferol      |
| MOL000422 | GABRA1    | kaempferol      |
| MOL000422 | F7        | kaempferol      |
| MOL000422 | RELA      | kaempferol      |
| MOL000422 | IKBKB     | kaempferol      |
| MOL000422 | AKT1      | kaempferol      |
| MOL000422 | BCL2      | kaempferol      |
| MOL000422 | BAX       | kaempferol      |
| MOL000422 | TNFSF15   | kaempferol      |
| MOL000422 | JUN       | kaempferol      |
| MOL000422 | AHSA1     | kaempferol      |
| MOL000422 | CASP3     | kaempferol      |
| MOL000422 | MAPK8     | kaempferol      |
| MOL000422 | MMP1      | kaempferol      |
| MOL000422 | STAT1     | kaempferol      |
| MOL000422 | PPARG     | kaempferol      |
| MOL000422 | HMOX1     | kaempferol      |
| MOL000422 | CYP3A4    | kaempferol      |
| MOL000422 | CYP1A2    | kaempferol      |
| MOL000422 | CYP1A1    | kaempferol      |
| MOL000422 | ICAM1     | kaempferol      |
| MOL000422 | SELE      | kaempferol      |
| MOL000422 | VCAM1     | kaempferol      |
| MOL000422 | NR1I2     | kaempferol      |
| MOL000422 | CYP1B1    | kaempferol      |
| MOL000422 | ALOX5     | kaempferol      |
| MOL000422 | HAS2      | kaempferol      |
| MOL000422 | GSTP1     | kaempferol      |
MOL000422 AHR kaempferol
MOL000422 PSMD3 kaempferol
MOL000422 SLC2A4 kaempferol
MOL000422 NR1I3 kaempferol
MOL000422 INSR kaempferol
MOL000422 DIO1 kaempferol
MOL000422 PPP3CA kaempferol
MOL000422 GSTM1 kaempferol
MOL000422 GSTM2 kaempferol
MOL000422 AKR1C3 kaempferol
MOL000422 SLPI kaempferol
MOL000449 PGR Stigmasterol
MOL000449 NR3C2 Stigmasterol
MOL000449 NCOA2 Stigmasterol
MOL000449 ADH1C Stigmasterol
MOL000449 RXRA Stigmasterol
MOL000449 NCOA1 Stigmasterol
MOL000449 PTGS1 Stigmasterol
MOL000449 PTGS2 Stigmasterol
MOL000449 ADRA2A Stigmasterol
MOL000449 SLC6A2 Stigmasterol
MOL000449 SLC6A3 Stigmasterol
MOL000449 ADRB2 Stigmasterol
MOL000449 AKR1B1 Stigmasterol
MOL000449 PLAU Stigmasterol
MOL000449 LTA4H Stigmasterol
MOL000449 MAOB Stigmasterol
MOL000449 MAOA Stigmasterol
MOL000449 CTRB1 Stigmasterol
MOL000449 CHRM3 Stigmasterol
MOL000449 CHRM1 Stigmasterol
MOL000449 ADRB1 Stigmasterol
MOL000449 SCN5A Stigmasterol
MOL000449 ADRA1A Stigmasterol
MOL000449 CHRM2 Stigmasterol
MOL000449 ADRA1B Stigmasterol
MOL000449 GABRA1 Stigmasterol
MOL002058 KCNH2 40957-99-1
MOL002058 SCN5A 40957-99-1
MOL002058 PTGS2 40957-99-1
MOL002058 PTGS1 40957-99-1
MOL002058 NCOA2 40957-99-1
MOL002058 F7 40957-99-1
MOL003283 ESR1 (2R,3R,4S)-4-(3-hydroxy-4-hydroxyphenyl)-7-methoxy-2,3-dimethylol-tetralin-6-ol
MOL003283 AR (2R,3R,4S)-4-(4-hydroxy-3-methoxy-phenyl)-7-methoxy-2,3-dimethylol-tetralin-6-ol
MOL003283 PPARG (2R,3R,4S)-4-(4-hydroxy-3-methoxy-phenyl)-7-methoxy-2,3-dimethylol-tetralin-6-ol
MOL003283 PTGS2 (2R,3R,4S)-4-(4-hydroxy-3-methoxy-phenyl)-7-methoxy-2,3-dimethylol-tetralin-6-ol
MOL003283 F7 (2R,3R,4S)-4-(4-hydroxy-3-methoxy-phenyl)-7-methoxy-2,3-dimethylol-tetralin-6-ol
MOL003283 ADRB2 (2R,3R,4S)-4-(4-hydroxy-3-methoxy-phenyl)-7-methoxy-2,3-dimethylol-tetralin-6-ol
MOL003283 ESR2 (2R,3R,4S)-4-(4-hydroxy-3-methoxy-phenyl)-7-methoxy-2,3-dimethylol-tetralin-6-ol
MOL003283 MAPK14 (2R,3R,4S)-4-(4-hydroxy-3-methoxy-phenyl)-7-methoxy-2,3-dimethylol-tetralin-6-ol
MOL003283 GSK3B (2R,3R,4S)-4-(4-hydroxy-3-methoxy-phenyl)-7-methoxy-2,3-dimethylol-tetralin-6-ol
MOL003283 CHEK1 (2R,3R,4S)-4-(4-hydroxy-3-methoxy-phenyl)-7-methoxy-2,3-dimethylol-tetralin-6-ol
MOL003283 NCOA2 (2R,3R,4S)-4-(4-hydroxy-3-methoxy-phenyl)-7-methoxy-2,3-dimethylol-tetralin-6-ol
MOL003283 SCN5A (2R,3R,4S)-4-(4-hydroxy-3-methoxy-phenyl)-7-methoxy-2,3-dimethylol-tetralin-6-ol
MOL003283 CCNA2 (2R,3R,4S)-4-(4-hydroxy-3-methoxy-phenyl)-7-methoxy-2,3-dimethylol-tetralin-6-ol
MOL003283 PTGS1 (2R,3R,4S)-4-(4-hydroxy-3-methoxy-phenyl)-7-methoxy-2,3-dimethylol-tetralin-6-ol
MOL004443 PTGS1 Zhebeiresinol
MOL004443 SCN5A Zhebeiresinol
MOL004443 PTGS2 Zhebeiresinol
MOL004443 RXRA Zhebeiresinol
MOL004443 ADRB2 Zhebeiresinol
MOL004443 GABRA1 Zhebeiresinol
MOL005828 NOS2 noblelin
MOL005828 PTGS1 noblelin
MOL005828 KCNH2 noblelin
MOL005828 ESR1 noblelin
MOL005828 AR noblelin
MOL005828 PPARG noblelin
MOL005828 PTGS2 noblelin
MOL005828 F7 noblelin
MOL005828 ESR2 noblelin
MOL005828 CHEK1 noblelin
MOL005828 PRSS1 noblelin
MOL005828 NCOA2 noblelin
MOL005828 GSK3B noblelin
MOL005828 SCN5A noblelin
MOL005828 BCL2 noblelin
MOL005828 BAX noblelin
MOL005828 CASP9 noblelin
MOL005828 MMP9 noblelin
MOL005828 JUN noblelin
MOL005828 TP63 noblelin
MOL005828 MAPK8 noblelin
MOL005828 TIMP1 noblelin
MOL005828  PPARG  nobiletin
MOL005828  CREB1  nobiletin
MOL005828  PLA2G4A  nobiletin
MOL005828  CD163  nobiletin
MOL005828  EPHB2  nobiletin
MOL007415  KCNH2  [(2S)-2-[(2S)-2-(benzoylamino)-3-phenylpropanoyl]amino]-3-phenylpropyl] acetate
MOL007415  PTGS2  [(2S)-2-[(2S)-2-(benzoylamino)-3-phenylpropanoyl]amino]-3-phenylpropyl] acetate
MOL007415  PRSS1  [(2S)-2-[(2S)-2-(benzoylamino)-3-phenylpropanoyl]amino]-3-phenylpropyl] acetate
MOL007535  PGR  (5S,8S,9S,10R,13R,14S,17R)-17-[(1R,4R)-4-ethyl-1,5-dimethylhexyl]-10,13-dimethyl-2,4,5,7,8,9,11,12,14,15,16,17-dodecahydro-1H-cyclopenta[a]phenanthrene-3,6-dione
MOL009386  KCNH2  3,3'-bis-(3,4-dihydro-4-hydroxy-6-methoxy)-2H-1-benzopyran
MOL009386  ESR1  3,3'-bis-(3,4-dihydro-4-hydroxy-6-methoxy)-2H-1-benzopyran
MOL009386  PTGS2  3,3'-bis-(3,4-dihydro-4-hydroxy-6-methoxy)-2H-1-benzopyran
MOL009386  ADRB2  3,3'-bis-(3,4-dihydro-4-hydroxy-6-methoxy)-2H-1-benzopyran
MOL009386  CCNA2  3,3'-bis-(3,4-dihydro-4-hydroxy-6-methoxy)-2H-1-benzopyran