



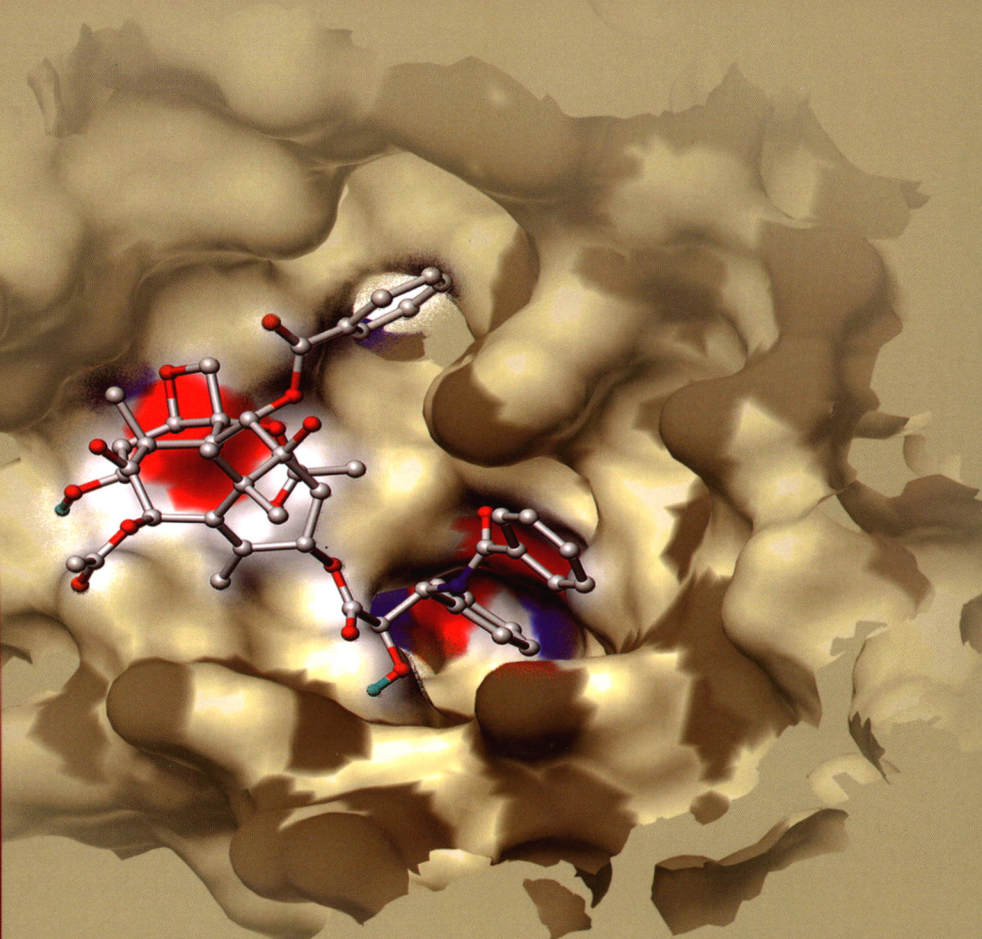
QK2126970

药 学 学 报

第56卷 第7期

Vol. 56 No. 7

2021年7月



Acta Pharmaceutica Sinica

专题报道

孙 昱, 徐 毅, 马双成

中药质量整体评价研究思路探讨

万方数据

于 航, 邢建国, 王 琰等

基于肠道菌的黄酮类成分代谢特征
及药理学思考



中国药学会
中国医学科学院药物研究所

药 学 学 报

第 56 卷 第 7 期 2021 年 7 月

图 文 摘 要

专题报道：聚焦天然产物质量与体内过程研究

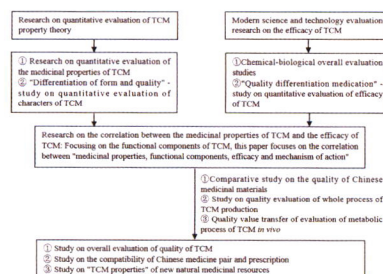
1749

中药质量整体评价研究思路探讨

孙昱¹, 徐敢^{2*}, 马双成^{3*}

(1. 国家药品监督管理局药品审评中心, 北京 100022; 2. 北京中医药大学, 北京 102248; 3. 中国食品药品检定研究院, 北京 100050)

本文通过学习领会中药生产全过程质量控制的内涵要求, 综述现代科学技术和传统中医药研究方法, 了解中药质量的基础研究现状, 探讨建立和完善以临床为导向、符合临床实际和中医药特点的中药质量整体评价体系。



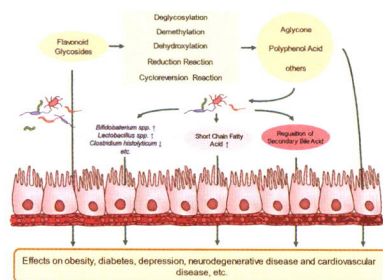
1757

基于肠道菌的黄酮类成分代谢特征及药理学思考

于航¹, 郑瑞芳², 苏文灵², 邢建国^{2*}, 王琰^{1*}

(1. 中国医学科学院、北京协和医学院药物研究所, 北京 100050; 2. 新疆维吾尔自治区药物研究所, 新疆 乌鲁木齐 830004)

黄酮类成分与肠道菌的相互作用分为两方面: 1) 黄酮类成分可被肠道菌代谢为苷元及多酚类小分子化合物; 2) 肠道菌也反过来受到黄酮类成分及其代谢物的调节, 如肠道菌群的结构发生改变, 同时影响短链脂肪酸及次级胆汁酸等刺激肠道菌代谢产物的产生。两方面共同作用, 有利于肥胖、糖尿病等多种疾病的治疗。



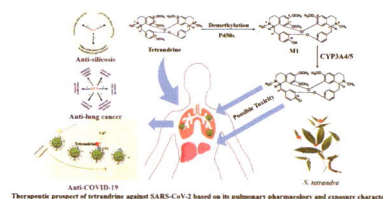
1769

从汉防己甲素的肺部药理活性及其暴露特征探讨其对抗新冠病毒的前景

王福润, 张文鹏, 丁日高, 钟武*, 庄笑梅*

(军事科学院军事医学研究院毒物药物研究所, 北京 100850)

汉防己甲素作为应用多年的天然药物, 其肺部药理活性与体内过程和肺部暴露特征密切相关。新发现 TET 的抗新冠病毒作用提示可能具有良好的抗新冠前景, 值得深入研究。



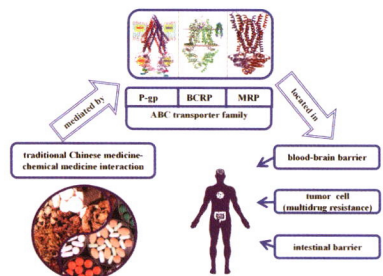
1778

ABC 转运蛋白家族介导的中药-化药相互作用研究进展

何宇臻, 王辉, 方家豪, 曹雨虹, 洪战英*, 柴逸峰

(海军军医大学药学院, 上海市药物 (中药) 代谢产物研究重点实验室, 上海 200433)

综述了近五年 ABC 转运蛋白介导的中药-化药相互作用研究进展, 包括 ABC 转运蛋白及其分布, 以及肠道屏障、血脑屏障和多药耐药肿瘤上 ABC 转运体介导的中药-化药相互作用。

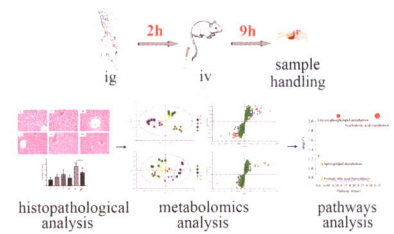


1789

免疫应激介导的赤芍缓解补骨脂肝脏毒性作用评价及其调控代谢网络分析武文星¹, 郭盛^{1*}, 吴励萍¹, 夏玲¹, 赵明¹, 李全², 王恒斌², 段金殿^{1*}

(1. 南京中医药大学, 中药资源产业化与方剂创新药物国家地方联合工程研究中心/江苏省中药资源产业化过程协同创新中心/江苏省方剂高新技术研究重点实验室, 江苏 南京 210023; 2. 雷允上药业集团有限公司, 江苏 苏州 215003)

本研究基于免疫应激大鼠模型探究补骨脂与赤芍配伍前后对其特异质肝损伤作用的影响及其代谢网络调控机制, 结果表明赤芍主要通过调节花生四烯酸代谢和甘油磷脂代谢等信号通路降低补骨脂导致的特异质肝损伤。

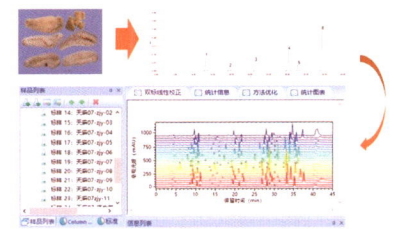


1797

双标线性校正技术用于天麻多成分色谱峰的定性分析周亚楠¹, 张元元¹, 李会军², 刘永利^{1*}, 孙磊³, 马双成^{3*}

(1. 河北省药品医疗器械检验研究院, 河北 石家庄 050227; 2. 中国药科大学中药学院, 江苏 南京 210009; 3. 中国食品药品检定研究院, 北京 100050)

双标线性校正法可提高天麻中 6 种成分的 HPLC 含量测定色谱峰保留时间预测准确性, 扩大色谱柱适用范围。

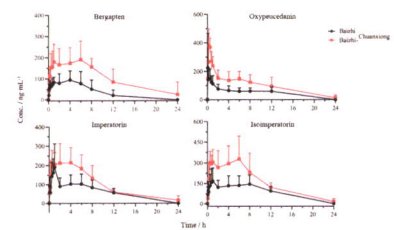


1804

川芎对白芷中 4 种香豆素类化合物吸收及清除的影响刘力榕^{1,2}, 贾志鑫^{2,3*}, 闫晓宁^{1,2}, 朱美霞^{1,2}, 方聪^{1,2}, 冯梦晗^{1,2}, 黄蓓蓓^{1,2}, 刘洁^{2,3}, 李乾^{1,2}, 肖红斌^{1,2,3*}

(1. 北京中医药大学中药学院, 北京 100029; 2. 北京中医药大学, 中药分析与转化研究中心, 北京 100029; 3. 北京中医药大学, 北京中医药研究院, 北京 100029)

川芎可以促进白芷中香豆素类化合物的吸收, 同时减缓其在体内的消除速率, 提高其生物利用度。

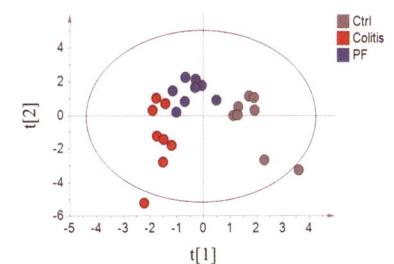


1811

芍药苷对结肠炎小鼠肠道菌群及胆汁酸代谢的调节作用王欣^{1#}, 朱敏^{2#}, 董思晶², 许银月², 景王慧^{2*}, 王嗣岑^{2*}

(1. 西安市第一医院药剂科, 陕西 西安 710002; 2. 西安交通大学医学部药学院, 陕西 西安 710061)

芍药苷通过重塑结肠炎小鼠肠道菌群结构, 调节菌群介导的胆汁酸代谢紊乱, 尤其提高游离型次级胆汁酸 DCA 和 LCA 的产生, 进而修复肠屏障损伤、降低肠道炎症, 最后对结肠炎小鼠发挥保护作用。

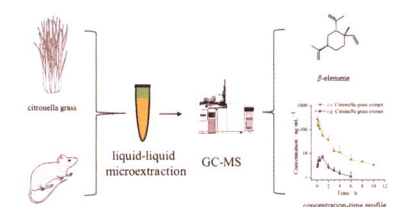


1820

液液微萃取 GC-MS 分析香茅草提取物给予大鼠后血浆中β-榄香烯及药代动力学特征李涛^{1,2}, 冯雪³, 冯雪¹, 彭娟², 赵小亮², 李佳⁴, 杨伟鹏^{1*}

(1. 中国中医科学院中药研究所, 北京 100700; 2. 中国中医科学院医学实验中心, 北京 100700; 3. 石药集团远大 (大连) 制药有限公司, 辽宁 大连 116600; 4. 清华大学医院, 北京 100084)

建立液液微萃取结合气相色谱-质谱联用法分析大鼠血浆中β-榄香烯及香茅草提取物的药代动力学特征。

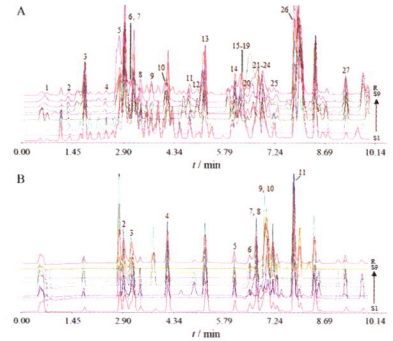


1826

菟丝子拟雌激素作用体内直接作用物质的发现

孙向明, 宋辉, 赵丽珠, 胡扬, 辛科颖, 李文兰*, 丁振铎*
(哈尔滨商业大学药学院, 黑龙江 哈尔滨 150076)

以去势(卵巢摘除)雌性大鼠为研究对象,通过“代谢产物-效应检测”模式进行相关性分析,初步明确菟丝子在体内发挥拟雌激素作用的直接作用物质。为菟丝子雌激素作用药效物质的揭示和质量标志物的确证提供了可靠依据。



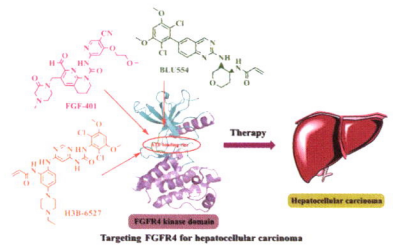
综述

1832

FGFR4: 一种有望治疗肝癌的靶点

王敏, 张谨阳, 王雨薇, 李雯, 孙丽萍*
(中国药科大学药学院药物化学系, 江苏省药物分子设计与成药性优化重点实验室, 江苏 南京 211198)

FGFR4 是一种治疗 FGF19-FGFR4 信号异常导致的肝癌的有前途的靶点。本文针对 FGFR4 的结构和配体、下游信号通路、在肝癌中的异常激活以及小分子 FGFR4 抑制剂、FGFR4 单克隆抗体和联合免疫治疗的研究进展进行总结。

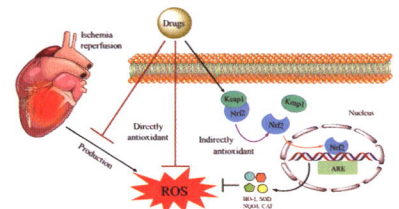


1845

抗氧化药物在心肌缺血再灌注损伤中的研究进展

谢静文^{1,2}, 苏天德², 魏雨亭¹, 李歌², 吴建章^{2*}, 黄丽丽^{3*}
(1. 重庆市万州区第一人民医院药学部, 重庆 404040; 2. 温州医科大学药学院, 浙江 温州 325035; 3. 宁波大学附属李惠利医院药剂科, 浙江 宁波 315040)

本文主要介绍了抗氧化药物在心肌缺血再灌注损伤中的作用,并根据其抗氧化机制将其分为以下两类药物进行阐述: ① 清除氧化自由基药物; ② 抑制氧化自由基产生的药物。

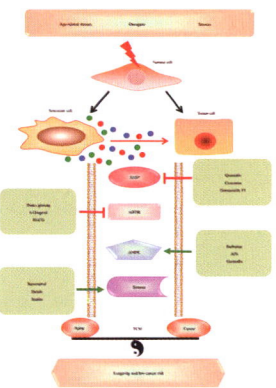


1856

中药有效成分在抗衰老与抗肿瘤作用机制中的研究进展

周若宇^{1,2}, 孙曼婷², 刘静^{2*}, 罗瑛^{1,2*}
(1. 昆明理工大学环境科学与工程学院, 云南 昆明 650500; 2. 昆明理工大学医学院衰老与肿瘤分子遗传学实验室, 云南 昆明 650500)

一些中药有效成分在衰老和肿瘤的常见信号通路中均有作用。癌基因和不同应激可诱导细胞衰老,并刺激各种衰老相关分泌表型(SASP)的分泌,包括细胞因子、生长因子、趋化因子和蛋白酶等,SASP可以进一步促进肿瘤发生。哺乳动物雷帕霉素分子靶标(mammalian target of rapamycin, mTOR)通路的激活与衰老和肿瘤风险增加相关;腺苷单磷酸激活依赖蛋白激酶[adenosine 5'-monophosphate (AMP)-activated protein kinase, AMPK]和组蛋白去乙酰化酶 sirtuins 通路的激活与寿命延长和肿瘤风险降低有关。槲皮素、白藜芦醇和一些中药有效成分可以靶向这些信号通路来平衡衰老和肿瘤。

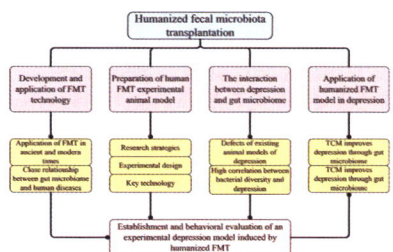


1865

人源化粪菌移植实验动物模型在抑郁症研究中的应用进展

赵慧亮¹, 杨晨¹, 王琦¹, 向欢², 秦雪梅¹, 田俊生^{1*}
(1. 山西大学中医药现代研究中心, 山西 太原 030006; 2. 山西大学体育学院, 山西 太原 030006)

人源化粪菌移植实验动物模型在抑郁症研究中的应用。



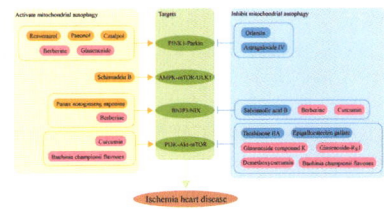
1872

线粒体自噬为靶点的抗缺血性心脏病天然药物研究进展

龚迪菲, 方莲花*, 杜冠华*

(中国医学科学院、北京协和医学院药物研究所, 天然药物活性物质与功能国家重点实验室, 药物靶点研究与新药筛选北京市重点实验室, 北京 100050)

天然药物可通过激活或抑制线粒体自噬, 调控线粒体自噬水平, 达到降低线粒体损伤、改善心肌缺血、减轻缺血性心脏病的目的。

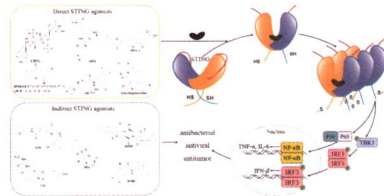


1880

干扰素基因刺激因子 (STING) 及其激动剂的研究进展常佳佳¹, 侯石², 闫心林², 肖军海^{2*}

(1. 天津大学化工学院, 天津 300350; 2. 军事科学院军事医学研究院毒物药物研究所, 北京 100850)

STING 激动剂通过激活 STING 通路, 诱导 I 型干扰素和促炎细胞因子的分泌, 具有抗菌、抗病毒和抗肿瘤的作用。分析直接 STING 激动剂与 STING 复合物的晶体结构及其构效关系有助于小分子 STING 激动剂的设计和发现。

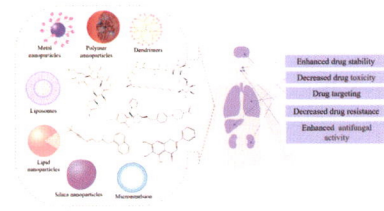


1893

纳米药物递释系统在抗真菌感染治疗中的应用及机制陈水生^{1#}, 周可倩^{2#}, 李晓东¹, 吕权真¹, 俞媛^{1*}

(1. 海军军医大学药理学系, 上海 200433; 2. 海军军医大学麻醉系, 上海 200433)

抗真菌纳米药物用于提高抗真菌感染治疗效果, 减少药物的毒性和耐药性。



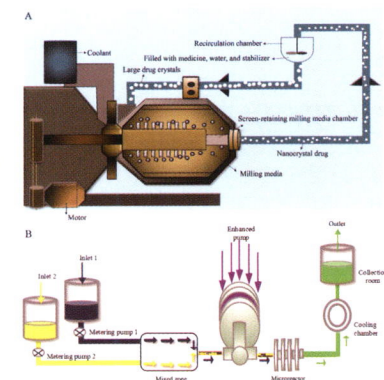
1902

纳米晶体药物制备技术的研究进展

田阳, 彭一凡, 张志伟, 张慧*, 高翔*

(军事科学院军事医学研究院毒物药物研究所, 北京 100850)

本文从“Top-down”技术、“Bottom-up”技术和组合技术 3 个方面系统地介绍了纳米晶体药物的新型制备技术。

**研究论文**

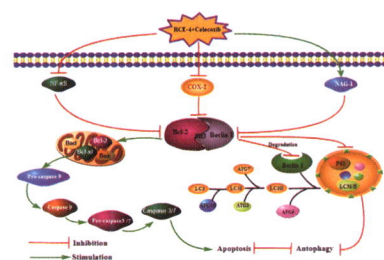
1911

吉祥草活性成分 RCE-4 与塞来昔布联合应用抗宫颈癌 Ca Ski 细胞增殖效果与机制研究

甄虹恒, 游方芳, 程凡, 邹坤, 陈重旭, 陈剑锋*

(三峡大学生物与制药学院, 三峡大学天然产物研究与利用湖北省重点实验室, 湖北 宜昌 443002)

RCE-4 与塞来昔布联用, 通过对 COX-2、NF-κB、NAG-1 等炎症介质及 Bcl-2-Bclln 1 复合体的调控, 抑制了 RCE-4 诱导的 Ca Ski 细胞的保护性自噬, 增强了细胞凋亡。



1921

不同方法建立固定比率为 10 的大鼠吗啡药物辨别模型

张欢^{1,2}, 王舒哲^{1,2}, 李贝贝², 王翊名³, 刘小珍^{2,4}, 陈华英², 邱云良^{2*}

(1. 上海工程技术大学化学化工学院, 上海 201620; 2. 中国医药工业研究总院, 上海益诺思生物技术股份有限公司, 上海 201203; 3. 上海健康医学院药学院, 上海 201318; 4. 复旦大学药学院, 上海 201203)

首次采用两种方法建立吗啡辨别模型, 初步证明单杆+双杆优于仅双杆训练; 其次, 吗啡诱导的辨别效应呈剂量依赖性增加。

- Drug discrimination
1. Food training
 2. Discrimination training
 - groups 1 and 2 were trained to discriminate morphine from saline until successful
 3. Generalization test
 - different doses of morphine were used to generalization test
 4. Results
 - successfully established the model
 - discrimination stimulus was dose-dependent
 - group 1 was better than group 2

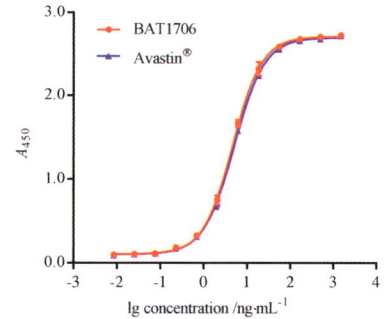
1927

贝伐珠单抗生物类似药 BAT1706 体外生物学活性相似性研究

邓春平, 陈航, 王英华, 梁神娣, 曹迪, 俞金泉, 李胜峰, 刘翠华*

(百奥泰生物制药股份有限公司, 广东 广州 510530)

BAT1706 与 Avastin® 的 VEGF-A 结合及中和活性、抑制 VEGFR-2 自磷酸化、Fcγ受体亲和力和生物效应子功能等体外功能活性高度相似。



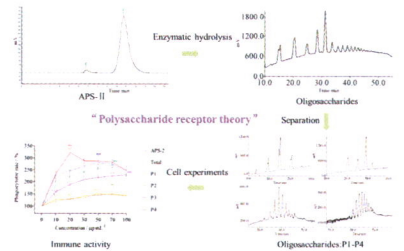
1936

黄芪活性多糖 APS-II 酶解方法的建立及其降解寡糖的免疫活性研究

李科^{1,2,3,4*}, 崔连杰^{1,3,4,5}, 李晓霞⁶, 石丽霞^{1,3,4}, 李震宇^{1,3,4}, 秦雪梅^{1,3,4}, 杜昱光²

(1. 山西大学中医药现代研究中心, 山西 太原 030006; 2. 中国科学院过程工程研究所, 北京 100190; 3. 山西大学化学生物学与分子工程教育部重点实验室, 山西 太原 030006; 4. 地产中药功效物质研究与利用山西省重点实验室, 山西 太原 030006; 5. 山西大学化学化工学院, 山西 太原 030006; 6. 山西省果业工作总站, 山西 太原 030001)

在“多糖受体理论”指导下, 建立黄芪活性多糖 APS-II 酶解方法, 并对其酶解产物进行免疫活性比较研究。



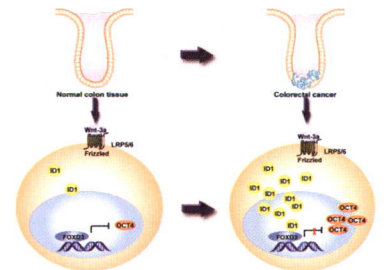
1945

结肠癌中 ID1 上调 OCT4 信号通路的机制研究

尚爽, 宋佳玮, 花芳*

(中国医学科学院、北京协和医学院药物研究所, 天然药物活性物质与功能国家重点实验室, 新药作用机制研究与药效评价北京市重点实验室 (BZ0150), 北京 100050)

结肠癌中 ID1 与 FOXD3 相互作用促进 OCT4 转录。



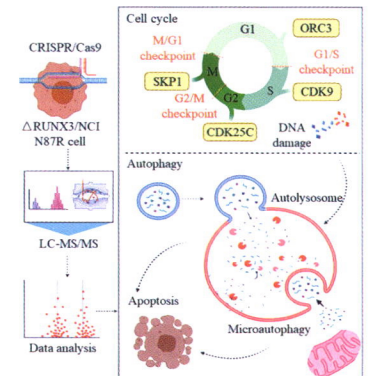
1953

RUNX3 调控胃癌细胞对赫赛汀耐药的蛋白组学研究

常晋霞¹, 王仕宝², 袁江北³, 刘文虎^{1*}

(1. 川北医学院基础医学院药学院, 四川 南充 637100; 2. 汉中职业技术学院药学院, 陕西 汉中 723000; 3. 北京大学深圳医院, 深圳北京大学-香港科技大学医学中心, 广东 深圳 518036)

本文构建了 RUNX3 敲除胃癌细胞株 (Δ RUNX3/NCI N87R), 与赫赛汀耐药细胞 (NCI N87R) 相比, Δ RUNX3/NCI N87R 细胞对赫赛汀敏感性增加。定量蛋白质组表明, 其机制可能与改变细胞周期、促进自噬、引起线粒体代谢异常并诱导凋亡有关, 提示 RUNX3 可能是胃癌赫赛汀耐药的潜在治疗靶标。

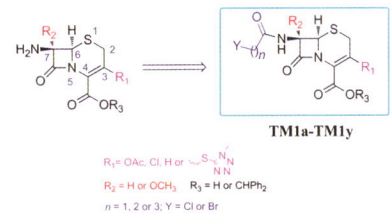


1965

C-7 位卤代酰基头孢化化合物的合成及其抗菌活性研究李洋¹, 范莉¹, 唐雪梅², 杨德蒙¹, 胡军华^{3*}, 吴玉珠³, 占爽³, 杨大成^{1*}

(1. 西南大学化学化工学院, 重庆市高校应用化学重点实验室, 生物有机与药物化学研究所, 重庆 400715; 2. 西南大学科学技术处, 重庆 400715; 3. 西南大学柑橘研究所, 重庆 400715)

C-3 位取代基不同的 4 种头孢母核, 经 C-7 位氨基的卤代酰基修饰, 获得 5 个系列 25 个目标分子, 抗菌活性测试发现某些分子具有强抗菌活性或强抗柑橘病原真菌活性。

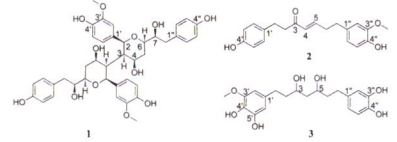


1976

姜皮中一个新的二苯庚烷二聚体宋志敏¹, 张晓娟¹, 王彦志^{1,2*}, 李曼倩¹, 刘煜飞¹, 胡雪雨¹, 冯卫生^{1,2*}

(1. 河南中医药大学药学院, 河南 郑州 450046; 2. 呼吸疾病中医药防治省部共建协同创新中心, 河南 郑州 450046)

运用多种色谱技术从姜皮中分离得到 3 个二苯庚烷类化合物, 其中化合物 1 为新二苯庚烷二聚体。

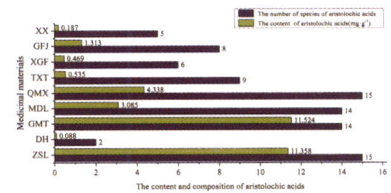


1980

9 种含马兜铃酸类毒性物质中药材中马兜铃酸类成分的定性与定量分析米士丽¹, 施海蔚², 谭力², 叶晓芸¹, 李忠红², 郭青^{2*}

(1. 南京中医药大学, 江苏 南京 210023; 2. 江苏省食品药品监督检验研究院, 江苏 南京 210019)

采用高效液相色谱-四极杆飞行时间质谱仪 (HPLC-Q-TOF-MS) 结合高效液相色谱-二极管阵列检测定性分析了 9 种药材中的马兜铃酸类成分, 应用高效液相色谱紫外检测法 (HPLC-UV) 对鉴定出的马兜铃酸类成分采用外标法进行了定量分析。

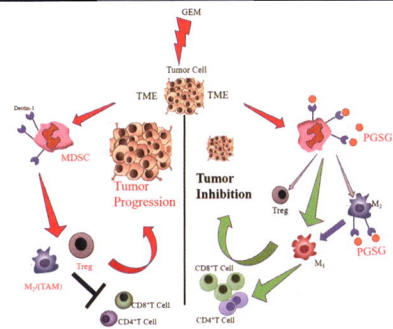


1988

微粒型灵芝孢子β-葡聚糖重塑免疫抑制微环境增强吉西他滨抗肺癌作用陈菲菲^{1,2}, 李畅^{1,2}, 罗毅^{1*}, 魏梦佳丽^{1,2}, 马倩^{1,2}, 宋捷^{1,2}, 封亮³, 贾晓斌³, 谭晓斌^{1,2*}

(1. 南京中医药大学附属中西医结合医院, 江苏 南京 210028; 2. 江苏省中医药研究院, 国家中医药管理局中药释药系统重点实验室, 江苏 南京 210028; 3. 中国药科大学中药学院, 江苏 南京 211198)

吉西他滨 (GEM) 反复化疗促进肿瘤微环境 (TME) 中免疫抑制性细胞蓄积, T 细胞耗竭, 而微粒型灵芝孢子粉β-葡聚糖 (PGSG) 重塑肿瘤免疫抑制微环境, 辅助 GEM 抗肿瘤作用。



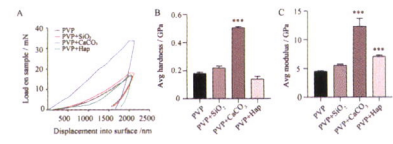
1999

纳米增强机械性能的可溶性微针制备与表征

包阳阳, 刘哲, 刘勇, 马凤森*

(浙江工业大学药学院, 生物制剂与材料实验室, 浙江 杭州 310014)

本文首次系统探究纳米粒材料、粒径及其处方含量对可溶性微针机械性能的影响。

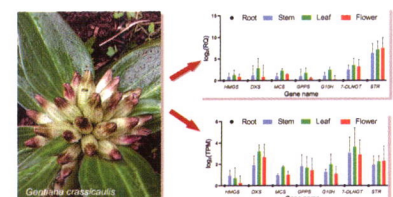


2005

粗茎秦艽转录组及其环烯醚萜类生物合成相关基因分析与验证康恒¹, 赵志礼^{1*}, 倪梁红¹, 李尉涛¹, 赵淑娟¹, 刘铜华^{2,3}

(1. 上海中医药大学, 上海 201203; 2. 西藏藏医药大学, 西藏 拉萨 850000; 3. 北京中医药大学, 北京 100029)

粗茎秦艽转录组及其环烯醚萜类合成相关基因验证。

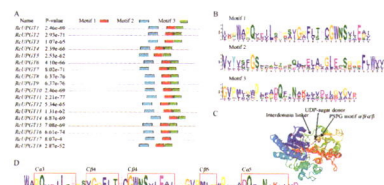


2015

西藏大花红景天 *RcUDPGTs* 基因克隆与表达分析

王宏鹏, 成璐璐, 滕彦娇, 陈成彬, 张力鹏*
(南开大学生命科学学院, 天津 300071)

本研究对西藏大花红景天 *RcUDPGTs* 基因家族中 18 个成员的序列和表达模式进行了分析, 并筛选了 *RcUDPGT* (JX228125.1) 的互作蛋白, 为了解大花红景天与高原环境的适应性机制, 以及深入研究根部次生代谢产物的合成和积累提供一定理论基础。



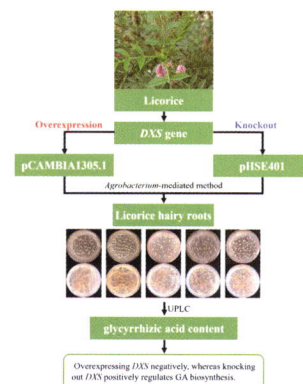
Conserve motif prediction of *RcUDPGTs*. A: Conserved domains; B: Motif sequences; C: Sugar donor region; D: PSPG region sequence

2025

甘草 *DXS* 基因过表达及表达沉默对甘草酸生物合成的影响研究

杨林¹, 汪逗逗¹, 田少凯¹, 张智新¹, 侯嘉铭¹, 肖瑶^{2*}, 刘颖^{1*}
(1. 北京中医药大学生命科学学院, 北京 102488; 2. 北京中医药大学中药学院, 北京 102488)

甘草 *DXS* 基因过表达及表达沉默对甘草酸生物合成的影响研究。



新药发现与研究实例简析

2033

以雌受体为靶标的骨质疏松治疗药雷洛昔芬

郭宗儒
(中国医学科学院、北京协和医学院药物研究所, 北京 100050)

Special Reports: Focalizing on the research of the quality control and *in vivo* process of natural drugs

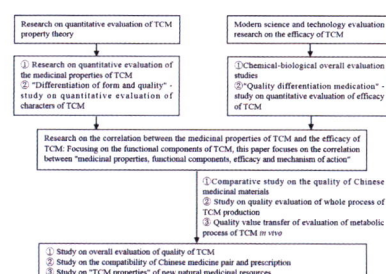
1749

Development of an overall evaluation system for traditional Chinese medicine

SUN Yu¹, XU Gan^{2*}, MA Shuang-cheng^{3*}

(1. Center for Drug Evaluation, National Medical Products Administration, Beijing 100022, China; 2. Beijing University of Chinese Medicine, Beijing 102248, China; 3. National Institutes for Food and Drug Control, Beijing 100050, China)

Through learning and understanding the connotation requirements of quality control in the whole process of production of traditional Chinese medicine (TCM), this paper summarized modern science and technology and the research methods of TCM, understood the basic research status of quality of TCM, and discussed the establishment and improvement of the overall evaluation system of quality of TCM, which is clinical-oriented and in line with clinical practice and characteristics of TCM.



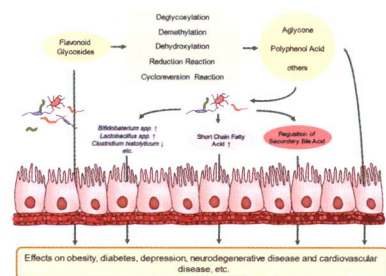
1757

Metabolism characteristics and pharmacological insights of flavonoids based on the intestinal bacteria

YU Hang¹, ZHENG Rui-fang², SU Wen-ling², XING Jian-guo^{2*}, WANG Yan^{1*}

(1. Institute of Materia Medica, Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing 100050, China; 2. Xinjiang Institute of Materia Medica, Urumqi 830004, China)

The interaction between flavonoids and gut microbiota can be concluded as follows: 1) Flavonoids can be metabolized by intestinal bacteria into aglycon and polyphenols; 2) Intestinal bacteria are also regulated by flavonoids and their metabolites, including changing the structure of the intestinal flora, and affecting the production of short-chain fatty acids and secondary bile acids, etc. The interaction between flavonoids and gut microbiota plays an important role in the treatment of obesity, diabetes and other diseases.

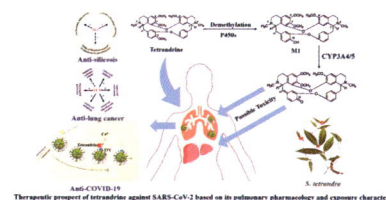


1769

Therapeutic prospect of tetrandrine against SARS-CoV-2 based on its pulmonary pharmacology and exposure character

WANG Fu-run, ZHANG Wen-peng, DING Ri-gao, ZHONG Wu*, ZHUANG Xiao-mei* (Academy of Military Sciences, Academy of Military Medical Sciences, Institute of Pharmacology and Toxicology, Beijing 100850, China)

As a natural medicine with a long history of clinical practice, tetrandrine (TET) exhibits specific pulmonary pharmacological properties related to its *in vivo* disposition and target exposure. The latest research found that TET may have a good anti-COVID-19 prospect, which merits deep investigation.



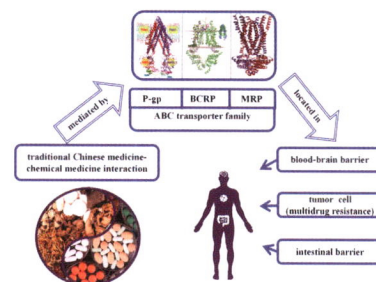
1778

Research progress on the traditional Chinese medicine-pharmaceutical drug interaction mediated by the ABC transporter family

HE Yu-zhen, WANG Hui, FANG Jia-hao, CAO Yu-hong, HONG Zhan-ying*, CHAI Yi-feng

(School of Pharmacy, Naval Medical University, Shanghai Key Laboratory for Pharmaceutical (Chinese Materia Medica) Metabolites Research, Shanghai 200433, China)

The recent trends in the traditional Chinese medicine-chemical medicine interaction mediated by ABC transporter family is reviewed, including ABC transporter superfamily and their distribution, as well as the traditional Chinese medicine - chemical medicine interactions mediated by ABC transporters on the intestinal barrier, the blood-brain barrier and the multi-drug resistance tumor cell.

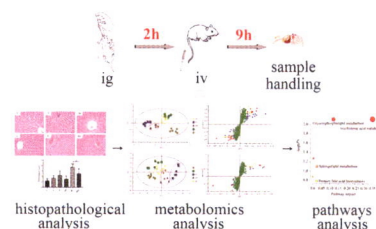


1789

Paeoniae Rubra Radix decreases the hepatotoxicity of Psoraleae Fructus in an immunologically stressed rat model: a metabolic network analysisWU Wen-xing¹, GUO Sheng^{1*}, WU Li-ping¹, XIA Ling¹, ZHAO Ming¹, LI Quan², WANG Heng-bin², DUAN Jin-ao^{1*}

(1. National and Local Collaborative Engineering Center of Chinese Medicinal Resources Industrialization and Formulae Innovative Medicine, and Jiangsu Collaborative Innovation Center of Chinese Medicinal Resources Industrialization, and Jiangsu Key Laboratory for High Technology Research of Traditional Chinese Medicine Formulae, Nanjing University of Chinese Medicine, Nanjing 210023, China; 2. Leiyunshang Pharmaceutical Co. Limited, Suzhou 215003, China)

In this research, an immunologically stressed rat model was used to study the effect of Paeoniae Rubra Radix on reducing liver toxicity of Psoraleae Fructus by metabolomics method. The results showed that the compatibility of Paeoniae Rubra Radix relieved the idiosyncratic hepatotoxicity of Psoraleae Fructus in rats mainly through the regulation of arachidonic acid metabolism and glycerophospholipid metabolism pathways.

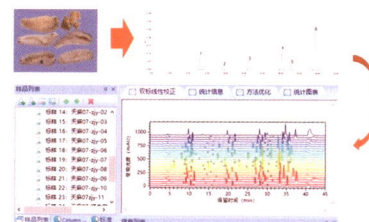


1797

Identification of Gastrodiae Rhizoma chromatographic peaks identification by liner calibration with two reference substances assistedZHOU Ya-nan¹, ZHANG Yuan-yuan¹, LI Hui-jun², LIU Yong-li^{1*}, SUN Lei³, MA Shuang-cheng^{3*}

(1. Hebei Institute for Drug and Medical Device Control, Shijiazhuang 050227, China; 2. China Pharmaceutical University of Traditional Chinese Pharmacy, Nanjing 210009, China; 3. National Institutes for Food and Drug Control, Beijing 100050, China)

The method of liner calibration with two reference substances can improve the rediction accuracy of retention time for determination of six components of *Gastrodiae Rhizoma* by HPLC chromatographic, and more kinds of chromatographic columns can be extended.

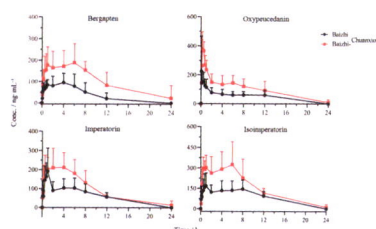


1804

Effect of Chuanxiong Rhizoma on the absorption and clearance of four coumarins in Angelicae Dahuricae RadixLIU Li-rong^{1,2}, JIA Zhi-xin^{2,3*}, YAN Xiao-ning^{1,2}, ZHU Mei-xia^{1,2}, FANG Cong^{1,2}, FENG Meng-Han^{1,2}, HUANG Bei-bei^{1,2}, LIU Jie^{2,3}, LI Qian^{1,2}, XIAO Hong-bin^{1,2,3*}

(1. School of Chinese Materia Medica, Beijing University of Chinese Medicine, Beijing 100029, China; 2. Research Center for Chinese Medicine Analysis and Transformation, Beijing University of Chinese Medicine, Beijing 100029, China; 3. Beijing Research Institute of Chinese Medicine, Beijing University of Chinese Medicine, Beijing 100029, China)

Chuanxiong Rhizoma can promote the absorption of coumarins in Angelicae Dahuricae Radix, slow down the elimination of coumarins, and increase their bioavailability *in vivo*.



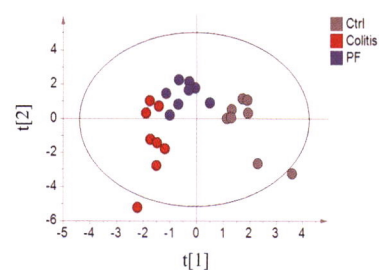
1811

Paeoniflorin regulates gut microbiota and bile acids metabolism in colitis miceWANG Xin^{1#}, ZHU Min^{2#}, DONG Si-jing², XU Yin-yue², JING Wang-hui^{2*}, WANG Si-cen^{2*}

(1. Department of Pharmacy, the First Hospital of Xi'an, Xi'an 710002, China;

2. School of Pharmacy, Health Science Center, Xi'an Jiaotong University, Xi'an 710061, China)

Paeoniflorin treatment improved the gut barrier function and colonic inflammation during the development of DSS-induced colitis in mice by remodeling the gut microbiota and increasing the concentrations of secondary BAs such as DCA and LCA.

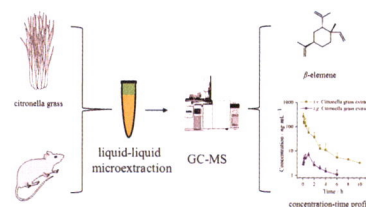


1820

Development of a liquid-liquid microextraction GC-MS method for simultaneous determination and pharmacokinetic analysis of β -elemene in rat plasma after administration of citronella grass extractLI Tao^{1,2}, FENG Xue³, FENG Xue¹, PENG Juan², ZHAO Xiao-liang², LI Jia⁴, YANG Wei-peng^{1*}

(1. Institute of Chinese Materia Medica, China Academy of Chinese Medical Sciences, Beijing 100700, China; 2. Experimental Research Center, China Academy of Chinese Medical Sciences, Beijing 100700, China; 3. CSPC Yuanda (Dalian) Pharmaceutical Co., Ltd., Dalian 116600, China; 4. Tsinghua University Hospital, Beijing 100084, China)

The liquid-liquid microextraction GC-MS method for simultaneous determination and pharmacokinetic analysis of β -elemene in rat plasma after administration of citronella grass extract was established in this paper.



The liquid-liquid microextraction GC-MS method for simultaneous determination and pharmacokinetic analysis of β -elemene in rat plasma after administration of citronella grass extract was established in this paper.

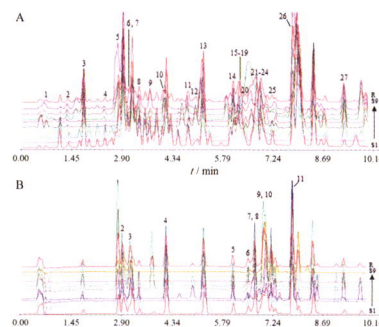
1826

Direct acting substances discovery of estrogen effect of *Cuscuta chinensis* in vivo

SUN Xiang-ming, SONG Hui, ZHAO Li-zhu, HU Yang, XIN Ke-ying, LI Wen-lan*, DING Zhen-duo*

(College of Pharmacy, Harbin University of Commerce, Harbin 150076, China)

The ovariectomized female rats were used as the research objects. The direct acting substances of *Cuscuta chinensis* in vivo were preliminarily identified through the correlation analysis of "metabolites-effect identification" model, which provides a reliable basis for revealing the estrogen-effective substances of *Cuscuta chinensis* and confirming the quality markers.

**Reviews**

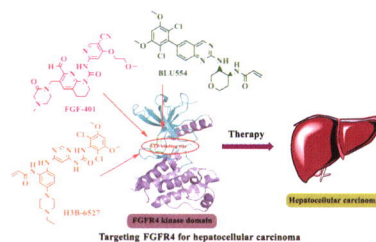
1832

FGFR4: a promising therapeutic target for liver cancer

WANG Min, ZHANG Jin-yang, WANG Yu-wei, LI Wen, SUN Li-ping*

(Department of Medicinal Chemistry, College of Pharmacy, Jiangsu Provincial Key Laboratory of Drug Molecular Design and Drug Formation Optimization, China Pharmaceutical University, Nanjing 211198, China)

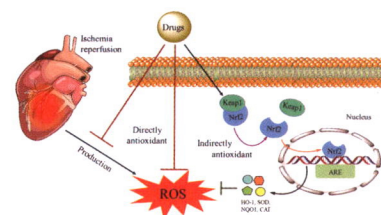
FGFR4 is a promising target for the treatment of hepatocellular carcinoma harboring aberrant FGF19-FGFR4 signaling. In this paper, we focus on assessing the role of FGFR4 in liver cancer, including a summary of the structure and ligand of FGFR4, downstream signaling pathways, abnormal activation in liver cancer, and the research progress of small molecule FGFR4 inhibitors, FGFR4 monoclonal antibodies and combined immunotherapy.



1845

Research progress of antioxidant drugs in myocardial ischemia-reperfusion injury

XIE Jing-wen^{1,2}, SU Tian-de², WEI Yu-ting¹, LI Ge², WU Jian-zhang^{2*}, HUANG Li-li^{3*}
 (1. Department of Pharmacy, the First People's Hospital of Wanzhou District, Chongqing 404040, China; 2. School of Pharmaceutical Sciences, Wenzhou Medical University, Wenzhou 325035, China; 3. Department of Pharmacy, Lihuli Hospital Affiliated to Ningbo University, Ningbo 315040, China)



This article mainly introduces the role of antioxidant drugs in myocardial ischemia-reperfusion injury, and divides them into following two types of drugs according to their antioxidant mechanisms:

- ① drugs for scavenging oxidative free radicals; ② drugs for inhibiting the generation of oxidative free radicals.

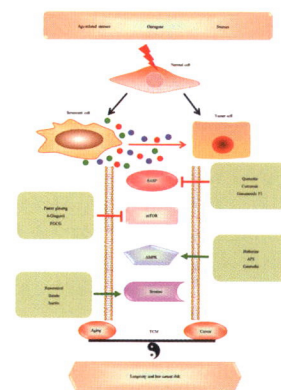
1856

Research progress of effective components of traditional Chinese medicine in anti-aging and anti-tumor mechanism

ZHOU Ruo-yu^{1,2}, SUN Man-ting², LIU Jing^{2*}, LUO Ying^{1,2*}

(1. Faculty of Environmental Science and Engineering, Kunming University of Science and Technology, Kunming 650500, China; 2. Laboratory of Molecular Genetics of Aging and Tumor, Medical School, Kunming University of Science and Technology, Kunming 650500, China)

The role of some effective components of traditional Chinese medicine in common signaling pathways of aging and tumors. Oncogenes and various stresses can induce cell senescence and stimulate the secretion of various senescence-associated secretory phenotype (SASP) including cytokines, growth factors, chemokines and proteases, SASP can further promote tumorigenesis. The activation of the mammalian target of rapamycin (mTOR) pathway is associated with aging and increased tumor risk, while the activation of adenosine 5'-monophosphate (AMP)-activated protein kinase (AMPK) and sirtuins pathways is associated with prolonged lifespan and reduced tumor risk. Quercetin, resveratrol and other active components of traditional Chinese medicine can target these signals and pathways to balance aging and tumors.



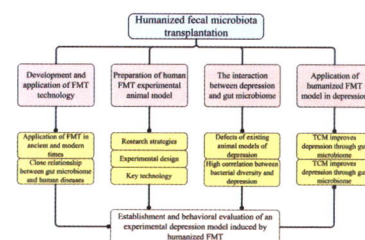
1865

Application progress of experimental animal model of humanized fecal microbiota transplantation in depression research

ZHAO Hui-liang¹, YANG Chen¹, WANG Qi¹, XIANG Huan², QIN Xue-mei¹, TIAN Jun-sheng^{1*}

(1. Modern Research Center for Traditional Chinese Medicine, Shanxi University, Taiyuan 030006, China; 2. School of Physical Education, Shanxi University, Taiyuan 030006, China)

Application of humanized fecal microbiota transplantation in animal models of depression.

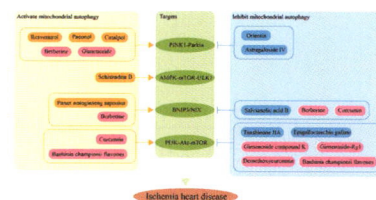


1872

Research progress of natural drugs targeting mitochondrial autophagy against ischemic heart disease

GONG Di-fei, FANG Lian-hua*, DU Guan-hua*

(State Key Laboratory of Bioactive Substances and Functions of Natural Medicines, Beijing Key Laboratory of Drug Target Identification and Drug Screening, Institute of Materia Medica, Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing 100050, China)



Natural drugs from plants can alleviate myocardial cell damage after ischemia/reperfusion through activating or inhibiting mitochondrial autophagy.

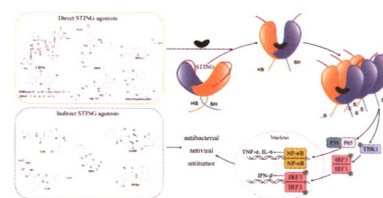
1880

Research advances on stimulator of interferon genes (STING) and its agonists

CHANG Jia-jia¹, HOU Shi², YAN Xin-lin², XIAO Jun-hai^{2*}

(1. School of Chemical Engineering and Technology, Tianjin University, Tianjin 300350, China; 2. Institute of Pharmacology and Toxicology, Academy of Military Medical Sciences, Academy of Military Sciences, Beijing 100850, China)

STING agonists have antibacterial, antiviral and antitumor effects by activating the STING pathway and inducing the secretion of type I interferon and proinflammatory cytokines. Analysis the crystal structure of the direct STING agonists in complex with STING and the structure-activity relationship is helpful to design and discovery of small molecular STING agonist.



1893

Application and mechanism of nanomedicine in antifungal infection therapy
 CHEN Shui-sheng^{1#}, ZHOU Ke-qian^{2#}, LI Xiao-dong¹, LÜ Quan-zhen¹, YU Yuan^{1*}
 (1. School of Pharmacy, Naval Medical University, Shanghai 200433, China;
 2. Anesthesiology Department, Naval Medical University, Shanghai 200433, China)

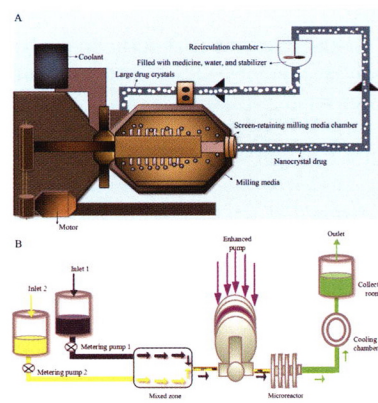
Antifungal nanomedicines are applied to reduce the toxicity of drugs, reduce drug resistance, and improve the antifungal therapy.



1902

Research progress on preparation technology of nanocrystal drugs
 TIAN Yang, PENG Yi-fan, ZHANG Zhi-wei, ZHANG Hui*, GAO Xiang*
 (China Institute of Pharmacology and Toxicology, Academy of Military Medical Sciences, Academy of Military Sciences, Beijing 100850)

This article systematically introduces the new preparation technology of nanocrystal drugs from three aspects: "Top-down" technology, "Bottom-up" technology and combination technology.

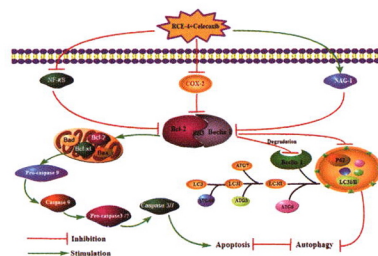


Original Articles

1911

The mechanism of RCE-4, an active ingredient of *Reineckia carnea*, in combination with celecoxib on the anti-proliferation of cervical cancer Ca Ski cells
 ZHEN Hong-heng, YOU Fang-fang, CHENG Fan, ZOU Kun, CHEN Chong-xu, CHEN Jian-feng*
 (College of Biological and Pharmaceutical Sciences of China Three Gorges University, Hubei Key Laboratory of Natural Products Research and Development, Yichang 443002, China)

RCE-4 in combination with celecoxib can inhibit RCE-4-induced cytoprotective autophagy and enhance RCE-4-induced apoptosis, through regulating inflammatory mediators of COX-2, NF-κB, and NAG-1, and disrupting the formation of Bcl-2-Beclin 1 complex.



1921

Different methods establish a rat model of morphine drug discrimination with a fixed ratio 10
 ZHANG Huan^{1,2}, WANG Shu-zhe^{1,2}, LI Bei-bei², WANG Yi-ming³, LIU Xiao-zhen^{2,4}, CHEN Hua-ying², QIU Yun-liang^{2*}
 (1. College of Chemistry and Chemical Engineering, Shanghai University of Engineering Science, Shanghai 201620, China; 2. Shanghai InnoStar Bio-Tech Co., Ltd., China State Institute of Pharmaceutical Industry, Shanghai 201203, China; 3. School of Pharmacy, Shanghai University of Medicine and Health Sciences, Shanghai 201318, China; 4. School of Pharmacy, Fudan University, Shanghai 201203, China)

The morphine discrimination model was established by using two methods for the first time at home and abroad, which preliminarily proves that single-lever + double-lever is better than only double-lever training.

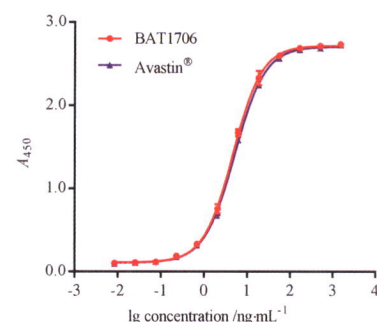
- Drug discrimination
1. Food training
 2. Discrimination training
 - groups 1 and 2 were trained to discriminate morphine from saline until successful
 3. Generalization test
 - different doses of morphine were used to generalization test
 4. Results
 - successfully established the model
 - discrimination stimulus was dose-dependent
 - group 1 was better than group 2

1927

In vitro functional similarity assessment of a proposed biosimilar BAT1706 to bevacizumab

DENG Chun-ping, CHEN Hang, WANG Ying-hua, LIANG Shen-di, CAO Di,
YU Jin-quan, LI Sheng-feng, LIU Cui-hua*
(Bio-Thera Solutions, Ltd., Guangzhou 510530, China)

BAT1706 is highly similar to Avastin® in terms of *in vitro* functional activities such as VEGF-A binding or neutralization activity, inhibition of VEGFR-2 autophosphorylation, Fcγ receptor binding activity, and effector function.

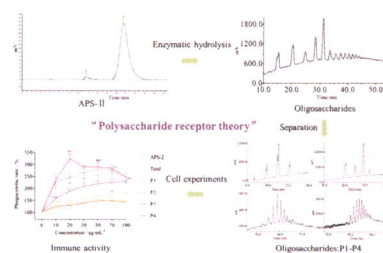


1936

Establishment of enzymatic hydrolysis method of active *Astragalus* polysaccharides APS-II and study on the immune activity of oligosaccharides after its degradation

LI Ke^{1,2,3,4*}, CUI Lian-jie^{1,3,4,5}, LI Xiao-xia⁶, SHI Li-xia^{1,3,4}, LI Zhen-yu^{1,3,4},
QIN Xue-mej^{1,3,4}, DU Yu-guang²

(1. Modern Research Center for Traditional Chinese Medicine, Shanxi University, Taiyuan 030006, China; 2. Institute of Process Engineering, Chinese Academy of Sciences, Beijing 100190, China; 3. Key Laboratory of Chemical Biology and Molecular Engineering of Ministry of Education, Shanxi University, Taiyuan 030006, China; 4. Key Laboratory of Effective Substances Research and Utilization in TCM of Shanxi Province, Shanxi University, Taiyuan 030006, China; 5. College of Chemistry and Chemical Engineering, Shanxi University, Taiyuan 030006, China; 6. Shanxi Fruit Industry Work Station, Taiyuan 030001, China)



According to the "polysaccharide receptor theory", a method for enzymatic hydrolysis of APS-II was established, and the immunological activity of the enzymatic hydrolysate products were compared.

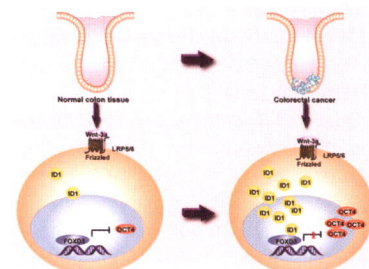
1945

The upregulation mechanism of OCT4 signaling by ID1 in colorectal cancer

SHANG Shuang, SONG Jia-wei, HUA Fang*

(State Key Laboratory of Bioactive Substance and Function of Natural Medicines, Beijing Key Laboratory of New Drug Mechanisms and Pharmacological Evaluation Study (BZ0150), Institute of Materia Medica, Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing 100050, China)

ID1 interacts with FOXD3 to promote *OCT4* transcription in colorectal cancer.



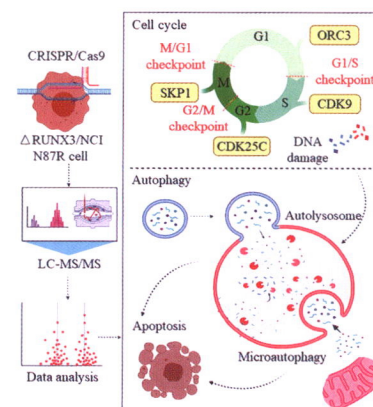
1953

Label-free quantitative proteomic study of RUNX3 regulating Herceptin resistance in gastric cancer cells

CHANG Jin-xia¹, WANG Shi-bao², YUAN Jiang-bei³, LIU Wen-hu^{1*}

(1. School of Basic Medical Sciences, Department of Pharmacy, North Sichuan Medical College, Nanchong 637100, China; 2. Department of Pharmacy, Hanzhong Vocation and Technology College, Hanzhong 723000, China; 3. Peking University Shenzhen Hospital, Shenzhen Peking University-The Hong Kong University of Science and Technology Medical Center, Shenzhen 518036, China)

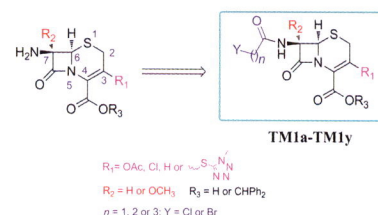
RUNX3 knock-out cell line (Δ RUNX3/NCI N87R) was constructed by using CRISPR/Cas9. The results showed that Δ RUNX3/NCI N87R cells become more sensitive to Herceptin compared with NCI N87R. Quantitative proteomics suggested that the mechanisms might be related to alteration of cell cycle, the facilitation of autophagy, the abnormal mitochondrial metabolism and the induction of apoptosis, which suggested that RUNX3 may be a potential therapeutic target for Herceptin resistance in gastric cancer cells.



1965

Synthesis and antibacterial activity of C-7 haloacyl cephalosporinsLI Yang¹, FAN Li¹, TANG Xue-mei², YANG De-meng¹, HU Jun-hua^{3*}, WU Yu-zhu³, ZHAN Shuang³, YANG Da-cheng^{1*}

(1. Key Laboratory of Applied Chemistry of Chongqing Municipality, Institute of Bioorganic and Medicinal Chemistry, School of Chemistry and Chemical Engineering, Southwest University, Chongqing 400715, China; 2. Science and Technology Division, Southwest University, Chongqing 400715, China; 3. Citrus Research Institute, Southwest University, Chongqing 400715, China)

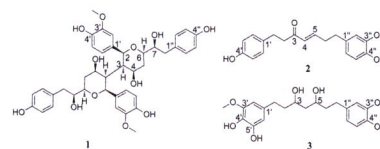


Twenty-five haloacylated cephalosporins of five series were tentatively designed by introducing simple substituent at C-7 amino group from four cephalosporin parent nucleus with different C-3 substituent and then synthesized efficiently. Some molecules had strong inhibitory activities against eight human pathogens or against *Alternaria alternata* Al.6, which was the first report that some cephalosporins had strong activity against *citrus* pathogenic fungi.

1976

A new diarylheptane dimer from *Zingiber officinale* peelSONG Zhi-min¹, ZHANG Xiao-juan¹, WANG Yan-zhi^{1,2*}, LI Man-qian¹, LIU Yu-fei¹, HU Xue-yu¹, FENG Wei-sheng^{1,2*}

(1. School of Pharmacy, Henan University of Chinese Medicine, Zhengzhou 450046, China; 2. Co-construction of Collaborative Innovation Center for Chinese Medicine and Respiratory Diseases by Henan and Education Ministry of P. R. China, Zhengzhou 450046, China)



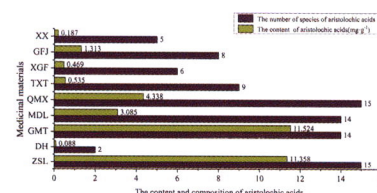
A new diarylheptane dimer was isolated from the *n*-butanol fraction of *Zingiber officinale* peel by MCI Gel CHP-20, Sephadex LH-20, ODS and semi-preparative high performance liquid chromatography.

1980

Qualitative and quantitative analysis of aristolochic acid components in nine Chinese medicinal materials containing toxic aristolochic substancesMI Shi-li¹, SHI Hai-wei², TAN Li², YE Xiao-yun¹, LI Zhong-hong², GUO Qing^{2*}

(1. Nanjing University of Traditional Chinese Medicine, Nanjing 210023, China; 2. Jiangsu Institute of Food and Drug Control, Nanjing 210019, China)

The aristolochic acid components in the nine Chinese medicinal materials were analyzed by high performance liquid chromatography-quadrupole time of flight mass spectrometry (HPLC-Q-TOF-MS) combined with high performance liquid chromatography diode-array detection, and the identified aristolochic acid components were quantified using an external standard method by HPLC-UV.

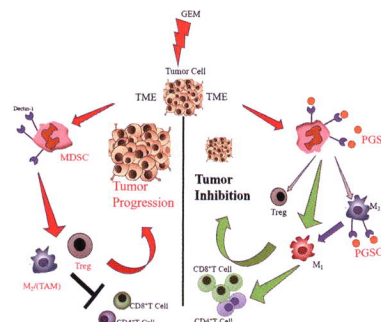


1988

Micro-particulate *Ganoderma lucidum* spore β -glucanin enhances the antitumor activity of gemcitabine via remodeling immunosuppressive microenvironment in Lewis lung cancerCHEN Fei-fei^{1,2}, LI Chang^{1,2}, LUO Yi^{1*}, WEI Meng-jia-li^{1,2}, MA Qian^{1,2}, SONG Jie^{1,2}, FENG Liang³, JIA Xiao-bin³, TAN Xiao-bin^{1,2*}

(1. Affiliated Hospital of Integrated Traditional Chinese and Western Medicine, Nanjing University of Chinese Medicine, Nanjing 210028, China; 2. Key Laboratory of New Drug Delivery Systems of Chinese Materia Medica, Jiangsu Provincial Academy of Chinese Medicine, Nanjing 210028, China; 3. School of Traditional Chinese Pharmacy, China Pharmaceutical University, Nanjing 211198, China)

Repeated chemotherapy of gemcitabine (GEM) promotes the accumulation of immunosuppressive cells and exhaustion of T cells in tumor microenvironment (TME), while micro-particulate *Ganoderma lucidum* spore β -glucan (PGSG) reshapes the tumor immunosuppressive microenvironment and assists GEM in anti-tumor.



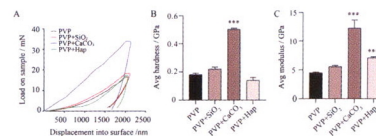
1999

Preparation and characterization of dissolving microneedles with nano-enhanced mechanical properties

BAO Yang-yang, LIU Zhe, LIU Yong, MA Feng-sen*

(Biologics and Biomaterials Laboratory, College of Pharmacy, Zhejiang University of Technology, Hangzhou 310014, China)

In this paper, the effects of nanoparticle material, particle size and its content on the mechanical properties of dissolving microneedles were systematically investigated for the first time.

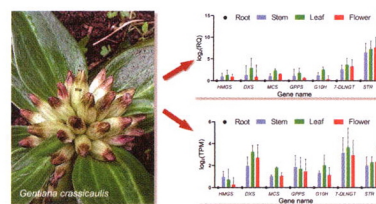


2005

Transcriptome analysis and exploration of genes involved in the biosynthesis of iridoids in *Gentiana crassicaulis* (Gentianaceae)KANG Heng¹, ZHAO Zhi-li^{1*}, NI Liang-hong¹, LI Wei-tao¹, ZHAO Shu-juan¹, LIU Tong-hua^{2,3}

(1. Shanghai University of Traditional Chinese Medicine, Shanghai 201203, China; 2. Tibetan Traditional Medical College, Lhasa 850000, China; 3. Beijing University of Chinese Medicine, Beijing 100029, China)

Transcriptome analysis and validation of genes contributing to biosynthesis of iridoids in *Gentiana crassicaulis*.



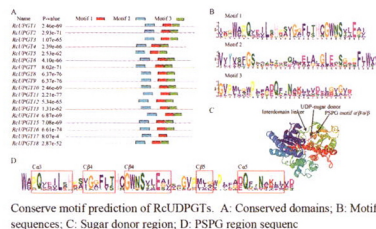
2015

Cloning and expression analysis of *RcUDPGTs* genes in Tibetan *Rhodiola crenulata*

WANG Hong-peng, CHENG Lu-lu, TENG Yan-jiao, CHEN Cheng-bin, ZHANG Li-peng*

(College of Life Science, Nankai University, Tianjin 300071, China)

In this study, Tibet *Rhodiola crenulata* was used as research material, the sequences and expression patterns of 18 members of the *RcUDPGTs* gene family were analyzed, and the interacting proteins of *RcUDPGT* (JX228125.1) were screened from Arabidopsis yeast library. The results would lay a foundation for understanding the adaptive mechanism of *Rhodiola crenulata* with plateau environment, and provided a theoretical basis for in-depth study of the synthesis and accumulation of secondary metabolites.



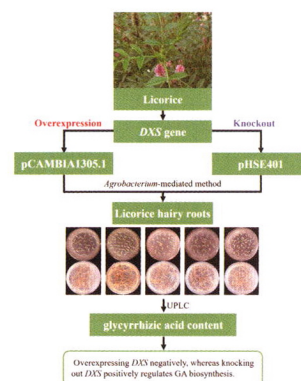
Conserved motif prediction of *RcUDPGTs*. A: Conserved domains; B: Motif sequences; C: Sugar donor region; D: PSPG region sequence

2025

The role of licorice *DXS* knockout and overexpression in glycyrrhizic acid biosynthesisYANG Lin¹, WANG Dou-dou¹, TIAN Shao-kai¹, ZHANG Zhi-xin¹, HOU Jia-ming¹, XIAO Yao^{2*}, LIU Ying^{1*}

(1. School of Life Sciences, Beijing University of Chinese Medicine, Beijing 102488, China; 2. School of Chinese Pharmacy, Beijing University of Chinese Medicine, Beijing 102488, China)

The study of licorice *DXS* knocking out and overexpression influencing glycyrrhizic acid biosynthesis.



ACTA PHARMACEUTICA SINICA

Volume 56 Number 7 2021 July



期刊基本参数: CN 11-2163/R*1953*m*A4*290*zh*P*¥40.00* *32*2021-07

本期责任编辑 岳 瑞

药学报 (YAOXUE XUEBAO)

(月刊, 1953年7月创刊)

主管单位: 中国科学技术协会

主办单位: 中国药学会 (<http://www.cpa.org.cn>)

中国医学科学院药物研究所

(<http://www.imm.ac.cn>)

编辑出版: 药学报编辑部 (100050 北京市先农坛街1号)

电话/传真: 86-10-63026192, 63035012;

电子信箱: yxxb@imm.ac.cn;

网址: <http://www.yxxb.com.cn>

主编: 王晓良

印刷: 北京科信印刷有限公司

国内订购: 全国各地邮电局

发行范围: 公开发行

国内: 北京报刊发行局

国外: 中国国际图书贸易集团有限公司

(北京市399信箱, 100044)

ACTA PHARMACEUTICA SINICA

(Monthly, Founded in 1953 July)

Directed by: China Association for Science and Technology

Sponsored by: Chinese Pharmaceutical Association

(<http://www.cpa.org.cn>)

Institute of Materia Medica, Chinese Academy of Medical Sciences (<http://www.imm.ac.cn>)

Edited and Published by: Editorial Office of Acta Pharmaceutica Sinica

(1 Xiannongtan Street, Beijing 100050).

Tel / Fax: 86-10-63026192, 63035012;

E-mail: yxxb@imm.ac.cn; <http://www.yxxb.com.cn>

Editor-in-chief: WANG Xiao-liang

Printed by: Beijing Kexin Printing Co., Ltd.

Domestic subscriptions: Local Post Offices

Distribution

Domestic: Beijing Post Offices

Foreign: China International Book Trading Corporation,
PO Box 399, Beijing 100044, China

ISSN 0513-4870

2021年 第56卷 第7期 :

2021年7月12日出版

邮发代号: 2-233

CN 11-2163/R

2021, Vol. 56, No.7

Publication Date: 2021-07-12

Code number: M105

国内定价: 每期40.00元



万方数据

ISSN 0513-4870



9 770513 487216