

TUNEL细胞凋亡检测试剂盒(显色法)

产品编号	产品名称	包装
C1091	TUNEL细胞凋亡检测试剂盒(显色法)	20次

产品简介:

- 碧云天生产的显色法TUNEL细胞凋亡检测试剂盒(Colorimetric TUNEL Apoptosis Assay Kit)为您提供了一种高灵敏度又快速简便的细胞凋亡检测方法。对于待检测的细胞或组织样品, 经过生物素标记和后续的DAB显色等步骤, 即可在普通光学显微镜下观察到凋亡细胞。
- 细胞在发生凋亡时, 会激活一些DNA内切酶, 这些内切酶会切断核小体间的基因组DNA。细胞凋亡时抽提DNA进行电泳检测, 可以发现180-200bp的DNA ladder。基因组DNA断裂时, 暴露的3'-OH可以在末端脱氧核苷酸转移酶(Terminal Deoxynucleotidyl Transferase, TdT)的催化下加上生物素(Biotin)标记的dUTP(Biotin-dUTP), 随后和辣根过氧化物酶(HRP)标记的Streptavidin (Streptavidin-HRP)结合, 最后在HRP的催化下通过DAB显色来显示凋亡细胞, 从而可以通过普通光学显微镜检测到凋亡的细胞, 这就是TUNEL(TdT-mediated dUTP Nick-End Labeling)法检测细胞凋亡的原理。
- 本试剂盒有如下优点。(1) 高灵敏度: 背景染色极低, 阳性染色强, 可以在单细胞水平检测到细胞凋亡, 同时由于凋亡早期就有DNA断裂, 可以检测到早期的细胞凋亡。(2) 特异性好: TUNEL检测时通常更容易标记凋亡细胞, 而不容易标记坏死细胞。(3) 快速: 仅需约2-3个小时即可完成。(4) 应用范围广: 可以用于检测冷冻或石蜡切片中的细胞凋亡情况, 也可以检测培养的贴壁细胞或悬浮细胞的凋亡情况。(5) 实测效果好: 参考图1。

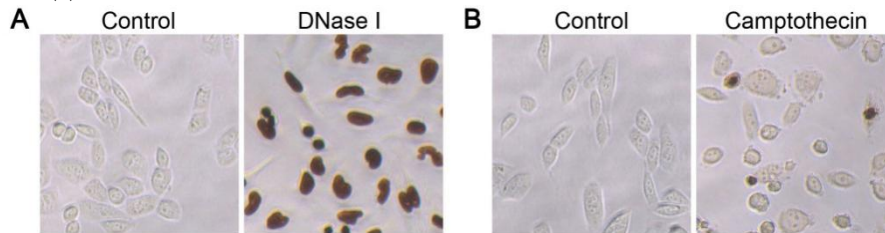


图1. 本试剂盒的检测效果图。A. HeLa细胞未处理或用DNase I室温孵育10分钟后的检测效果图。B. HeLa细胞未处理或用10 μ M喜树碱(Camptothecin)处理24小时后的检测效果图。图中棕褐色为DAB染色阳性细胞。本图中的染色实验均在12孔板中进行。本图仅作参考, 不同的样品不同的检测条件, 实际获得的结果可能和上图有较明显的差别。

- TUNEL法特异性检测细胞凋亡时产生的DNA断裂, 但不会检测出射线等诱导的DNA断裂(和细胞凋亡时的断裂方式不同)。这样一方面可以把凋亡和坏死区分开, 另一方面也不会把射线等诱导发生DNA断裂的非凋亡细胞判断为凋亡细胞。
- 极少数细胞凋亡时没有DNA断裂, 此时不适用TUNEL法检测。在个别类型的坏死细胞中也发现TUNEL检测呈阳性。在需要严格判断细胞凋亡的情况下, 最好同时检测多个凋亡指标。
- 本试剂盒足够检测20个样品。

包装清单:

产品编号	产品名称	包装
C1091-1	TdT酶	100 μ l
C1091-2	Biotin-dUTP	900 μ l
C1091-3	TdT酶稀释液(选用)	500 μ l
C1091-4	Streptavidin-HRP	22 μ l
C1091-5	Streptavidin-HRP稀释液	1ml
C1091-6	DAB显色液A	6ml
C1091-7	DAB显色液B	6ml
C1091-8	标记反应终止液	6ml
—	说明书	1份

保存条件:

-20 $^{\circ}$ C保存, DAB显色液A和DAB显色液B需避光保存。

注意事项:

- 需自备用于洗涤细胞的PBS或HBSS，用于封片的抗荧光淬灭封片液(P0126)等适当的封片液，用于固定的4%多聚甲醛或向碧云天订购免疫染色固定液(P0098)，同时需自备含0.3% Triton X-100的PBS或向碧云天订购免疫染色强力通透液(P0097)。 需自备过氧化氢。
- 如果用于石蜡切片的检测，需自备蛋白酶K和二甲苯。蛋白酶K(ST533)可以向碧云天订购。
- DAB 对人体有害，操作时请小心，并注意有效防护以避免直接接触人体或吸入体内。
- 本产品仅限于专业人员的科学研究用，不得用于临床诊断或治疗，不得用于食品或药品，不得存放于普通住宅内。
- 为了您的安全和健康，请穿实验服并戴一次性手套操作。

使用说明：

1. 对于贴壁细胞或细胞涂片：

- 用PBS或HBSS洗涤1次。
- 如果细胞贴得不牢，可以干燥样品使细胞贴得更牢。
- 用4%多聚甲醛或碧云天生产的免疫染色固定液(P0098)固定细胞30分钟。
- 用PBS或HBSS洗涤1次。
- 加入碧云天生产的免疫染色强力通透液(P0097)或含0.3% Triton X-100的PBS，室温孵育5分钟。
- 用PBS或HBSS洗涤1次。
- 在碧云天生产的内源性过氧化物酶封闭液(P0100A)或PBS配制的0.3%过氧化氢溶液(0.3% H₂O₂ in PBS)中室温孵育20分钟，以灭活切片内源的过氧化物酶。随后用PBS或HBSS洗涤3次。
- 转步骤5。

2. 对于悬浮细胞或细胞悬液：

- 收集细胞(不超过200万细胞)，用PBS或HBSS洗涤1次。
- 涂片，使细胞粘附在载玻片上。可以干燥样品使细胞贴得更牢，或使用适当的粘附试剂。
- 用碧云天生产的免疫染色固定液(P0098)或4%多聚甲醛固定细胞30分钟。
- 用PBS或HBSS洗涤1次。
- 加入碧云天生产的免疫染色强力通透液(P0097)或含0.3% Triton X-100的PBS，室温孵育5分钟。
- 用PBS或HBSS洗涤1次。
- 在碧云天生产的内源性过氧化物酶封闭液(P0100A)或PBS配制的0.3%过氧化氢溶液(0.3% H₂O₂ in PBS)中室温孵育20分钟，以灭活切片内源的过氧化物酶。随后用PBS或HBSS洗涤3次。
- 转步骤5。

3. 对于石蜡切片：

- 二甲苯中脱蜡5-10分钟。换用新鲜的二甲苯，再脱蜡5-10分钟。无水乙醇5分钟。90%乙醇2分钟。70%乙醇2分钟，蒸馏水2分钟。
- 滴加20μg/ml不含DNase的蛋白酶K(推荐使用碧云天的ST532/ST533 蛋白酶K(20mg/ml)，用P0106 免疫染色洗涤液或10mM Tris-HCl pH7.4-7.8稀释1000倍即为20μg/ml不含DNase的蛋白酶K)，20-37°C作用15-30分钟(不同组织的最佳作用温度和时间需自行摸索)。
- PBS或HBSS洗涤3次。注意：这一步必须把蛋白酶K洗涤干净，否则会严重干扰后续的标记反应。
- 在碧云天生产的内源性过氧化物酶强力封闭液(P0100B)或PBS配制的3%过氧化氢溶液(3% H₂O₂ in PBS)中室温孵育20分钟，以灭活切片内源的过氧化物酶。随后用PBS或HBSS洗涤3次。注：请勿在用PBS配制的3%过氧化氢溶液中孵育过长时间，否则会出现过氧化氢导致的DNA断裂，从而产生假阳性。
- 转步骤5。

4. 对于冷冻切片：

- 用碧云天生产的免疫染色固定液(P0098)或4%多聚甲醛固定细胞30分钟。
- PBS或HBSS洗涤2次，每次10分钟。
- 加入碧云天生产的免疫染色强力通透液(P0097)或含0.3% Triton X-100的PBS，室温孵育5分钟。
- 在碧云天生产的内源性过氧化物酶封闭液(P0100A)或PBS配制的0.3%过氧化氢溶液(0.3% H₂O₂ in PBS)中室温孵育20分钟，以灭活切片内源的过氧化物酶。随后用PBS或HBSS洗涤3次。
- 转步骤5。

5. 配制生物素标记液：

参考下表配制适量的生物素标记液，需充分混匀。注意：配制好的生物素标记液必须一次使用完毕，不宜冻存。

	1个样品	5个样品	10个样品
TdT酶	5μl	25μl	50μl
Biotin-dUTP	45μl	225μl	450μl
生物素标记液	50μl	250μl	500μl

6. 样品的生物素标记：

- 在样品上加50μl生物素标记液，37°C避光孵育60分钟。注意：50μl生物素标记液适合涂片、切片或96孔板、48孔板、24孔板或12孔板的一个孔，如果是6孔板中的一个孔生物素标记液宜使用100μl。如果待检测的样品为涂片、切片或在24孔板、12孔板或6孔板中，可以使用防蒸发膜，或自行尝试使用自封袋或者其它适当材料自行裁剪成比孔略小的圆形塑料片，滴加生物素

标记液后覆盖在样品上，可以防止生物素标记液蒸发，并且使生物素标记液均匀覆盖样品。自行裁剪圆片时需要连着圆片突出一个角或连着一一条，并将圆形之外的突出部分折叠，方便染色结束后利用突出部分顺利取出圆片。也可以用PAP Pen圈出一个区域进行染色。孵育时需注意在多余的孔和多孔板的空隙中加入适量水以保持湿润，从而尽量减少生物素标记液的蒸发。

- b. 用PBS或HBSS洗涤1次，滴加0.1-0.3ml标记反应终止液，室温孵育10分钟。
- c. 用PBS或HBSS洗涤3次。

7. Streptavidin-HRP工作液和DAB显色液的配制：

- a. Streptavidin-HRP工作液的配制：

参考下表配制适量的Streptavidin-HRP工作液，需充分混匀。注意：配制好的Streptavidin-HRP工作液必须一次使用完毕，不宜冻存。

	1个样品	5个样品	10个样品
Streptavidin-HRP	1 μ l	5 μ l	10 μ l
Streptavidin-HRP稀释液	49 μ l	245 μ l	490 μ l
Streptavidin-HRP工作液	50 μ l	250 μ l	500 μ l

- b. DAB显色液的配制：

按照每个样品使用0.2-0.5ml显色液的比例配制适量DAB显色液。等体积混合适量DAB显色液A和DAB显色液B，充分混匀后即成为DAB显色液。注意：配制好的DAB显色液必须一次使用完毕，不宜冻存。

8. 样品的显色：

- a. 在样品上加50 μ l Streptavidin-HRP工作液，室温孵育30分钟。注意：50 μ l Streptavidin-HRP工作液适合涂片、切片或96孔板、48孔板、24孔板或12孔板的一个孔，如果是6孔板中的一个孔Streptavidin-HRP工作液宜使用100 μ l。如果待检测的样品为切片、涂片或在24孔板、12孔板或6孔板中，可以使用防蒸发膜，或自行尝试使用自封袋或者其它适当材料自行裁剪成比孔略小的圆形塑料片，滴加Streptavidin-HRP工作液后覆盖在样品上，可以防止Streptavidin-HRP工作液蒸发，并且使Streptavidin-HRP工作液均匀覆盖样品。自行裁剪圆片时需要连着圆片突出一个角或连着一一条，并将圆形之外的突出部分折叠，方便染色结束后利用突出部分顺利取出圆片。也可以用PAP Pen圈出一个区域进行染色。孵育时需注意在多余的孔和多孔板的空隙中加入适量水以保持湿润，从而尽量减少Streptavidin-HRP工作液的蒸发。
- b. 用PBS或HBSS洗涤3次。
- c. 滴加0.2-0.5ml DAB显色液，室温孵育5-30分钟或根据显色情况孵育适当时间。注：如果显色很强可以短于5分钟即停止显色，如果显色很弱，可以适当延长显色时间，甚至显色过夜。
- d. 用PBS或HBSS洗涤3次。
- e. 染色效果可参见图1或图2。
- f. 选做(本步骤可以不做)：用苏木素染色液(C0107)或甲基绿染色液(C0115)进行细胞核染色。随后用PBS或HBSS洗涤3次。
- g. 直接进行观察，或用95%乙醇脱水5分钟，再用100%乙醇脱水2次，每次约3分钟，再用二甲苯透明2次，每次5分钟，随后封片观察。染色结果可参考图2：

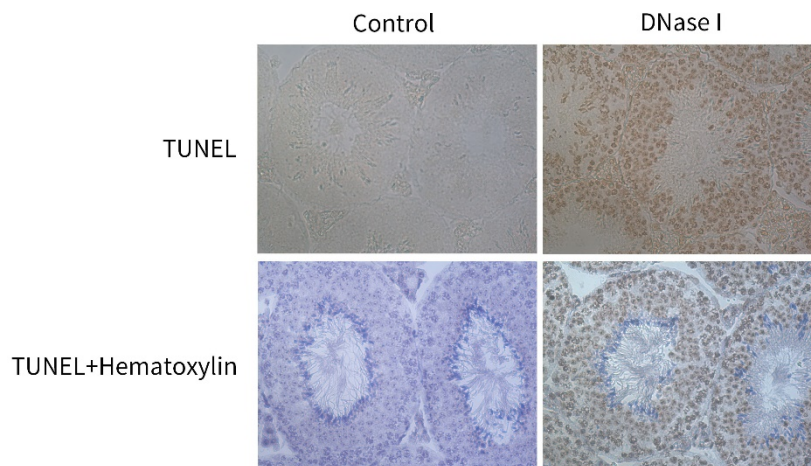


图2. TUNEL细胞凋亡检测试剂盒(显色法)用于小鼠睾丸切片的检测效果图。睾丸组织未处理(Control)或经DNase I处理60min后(DNase I)，用本试剂盒进行检测(TUNEL)，或本试剂盒检测后再用苏木素复染(TUNEL+Hematoxylin)。TUNEL染色阳性的凋亡细胞显棕色，苏木素染色的细胞核显蓝色，被TUNEL染色呈现阳性的细胞通常不能再被苏木素染色。实际检测效果会因样品和检测条件的不同而存在差异，本图仅作参考。

常见问题：

1. 出现非特异性显色。

- a. 有些细胞或组织，例如平滑肌细胞或组织，nuclease或polymerase的酶活性水平较高，易导致出现非特异性的显色。解决方法是，取细胞或组织后立即固定并且要充分固定，以阻止这些酶导致假阳性。
- b. 使用了不适当的固定液，例如一些酸性固定液，导致出现假阳性。建议采用推荐的固定液。
- c. TUNEL检测反应时间过长，或TUNEL检测反应过程中反应液渗漏，细胞或组织表面不能保持湿润，也可能出现非特异性染色。

注意控制反应时间，并确保TUNEL检测反应液能很好地覆盖样品。

2. 染色背景很高。

- 支原体污染。请使用支原体染色检测试剂盒检测是否为支原体污染。支原体染色检测试剂盒(C0296)可以向碧云天订购。
- 高速分裂和增殖的细胞，有时也会出现细胞核中的DNA断裂。
- TUNEL反应过强。可以用试剂盒提供的TdT酶稀释液稀释TdT酶2-5倍后再按照说明书操作。稀释后的TdT酶需当日使用。
- 细胞内的过氧化物酶灭活不充分会导致很多细胞呈现阳性染色，改进过氧化物酶的灭活方法，例如延长灭活时间等会有所帮助。
- 所使用的溶液有DNA酶污染。DNA酶污染导致的随即切割会导致产生一定的背景并干扰检测。把溶液高压灭菌可以有效灭活各种常见DNA酶。

3. 标记效率低。

- 使用乙醇或甲醇固定会导致标记的效率较低。
- 固定时间过长，导致交联程度过高。此时宜减少固定时间。
- 贴壁细胞如果使用药物诱导凋亡，会使发生凋亡细胞的贴壁性会减弱，所以建议在凋亡诱导结束后，用可以对多孔板进行离心的离心机1000g离心5分钟，然后再吸除培养基并用PBS洗涤。如果没有适合的离心机，请注意操作轻柔，防止发生凋亡的细胞在洗涤时洗去。后续整个操作也需要轻柔。

相关产品：

产品编号	产品名称	包装
C1086	一步法TUNEL细胞凋亡检测试剂盒(绿色荧光)	20次
C1088	一步法TUNEL细胞凋亡检测试剂盒(绿色荧光)	50次
C1089	一步法TUNEL细胞凋亡检测试剂盒(红色荧光)	20次
C1090	一步法TUNEL细胞凋亡检测试剂盒(红色荧光)	50次
C1091	TUNEL细胞凋亡检测试剂盒(显色法)	20次
C1098	TUNEL细胞凋亡检测试剂盒(显色法)	50次
C1062	Annexin V-FITC细胞凋亡检测试剂盒	20次
C1063	Annexin V-FITC细胞凋亡检测试剂盒	50次
C1065	Annexin V-PE细胞凋亡检测试剂盒	20次
C1067	Annexin V-EGFP细胞凋亡检测试剂盒	20次
C1068	Annexin V-EGFP细胞凋亡检测试剂盒	50次
C1082	TUNEL检测阳性对照制备试剂盒	10次
P0098	免疫染色固定液	100ml
P0097-100ml	免疫染色强力通透液	100ml
P0097-500ml	免疫染色强力通透液	500ml
P0126	抗荧光淬灭封片液	5ml
ST533	Proteinase K (20mg/ml)	1ml

使用本产品的文献：

- Zhang C, Wu R, Zhu H, Hu YZ, Jiang H, Lin NM, He QJ, Yang B. Enhanced anti-tumor activity by the combination of TRAIL/Apo-2L and combretastatin A-4 against human colon cancer cells via induction of apoptosis in vitro and in vivo. *Cancer Lett.* 2011 Mar 1;302(1):11-9.
- Xu X, Gao X, Jin L, Bhadury PS, Yuan K, Hu D, Song B, Yang S. Antiproliferation and cell apoptosis inducing bioactivities of constituents from *Dyosma versipellis* PC3 and Bcap-37 cell lines. *Cell Div.* 2011 Jun 15;6(1):14.
- Peng YR, Ding YF, Wei YJ, Shu B, Li YB, Liu XD. Caudatin-2,6-dideoxy-3-O-methyl-β-D-cymaropyranoside 1 induced apoptosis through caspase 3-dependent pathway in human hepatoma cell line SMMC7721. *Phytother Res.* 2011 May;25(5):631-7.
- Liu M, Yang S, Jin L, Hu D, Wu Z, Yang S. Chemical Constituents of the Ethyl Acetate Extract of *Belamcanda chinensis* (L.) DC Roots and Their Antitumor Activities. *Molecules.* 2012 May 24;17(5):6156-69.
- Liu MC, Yang SJ, Jin LH, Hu DY, Xue W, Song BA, Yang S. Synthesis and cytotoxicity of novel ursolic acid derivatives containing an acyl piperazine moiety. *Eur J Med Chem.* 2012 Dec;58:128-35.
- Liu L, Wang P, Liang C, He D, Yu Y, Liu X. Distinct effects of Nampt inhibition on mild and severe models of lipopolysaccharide-induced myocardial impairment. *Int Immunopharmacol.* 2013 Oct;17(2):342-9.
- Zhu Z, Li K, Xu D, Liu Y, Tang H, Xie Q, Xie L, Liu J, Wang H, Gong Y, Hu Z, Zheng J. ZFX regulates glioma cell proliferation and survival in vitro and in vivo. *NEURO-ONCOLOGY.* 2013 Jul;113(3):533.
- Qi R, Yang F, Huang J, Peng H, Liu Y, Liu Z. Supplementation with conjugated linoleic acid decreases pig back fat deposition by inducing adipocyte apoptosis. *BMC Vet Res.* 2014 Jun 26;10:141.
- Wang N, Wei H, Yin D, Lu Y, Zhang Y, Jiang D, Jiang Y, Zhang S. Cyclin D1b overexpression inhibits cell proliferation and induces cell apoptosis in cervical cancer cells in vitro and in vivo. *INT J CLIN EXP PATHO.* 2014 Jun 15;7(7):4016-23.
- You H, Li T, Zhang J, Lei Q, Tao X, Xie P, Lu W. Reduction in ischemic cerebral infarction is mediated through golgi phosphoprotein 3 and Akt/mTOR signaling following salvianolate administration. *Curr Neurovasc Res.* 2014 May;11(2):107-13.
- Wu Z, Kong X, Zhang T, Ye J, Fang Z, Yang X. Pseudoephedrine/ephedrine shows potent anti-inflammatory activity against TNF-α-mediated acute liver failure induced by lipopolysaccharide/D-galactosamine. *Eur J Pharmacol.* 2014 Feb 5;724:112-21.
- Hao R, Hu X, Wu C, Li N. Hypoxia-induced miR-15a promotes mesenchymal ablation and adaptation to hypoxia during lung development in chicken. *PLoS One.* 2014 Jun 2;9(6):e98868.
- Shi Y, Song Q, Yu S, Hu D, Zhuang X. Microvascular invasion in hepatocellular carcinoma overexpression promotes cell proliferation and inhibits cell apoptosis of hepatocellular carcinoma via inhibiting miR-199a expression. *ONCOTARGETS THER.* 2015 Aug 27;8:2303-10.

14. Ke J, Yao YL, Zheng J, Wang P, Liu YH, Ma J, Li Z, Liu XB, Li ZQ, Wang ZH, Xue YX. Knockdown of long non-coding RNA HOTAIR inhibits malignant biological behaviors of human glioma cells via modulation of miR-326. *ONCOTARGET*. 2015 Sep 8;6(26):21934-49.
15. Lu C, Jiang Q, Hu M, Tan C, Yu H, Hua Z. Preliminary biological evaluation of 18F-FBEM-Cys-Annexin V a novel apoptosis imaging agent. *Molecules*. 2015 Mar 17;20(3):4902-14.
16. Xu P, Meng Q, Sun H, Yin Q, Yu H, Zhang Z, Cao M, Zhang Y, Li Y. Shrapnel nanoparticles loading docetaxel inhibit metastasis and growth of breast cancer. *Biomaterials*. 2015 Sep;64:10-20.
17. Li Z, Yin H, Hao S, Wang L, Gao J, Tan X, Yang Z. miR-200 family promotes podocyte differentiation through repression of RSAD2. *SCI REP-UK*. 2016 Jun 2;6:27105.
18. Han R, Wang R, Zhao Q, Han Y, Zong S, Miao S, Song W, Wang L. Trim69 regulates zebrafish brain development by ap-1 pathway. *SCI REP-UK*. 2016 Apr 6;6:24034.
19. Meng C, Song L, Wang J, Li D, Liu Y, Cui X. Propofol induces proliferation partially via downregulation of p53 protein and promotes migration via activation of the Nrf2 pathway in human breast cancer cell line MDA-MB-231. *Oncol Rep*. 2017 Feb;37(2):841-848.
20. Liu W, Gao Y, Chang N. Nurr1 overexpression exerts neuroprotective and anti-inflammatory roles via down-regulating CCL2 expression in both in vivo and in vitro Parkinson's disease models. *BIOCHEM BIOPH RES CO*. 2017 Jan 22;482(4):1312-1319.
21. Hu SY, Zhang Y, Zhu PJ, Zhou H, Chen YD. Liraglutide directly protects cardiomyocytes against reperfusion injury possibly via modulation of intracellular calcium homeostasis. *J Geriatr Cardiol*. 2017 Jan;14(1):57-66.
22. Meng C, Song L, Wang J, Li D, Liu Y, Cui X. Propofol induces proliferation partially via downregulation of p53 protein and promotes migration via activation of the Nrf2 pathway in human breast cancer cell line MDA-MB-231. *Oncol Rep*. 2017 Feb;37(2):841-848.
23. Yan Y, Wang L, He J, Liu P, Lv X, Zhang Y, Xu X, Zhang L, Zhang Y. Synergy with interferon-lambda 3 and sorafenib suppresses hepatocellular carcinoma proliferation. *Biomed Pharmacother*. 2017 Apr;88:395-402.
24. Geng YD, Zhang C, Lei JL, Yu P, Xia YZ, Zhang H, Yang L, Kong LY. Walsuronoid B induces mitochondrial and lysosomal dysfunction leading to apoptotic rather than autophagic cell death via ROS/p53 signaling pathways in liver cancer. *Biochem Pharmacol*. 2017 Oct 15;142:71-86.
25. Lu C, Jiang Q, Hu M, Tan C, Yu H, Hua Z. Preliminary biological evaluation of 18F-AIF-NOTA-MAL-Cys-Annexin V as a novel apoptosis imaging agent. *ONCOTARGET*. 2017 Apr 10;8(31):51086-51095.
26. Liu W, Gao Y, Chang N. Nurr1 overexpression exerts neuroprotective and anti-inflammatory roles via down-regulating CCL2 expression in both in vivo and in vitro Parkinson's disease models. *BIOCHEM BIOPH RES CO*. 2017 Jan 22;482(4):1312-1319.
27. Wang J, Wang WN, Xu SB, Wu H, Dai B, Jian DD, Yang M, Wu YT, Feng Q, Zhu JH, Zhang L, Zhang L. MicroRNA-214-3p: A link between autophagy and endothelial cell dysfunction in atherosclerosis. *ACTA PHYSIOL*. 2017 Sep 9.
28. Zhao K, Li G, Yao Y, Zhou Y, Li Z, Guo Q, Lu N. Activation of phospholipase C-γ1 and translocation of phosphatidylinositol-3,4,5-trisphosphate 3-phosphatase contribute to GL-V9-induced apoptosis in human gastric cancer cells. *Exp Cell Res*. 2017 Jul 1;356(1):8-19.
29. Pan T, Zhang M, Zhang F, Yan G, Ru Y, Wang Q, Zhang Y, Wei X, Xu X, Shen L, Zhang J, Wu K, Yao L, Li X. NDRG2 overexpression suppresses hepatoma cells survival during metabolic stress through disturbing the activation of fatty acid oxidation. *BIOCHEM BIOPH RES CO*. 2017 Feb 5;483(2):860-866.
30. Song J, Li Y, Song J, Hou F, Liu B, Li A. Mangiferin protects mitochondrial function by preserving mitochondrial hexokinase-II in vessel endothelial cells. *BBA-BIOMEMBRANES*. 2017 Jul;1863(7):1829-1839.
31. Li R, Ma J, Wu Y, Nangle M, Zou S, Li Y, Yin J, Zhao Y, Xu H, Zhang H, Li X, Ye QS, Wang J, Xiao J. Dual Delivery of NGF and bFGF Coacervate Ameliorates Diabetic Peripheral Neuropathy via Inhibiting Schwann Cells Apoptosis. *Int J Biol Sci*. 2017 May 16;13(5):640-651.
32. Liu ZY, Hu S, Zhong QW, Tian CN, Ma HM, Yu JJ. N-Methyl-D-Aspartate Receptor-Driven Calcium Influx Potentiates the Adverse Effects of Myocardial Ischemia-Reperfusion Injury Ex Vivo. *J CARDIOVASC PHARM*. 2017 Nov;70(5):329-338.
33. Dai H, Zhang X, Yang Z, Li J, Zheng J. Effects of Baicalin on Blood Pressure and Left Ventricular Remodeling in Rats with Renovascular Hypertension. *MED SCI MONITOR*. 2017 Jun 16;23:2939-2948.
34. Chen D, Tao X, Zhou L, Sun F, Sun M, Fang X. Spaghetti, a homolog of human RPAP3 (RNA polymerase II-associated protein 3), determines the fate of germline stem cells in Drosophila ovary. *Cell Biol Int*. 2017 Nov 7.
35. Zhang X, Wang X, Liu T, Mo M, Ao L, Liu J, Cao J, Cui Z. ZnSO₄ rescued vimentin from collapse in DBP-exposed Sertoli cells by attenuating ER stress and apoptosis. *Toxicol In Vitro*. 2018 Apr;48:195-204.
36. Zheng X, Bi W, Yang G, Zhao J, Wang J, Li X, Zhou X. Hyperglycemia Induced by Chronic Restraint Stress in Mice Is Associated With Nucleus Tractus Solitarius Injury and Not Just the Direct Effect of Glucocorticoids. *FRONT NEUROSCI-SWITZ*. 2018 Dec 19;12:983.
37. Huang Y, Wu S, Zhang Y, Wang L, Guo Y. Antitumor effect of triptolide in T-cell lymphoblastic lymphoma by inhibiting cell viability, invasion, and epithelial-mesenchymal transition via regulating the PI3K/AKT/mTOR pathway. *ONCOTARGETS THER*. 2018 Feb 12;11:769-779.
38. Jiang C, Yang Y, Yang Y, Guo L, Huang J, Liu X, Wu C, Zou J. Long Noncoding RNA (lncRNA) HOTAIR Affects Tumorigenesis and Metastasis of Non-Small Cell Lung Cancer by Upregulating miR-613. *Oncol Res*. 2018 Jun 11;26(5):725-734.
39. Feng Q, He P, Wang Y. MicroRNA-223-3p regulates cell chemo-sensitivity by targeting FOXO3 in prostatic cancer. *Gene*. 2018 Jun 5;658:152-158.
40. Luo J, Zhu H, Jiang H, Cui Y, Wang M, Ni X, Ma C. The effects of aberrant expression of lncRNA DGCR5/miR-873-5p/TUSC3 in lung cancer cell progression. *CANCER MED-US*. 2018 May 23.
41. Liu J, Zhou S, Zhang Y, Li X, Qian X, Tao W, Jin L, Zhao J. Bax inhibitor-1 suppresses early brain injury following experimental subarachnoid hemorrhage in rats. *Int J Mol Med*. 2018 Nov;42(5):2891-2902.
42. Liu Z, Li H, Hong C, Chen M, Yue T, Chen C, Wang Z, You Q, Li C, Weng Q, Xie H, Hu R. ALS-Associated E478G Mutation in Human OPTN (Optineurin) Promotes Inflammation and Induces Neuronal Cell Death. *Front Immunol*. 2018 Nov 14;9:2647.
43. Tang P, Dang H, Huang J, Xu T, Yuan P, Hu J, Sheng JF. NADPH oxidase NOX4 is a glycolytic regulator through mROS-HIF1α axis in thyroid carcinomas. *SCI REP-UK*. 2018 Oct 26;8(1):15897.
44. Lou Z, Wang AP, Duan XM, Hu GH, Zuo ML, Yang ZB. Role of ALK5/SMAD2/3 signaling in the regulation of NOX expression in cerebral ischemia/reperfusion injury. *Exp Ther Med*. 2018 Sep;16(3):1671-1678.
45. Zhang H, Deng Z, Zhang D, Li H, Zhang L, Niu J, Zuo W, Fu R, Fan L, Ye JH, She J. High expression of leucine-rich repeat-containing 8A is indicative of a worse outcome of colon cancer patients by enhancing cancer cell growth and metastasis. *Oncol Rep*. 2018 Sep;40(3):1275-1286.
46. Zhang G, Wang Z, Chen W, Cao Y, Wu J, Qiang G, Ji A, Wu J, Jiang C. Dual effects of gossypol on human hepatocellular carcinoma via endoplasmic reticulum stress and autophagy. *INT J BIOCHEM CELL B*. 2019 Aug;113:48-57.
47. Zheng Y, Zhang P, Zhang C, Zeng W. Surgery-induced cryptorchidism induces apoptosis and autophagy of spermatogenic cells in mice. *Zygote*. 2019 Apr;27(2):101-110.
48. Yuan Y, Wang YY, Liu X, Luo B, Zhang L, Zheng F, Li XY, Guo LY, Wang L, Jiang M, Pan YM, Yan YW, Yang JY, Chen SY, Wang JN, Tang JM. KPC1 alleviates hypoxia/reoxygenation-induced apoptosis in rat cardiomyocyte cells through BAX degradation. *J Cell Physiol*. 2019 Dec;234(12):22921-22934.
49. Xiao Q, Zeng FL, Tang GY, Lei CY, Zou XX, Liu XL, Peng BL, Qin S, Li HX. Expression of galectin-3 and apoptosis in placental villi from patients with missed

- abortion during early pregnancy. *Exp Ther Med*. 2019 Apr;17(4):2623-2631.
50. Li W, Qinghai S, Kai L, Xue M, Lili N, Jihua R, Zhengxiang L, Xiaoling L, Di G, Qi Y, Mengyun D, Jianfeng F. Oral administration of Ginkgolide B alleviates hypoxia-induced neuronal damage in rat hippocampus by inhibiting oxidative stress and apoptosis. *Iran J Basic Med Sci*. 2019 Feb;22(2):140-145.
 51. Li J, Tan YJ, Wang MZ, Sun Y, Li GY, Wang QL, Yao JC, Yue J, Liu Z, Zhang GM, Ren YS. Loganetin protects against rhabdomyolysis-induced acute kidney injury by modulating the toll-like receptor 4 signalling pathway. *BRIT J PHARMACOL*. 2019 Apr;176(8):1106-1121.
 52. Ma W, Shen H, Li Q, Song H, Guo Y, Li F, Zhou X, Guo X, Shi J, Cui Q, Xing J, Deng J, Yu Y, Liu W, Zhao H. MARVELD1 attenuates arsenic trioxide-induced apoptosis in liver cancer cells by inhibiting reactive oxygen species production. *Ann Transl Med*. 2019 May;7(9):200.
 53. Nie C, Qin X, Li X, Tian B, Zhao Y, Jin Y, Li Y, Wang Q, Zeng D, Hong A, Chen X. CACNA2D3 Enhances the Chemosensitivity of Esophageal Squamous Cell Carcinoma to Cisplatin via Inducing Ca²⁺-Mediated Apoptosis and Suppressing PI3K/Akt Pathways. *Front Oncol*. 2019 Apr 2;9:185.
 54. Yang Y, Chen A, Ma J, Wu A, Xu F. Effects of radioactive 125I on apoptosis of HGC-27 gastric cancer cells. *Oncol Lett*. 2019 Nov;18(5):4916-4922.
 55. Zhang J, Fan J, Li Y, Liang S, Huo S, Wang X, Zuo Y, Cui D, Li W, Zhong Z, Zhong F. Porcine Parvovirus Infection Causes Pig Placenta Tissue Damage Involving Nonstructural Protein 1 (NS1)-Induced Intrinsic ROS/Mitochondria-Mediated Apoptosis. *VIRUSES-BASEL*. 2019 Apr 25;11(4). pii: E389.
 56. Ngekure M X K, Jiang J, Enayatullah H, Ennab W, Mustafa S, Rodeni S, Wei Q, Shi F. Sweet taste receptor agonists alter ovarian functions and ovarian cycles in aged mice. *Reprod Biol*. 2019 Sep;19(3):230-236.
 57. Liu M, Ai W, Sun L, Fang F, Wang X, Chen S, Wang H. Triclosan-induced liver injury in zebrafish (*Danio rerio*) via regulating MAPK/p53 signaling pathway. *COMP BIOCHEM PHYS C*. 2019 Aug;222:108-117.
 58. Liang M, Jia J, Chen L, Wei B, Guan Q, Ding Z, Yu J, Pang R, He G. LncRNA MCM3AP-AS1 promotes proliferation and invasion through regulating miR-211-5p/SPARC axis in papillary thyroid cancer. *Endocrine*. 2019 Aug;65(2):318-326.
 59. Liang Q, Li F, Li Y, Liu Y, Lan M, Wu S, Wu X, Ji Y, Zhang R, Yin L. Self-assisted membrane-penetrating helical polypeptides mediate anti-inflammatory RNAi against myocardial ischemic reperfusion (IR) injury. *BIOMATER SCI-UK*. 2019 Aug 20;7(9):3717-3728.
 60. Wang H, Yu D, Fang J, Cao C, Liu Z, Ren J, Qu X. Renal-Clearable Porphyrinic Metal-Organic Framework Nanodots for Enhanced Photodynamic Therapy. *ACS Nano*. 2019 Aug 27;13(8):9206-9217.
 61. Wang A, Zhao C, Gao Y, Duan G, Yang Y, Fan B, Wang X, Wang K. LEP1-AS1 contributes to proliferation and invasion through regulating miR-544a/ FOXPI axis in lung cancer. *INVEST NEW DRUG*. 2019 Dec;37(6):1127-1134.
 62. Tang KK, Liu XY, Wang ZY, Qu KC, Fan RF. Trehalose alleviates cadmium-induced brain damage by ameliorating oxidative stress, autophagy inhibition, and apoptosis. *Metallomics*. 2019 Dec 11;11(12):2043-2051.
 63. Tang Y, Cao G, Zhao G, Wang C, Qin Q. LncRNA differentiation antagonizing non-protein coding RNA promotes proliferation and invasion through regulating miR-135a/NLRP37 axis in pancreatic cancer. *INVEST NEW DRUG*. 2019 Jul 3
 64. Zheng Y, Liu W, Chen Y, Li C, Jiang H, Wang X. Conjugating gold nanoclusters and antimicrobial peptides: From aggregation-induced emission to antibacterial synergy. *J COLLOID INTERF SCI*. 2019 Jun 15;546:1-10.
 65. Zheng S, Li M, Miao K, Xu H. SNHG1 contributes to proliferation and invasion by regulating miR-382 in breast cancer. *Cancer Manag Res*. 2019 Jun 18;11:5589-5598.
 66. An W, Yu Y, Zhang Y, Zhang Z, Yu Y, Zhao X. Exogenous IL-19 attenuates acute ischaemic injury and improves survival in male mice with myocardial infarction. *BRIT J PHARMACOL*. 2019 Mar;176(5):699-710.
 67. Huang S, Qi P, Zhang T, Li F, He X. The HIF-1 α /miR-224-3p/ATG5 axis affects cell mobility and chemosensitivity by regulating hypoxia - induced protective autophagy in glioblastoma and astrocytoma. *Oncol Rep*. 2019 Mar;41(3):1759-1768.
 68. Wu G, Zhu Q, Zeng J, Gu X, Miao Y, Xu W, Lv T, Song Y. Extracellular mitochondrial DNA promote NLRP3 inflammasome activation and induce acute lung injury through TLR9 and NF- κ B. *J Thorac Dis*. 2019 Nov;11(11):4816-4828.
 69. Yang W, Hao Y, Hou W, Fang X, Fang P, Jiang T, Ma C, Zhang Q. Jieduan-Niwan Formula Reduces Liver Apoptosis in a Rat Model of Acute-on-Chronic Liver Failure by Regulating the E2F1-Mediated Intrinsic Apoptosis Pathway. *EVID-BASED COMPL ALT*. 2019 Nov 11;2019:8108503.
 70. Bai Y, Zhang G, Cheng R, Yang R, Chu H. CASC15 contributes to proliferation and invasion through regulating miR-766-5p/ KLF12 axis in lung cancer. *Cell Cycle*. 2019 Sep;18(18):2323-2331.
 71. Liu J, Zhang Y, Zeng Q, Zeng H, Liu X, Wu P, Xie H, He L, Long Z, Lu X, Xiao M, Zhu Y, Bo H, Cao K. Delivery of RIPK4 small interfering RNA for bladder cancer therapy using natural halloysite nanotubes. *Sci Adv*. 2019 Sep 25;5(9):eaaw6499.
 72. Gao F, Wu J, Gao H, Hu X, Liu L, Midgley AC, Liu Q, Sun Z, Liu Y, Ding D, Wang Y, Kong D, Huang X. Hypoxia-tropic nanozymes as oxygen generators for tumor-favoring theranostics. *Biomaterials*. 2020 Feb;230:119635.
 73. Zhan H, Zhao H, Muhammad N, Li T, Liu Y, Wang J. Lytic peptide-grafted beta-cyclodextrin polymer based nano-scaled drug delivery system with enhanced camptothecin anti-cancer efficacy. *Nanotechnology*. 2020 Feb 7;31(7):075101.
 74. Guanwen Huang, Jiwen Bao, Xinghua Shao, Wenyan Zhou, Bei Wu, Zhaohui Ni, Ling Wang. Inhibiting pannexin-1 alleviates sepsis-induced acute kidney injury via decreasing NLRP3 inflammasome activation and cell apoptosis. *Life Sci*. 2020 Aug 1;254:117791.
 75. Yajun Song, Wengang Hu, Ya Xiao, Yang Li, Xu Wang, Weifeng He, Jingming Hou, Yun Liu, Guangping Liang, Chibing Huang. Keratinocyte growth factor ameliorates mycophenolate mofetil-induced intestinal barrier disruption in mice. *Mol Immunol*. 2020 Aug;124:61-69.
 76. Zhilong Zhang, Yuting Zhao, Yanwen Zhang, Ruqian Zhao, Bin He. Paternal systemic inflammation induces offspring programming of growth and liver regeneration in association with Igf2 upregulation. *Mol Cell Endocrinol*. 2020 Dec 1;518:111001.
 77. Yixiong Wang, Baozhu Xu, Jianying Zhou, Xianyan Wu. Propofol activates AMPK to inhibit the growth of HepG2 cells in vitro and hepatocarcinogenesis in xenograft mouse tumor models by inducing autophagy. *J Gastrointest Oncol*. 2020 Dec;11(6):1322-1332.
 78. Yuanyuan Liu, Mengjie Wang, Wei Xu, Hongman Zhang, Weihe Qian, Xiang Li, Xingbo Cheng. Active vitamin D supplementation alleviates initiation and progression of nonalcoholic fatty liver disease by repressing the p53 pathway. *Life Sci*. 2020 Jan 15;241:117086.
 79. Jie Liu, Wang Wang, Lei Wang, Xian-Mei Qi, Yu-Hui Sha, Ting Yang. 3-Bromopyruvate alleviates the development of monocrotaline-induced rat pulmonary arterial hypertension by decreasing aerobic glycolysis, inducing apoptosis, and suppressing inflammation. *CHINESE MED J-PEKING*. 2020 Jan 5;133(1):49-60.
 80. Hailin Tan, Guiming Zhang, Xuecheng Yang, Tao Jing, Daqing Shen, Xinsheng Wang. Peimine inhibits the growth and motility of prostate cancer cells and induces apoptosis by disruption of intracellular calcium homeostasis through Ca²⁺/CaMKII/JNK pathway. *J Cell Biochem*. 2020 Jan;121(1):81-92.
 81. Xia Zhao, Shuai Li, Uma Gaur, Wenhua Zheng. Artemisinin Improved Neuronal Functions in Alzheimer's Disease Animal Model 3xtg Mice and Neuronal Cells via Stimulating the ERK/CREB Signaling Pathway. *Aging Dis*. 2020 Jul 23;11(4):801-819.
 82. Yi-Jun Zhou, Jian-Min Chen, Kiran Sapkota, Jiang-Yi Long, Yuan-Jun Liao, Jun-Jun Jiang, Bing-Yu Liang, Jin-Bin Wei, Yan Zhou. Panax notoginseng saponins attenuate CCL2-induced cognitive deficits in rats via anti-inflammation and anti-apoptosis effects that involve suppressing over-activation of NMDA receptors. *Biomed Pharmacother*. 2020 Jul;127:110139.
 83. Yan Xiao, Wanying Chen, Zehao Zhong, Liang Ding, Hua Bai, Hao Chen, Hongru Zhang, Yihuang Gu, Shengfeng Lu. Electroacupuncture preconditioning attenuates myocardial ischemia-reperfusion injury by inhibiting mitophagy

- mediated by the mTORC1-ULK1-FUNDC1 pathway. *Biomed Pharmacother.* 2020 Jul;127:110148.
84. Rui Wu, Xi Yang, Qian Zhou, Wenyan Yu, Minwei Li, Jianer Wo, Weiguang Shan, Hong Zhao, Yan Chen, Zhajun Zhan. Aurovertin B exerts potent antitumor activity against triple-negative breast cancer in vivo and in vitro via regulating ATP synthase activity and DUSP1 expression. *Pharmazie.* 2020 Jun 1;75(6):261-265.
 85. Yu-Shan Ren, Hong-Hua Li, Jing-Chun Yao, Yu-Jun Tan, Li-Hong Pan, Tao Peng, Li-Li Zhao, Gui-Min Zhang, Jiang Yue, Xue-Mei Hu, Zhong Liu, Jie Li. Application quantitative proteomics approach to identify differentially expressed proteins associated with cardiac protection mediated by cycloastragenol in acute myocardial infarction rats. *J Proteomics.* 2020 Jun 30;222:103691.
 86. Xiaoping Guo, Hongkun Lin, Jingjing Liu, Dongxia Wang, Dan Li, Chunjie Jiang, Yuhan Tang, Jun Wang, Tingrui Zhang, Yanyan Li, Ping Yao. 1,25-Dihydroxyvitamin D attenuates diabetic cardiac autophagy and damage by vitamin D receptor-mediated suppression of FoxO1 translocation. *J Nutr Biochem.* 2020 Jun;80:108380.
 87. Wenjing Liu, Yang Liu, Zhaohai Pan, Xin Zhang, Yao Qin, Xiaojie Chen, Minjing Li, Xiaoyu Chen, Qiusheng Zheng, Xiaona Liu, Defang Li. Systematic Analysis of tRNA-Derived Small RNAs Discloses New Therapeutic Targets of Caloric Restriction in Myocardial Ischemic Rats. *Front Cell Dev Biol.* 2020 Nov 3;8:568116.
 88. Zhezhe Sun, Ke Wu, Lei Gu, Lijie Huang, Qichuan Zhuge, Su Yang, Zhenzhong Wang. IGF-1R stimulation alters microglial polarization via TLR4/NF- κ B pathway after cerebral hemorrhage in mice. *Brain Res Bull.* 2020 Nov;164:221-234.
 89. Dejun Xu, Lingbin Liu, Yongju Zhao, Li Yang, Jianyong Cheng, Rongmao Hua, Zelin Zhang, Qingwang Li. Melatonin protects mouse testes from palmitic acid-induced lipotoxicity by attenuating oxidative stress and DNA damage in a SIRT1-dependent manner. *J Pineal Res.* 2020 Nov;69(4):e12690.
 90. Zhenrong Liu, Yan Huang, Fan Zhang, Huairong Tang, Youjuan Wang. Autophagy-related gene 7 deficiency caused by miR-154-5p overexpression suppresses the cell viability and tumorigenesis of retinoblastoma by increasing cell apoptosis. *Ann Transl Med.* 2020 Nov;8(21):1451.
 91. Hua Xue, Manxiang Li. Protective effect of pterostilbene on sepsis-induced acute lung injury in a rat model via the JAK2/STAT3 pathway. *Ann Transl Med.* 2020 Nov;8(21):1452.
 92. Zhibing Qiu, Wen Chen, Yafeng Liu, Ben Jiang, Li Yin, Xin Chen. LncRNA AC061961.2 overexpression inhibited endoplasmic reticulum stress induced apoptosis in dilated cardiomyopathy rats and cardiomyocytes via activating wnt/ β -catenin pathway. *J RECEPT SIG TRANSD.* 2020 Oct 22;1-10.
 93. Wenchong Sun, Jian Wang, Dasheng Cai, Ling Pei. Neuroprotection of the Developing Brain by Dexmedetomidine Is Mediated by Attenuating Single Propofol-induced Hippocampal Apoptosis and Synaptic Plasticity Deficits. *Exp Neurobiol.* 2020 Oct 31;29(5):356-375.
 94. Wenjing Wang, Wenxiao Ding, Hanpeng Huang, Yina Zhu, Ning Ding, Ganzhu Feng, Xilong Zhang. The role of mitophagy in the mechanism of genioglossal dysfunction caused by chronic intermittent hypoxia and the protective effect of adiponectin. *Sleep Breath.* 2020 Oct 8.
 95. Jun Zhang, Li Liu, Furong Li, Zongqian Wang, Jinghong Zhao. Treatment with catalpol protects against cisplatin-induced renal injury through Nrf2 and NF- κ B signaling pathways. *Exp Ther Med.* 2020 Oct;20(4):3025-3032.
 96. Bin Huai, Jiyu Ding. Atractylenolide III attenuates bleomycin-induced experimental pulmonary fibrosis and oxidative stress in rat model via Nrf2/NQO1/HO-1 pathway activation. *IMMUNOPHARM IMMUNOT.* 2020 Oct;42(5):436-444.
 97. Xiaoli Li, Wenhui Chen, Jinfang Feng, Bo Zhao. The effects of HIF-1 α overexpression on renal injury, immune disorders and mitochondrial apoptotic pathways in renal ischemia/reperfusion rats. *Transl Androl Urol.* 2020 Oct;9(5):2157-2165.
 98. Ying Luo, Yue Tian, Chunrong Zhao. Taurine attenuates liver autophagy and injury of offspring in gestational diabetic mellitus rats. *Life Sci.* 2020 Sep 15;257:117889.
 99. Xia Xu, Hua Feng, Chaochao Dai, Weida Lu, Jun Zhang, Xiaosun Guo, Qihui Yin, Jianli Wang, Xiaopei Cui, Fan Jiang. Therapeutic efficacy of the novel selective RNA polymerase I inhibitor CX-5461 on pulmonary arterial hypertension and associated vascular remodelling. *BRIT J PHARMACOL.* 2021 Apr;178(7):1605-1619.
 100. Zhi Yang, Weigang Wu, Pengcheng Ou, Minna Wu, Furong Zeng, Boping Zhou, Shipin Wu. MiR-122-5p knockdown protects against APAP-mediated liver injury through up-regulating NDRG3. *Mol Cell Biochem.* 2021 Feb;476(2):1257-1267.
 101. Qiushi Xu, Yunhui Fan, Juan J Loo, Yusheng Liang, Hongming Lv, Xudong Sun, Hongdou Jia, Chuang Xu. Aloin protects mice from diet-induced non-alcoholic steatohepatitis via activation of Nrf2/HO-1 signaling. *Food Funct.* 2021 Jan 21;12(2):696-705.
 102. Yuan Tian, Yue-Hai Xiao, Tian Geng, Chao Sun, Jiang Gu, Kai-Fa Tang, Bei Liu, Yi-Meng Liu, Fa Sun. Clusterin suppresses spermatogenic cell apoptosis to alleviate diabetes-induced testicular damage by inhibiting autophagy via the PI3K/AKT/mTOR axis. *Biol Cell.* 2021 Jan;113(1):14-27.
 103. Zhe Xu, Xiaoguang Liu, Yanqing Li, Hongliang Gao, Tao He, Chunlei Zhang, Wei Hao, Xu Teng. Shuxuetong injection simultaneously ameliorates dexamethasone-driven vascular calcification and osteoporosis. *Exp Ther Med.* 2021 Mar;21(3):197.
 104. Yamin Wang, Fengrong Liu, Peng Liu. 23-Hydroxytormentone acid reduces cerebral ischemia/reperfusion damage in rats through anti-apoptotic, antioxidant, and anti-inflammatory mechanisms. *N-S ARCH PHARMACOL.* 2021 May;394(5):1045-1054.
 105. Hu Lv, Ying Li, Qian Cheng, Jiawei Chen, Wei Chen. Neuroprotective Effects Against Cerebral Ischemic Injury Exerted by Dexmedetomidine via the HDAC5/NPAS4/MDM2/PSD-95 Axis. *Mol Neurobiol.* 2021 May;58(5):1990-2004.
 106. Jiechun Huang, Fangrui Wang, Xiaotian Sun, Xianglin Chu, Rongrong Jiang, Yiqing Wang, Liewen Pang. Myocardial infarction cardiomyocytes-derived exosomal miR-328-3p promote apoptosis via Caspase signaling. *Am J Transl Res.* 2021 Apr 15;13(4):2365-2378.
 107. Zhongyu Wang, Juan Li, Anqi Wang, Zhaoyang Wang, Junmin Wang, Jingjing Yuan, Xin Wei, Fei Xing, Wei Zhang, Na Xing. Sevoflurane Inhibits Traumatic Brain Injury-Induced Neuron Apoptosis via EZH2-Downregulated KLF4/p38 Axis. *Front Cell Dev Biol.* 2021 Aug 4;9:658720.
 108. Xiehui Chen, Jinjie Liang, Wugang Bin, Hongmin Luo, Xu Yang. Anti-hyperlipidemic, Anti-inflammatory, and Ameliorative Effects of DRP1 Inhibition in Rats with Experimentally Induced Myocardial Infarction. *Cardiovasc Toxicol.* 2021 Dec;21(12):1000-1011.
 109. Yuanyang Li, Yufan Zhang, Xiangzhong Zhou, Xianghong Lei, Xinhang Li, Liping Wei. Dynamic observation of 5-fluorouracil-induced myocardial injury and mitochondrial autophagy in aging rats. *Exp Ther Med.* 2021 Dec;22(6):1451.
 110. Yanli Zhang. Mechanism of neuroprotective effect of stevioside on cerebral ischemia-reperfusion injury via PPAR- γ activation. *Immunopharmacol Immunotoxicol.* 2021 Dec;43(6):704-712.
 111. Qing-Ping Xie, Bing-Bing Li, Wei Zhan, Feng Liu, Peng Tan, Xu Wang, Bao Lou. A Transient Hermaphroditic Stage in Early Male Gonadal Development in Little Yellow Croaker, *Larimichthys polyactis*. *Front Endocrinol (Lausanne).* 2021 Jan 27;11:542942.
 112. Peng Zhao, Jianhua Cheng, Bin Li, Ding Nie, Hongyun Wang, Chuzhong Li, Songbai Gui, Yazhuo Zhang. LncRNA PCAT6 regulates the progression of pituitary adenomas by regulating the miR-139-3p/BRD4 axis. *Cancer Cell Int.* 2021 Jan 6;21(1):14.
 113. Sisi Wang, Lixia Kai, Luoyi Zhu, Bocheng Xu, Nana Chen, Teresa G Valencak, Yizhen Wang, Tizhong Shan. Cathelicidin-WA Protects Against LPS-Induced Gut Damage Through Enhancing Survival and Function of Intestinal Stem Cells. *Front Cell Dev Biol.* 2021 Jul 26;9:685363.
 114. Yuqian Ren, Xiaoqing Ma, Tingting Wang, Baohe Cheng, Leiming Ren, Zehua Dong, Hongling Liu. The Cerebroprotein Hydrolysate-I Plays a Neuroprotective Effect on Cerebral Ischemic Stroke by Inhibiting MEK/ERK1/2 Signaling Pathway in Rats. *Neuropsychiatr Dis Treat.* 2021 Jul 6;17:2199-2208.

115. Qian-Lan Xu, Jie Wu. Effects of Txk-mediated activation of NF- κ B signaling pathway on neurological deficit and oxidative stress after ischemia-reperfusion in rats. *Mol Med Rep.* 2021 Jul;24(1):524.
116. Tianhe Li, Tingting Zhang, Huimin Gao, Ruixia Liu, Muqing Gu, Yuxi Yang, Tianyu Cui, Zhongbing Lu, Chenghong Yin. Tempol ameliorates polycystic ovary syndrome through attenuating intestinal oxidative stress and modulating of gut microbiota composition-serum metabolites interaction. *Redox Biol.* 2021 May;41:101886.
117. Feifei Shao, Lingmin Zhou, Yu Zhang, Hongping Chen, Yu Zhang, Zhihui Guan. Gastrodin alleviates inflammatory injury of cardiomyocytes in septic shock mice via inhibiting NLRP3 expression. *In Vitro Cell Dev Biol Anim.* 2021 May;57(5):571-581.
118. Yilong Cui, Miao Song, Bonan Xiao, Menglin Liu, Pengli Liu, Yanfei Han, Bing Shao, Yanfei Li. ROS-mediated mitophagy and apoptosis are involved in aluminum-induced femoral impairment in mice. *Chem Biol Interact.* 2021 Nov 1;349:109663.
119. Chen-Chen Hang, Yu-Hong Guo, Chun-Sheng Li, Shuo Wang. Effects of ulinastatin on renal perfusion evaluated by Doppler ultrasonography in a porcine model of septic shock. *Exp Ther Med.* 2021 Nov;22(5):1324.
120. Wei Liao, Wanren Yang, Jiecheng Xu, Zhengming Yan, Mingxin Pan, Xiaoping Xu, Shuqin Zhou, Yu Zhu, Jianqiang Lan, Min Zeng, Xu Han, Shao Li, Yang Li, Kangyan Liang, Yi Gao, Qing Peng. Therapeutic Potential of CUDC-907 (Fimepinostat) for Hepatocarcinoma Treatment Revealed by Tumor Spheroids-Based Drug Screening. *Front Pharmacol.* 2021 Oct 29;12:658197.
121. Wenyan Shan, Xiaoyun Liao, Yixun Tang, Jitong Liu. Dexmedetomidine alleviates inflammation in neuropathic pain by suppressing NLRP3 via Nrf2 activation. *Exp Ther Med.* 2021 Oct;22(4):1046.
122. Yunzhi Liu, Jingmin Lin, Yu Chen, Zhuonan Li, Jia Zhou, Xiao Lu, Zhengliang Chen, Daming Zuo. Omega-3 polyunsaturated fatty acids inhibit IL-11/STAT3 signaling in hepatocytes during acetaminophen hepatotoxicity. *Int J Mol Med.* 2021 Oct;48(4):190.
123. Ji Yuan, Xiaoyang Fu. MicroRNA-21 mediates the protective role of emulsified isoflurane against myocardial ischemia/reperfusion injury in mice by targeting SPP1. *Cell Signal.* 2021 Oct;86:110086.
124. Jiaqi Chen, Qiaoya Pan, Yang Bai, Xuepeng Chen, Yi Zhou. Hydroxychloroquine Induces Apoptosis in Cholangiocarcinoma via Reactive Oxygen Species Accumulation Induced by Autophagy Inhibition. *Front Mol Biosci.* 2021 Sep 10;8:720370.
125. Yi Wang, Hongxun Tao, Huimin Huang, Yaqin Xiao, Xiaoxiao Wu, Mingxing Li, Jing Shen, Zhangang Xiao, Yueshui Zhao, Fukan Du, Huijiao Ji, Yu Chen, Chi Hin Cho, Yitao Wang, Shengpeng Wang, Xu Wu. The dietary supplement *Rhodiola crenulata* extract alleviates dextran sulfate sodium-induced colitis in mice through anti-inflammation, mediating gut barrier integrity and reshaping the gut microbiome. *Food Funct.* 2021 Apr 7;12(7):3142-3158.
126. Yan Zhang, Shanshan Wang, Hongli Li, Xia Xu. miR-495 reduces neuronal cell apoptosis and relieves acute spinal cord injury through inhibiting PRDM5. *J Mol Histol.* 2021 Apr;52(2):385-396.
127. Rui Long, Lu Gao, Yunpeng Li, Guodong Li, Peng Qin, Zihan Wei, Dongbo Li, Cheng Qian, Jing Li, Guojie Yang. M2 macrophage-derived exosomes carry miR-1271-5p to alleviate cardiac injury in acute myocardial infarction through down-regulating SOX6. *Mol Immunol.* 2021 Aug;136:26-35.
128. Wensheng Wang, Rongxiang Lv, Jingjing Zhang, Yu Liu. circSAMD4A participates in the apoptosis and autophagy of dopaminergic neurons via the miR-29c-3p-mediated AMPK/mTOR pathway in Parkinson's disease. *Mol Med Rep.* 2021 Jul;24(1):540.
129. Zhigang Zhang, Yan-Fang Si, Wenyang Hu, Pengyong Yan, Yongsheng Yu. Treatment with XMU-MP-1 erases hyperglycaemic memory in hearts of diabetic mice. *Biochem Pharmacol.* 2021 Jun;188:114574.
130. Wenjun Yu, Busong Wang, Liang Zhou, Guoqiang Xu. Endoplasmic Reticulum Stress-Mediated p62 Downregulation Inhibits Apoptosis via c-Jun Upregulation. *Biomol Ther (Seoul).* 2021 Mar 1;29(2):195-204.
131. Yi Wang, Hongyu Qi, Chunjiao Zhang, Yuanyuan Guo, Yuchen Yao, Xiaohang Feng, Sijie Fan, Yingying Han, Zhengrong Yuan, Qiang Weng, Haolin Zhang. The seasonal profile of proliferation and apoptosis in the prostate gland of the wild ground squirrel (*Spermophilus dauricus*). *Comp Biochem Physiol A Mol Integr Physiol.* 2021 Mar;253:110862.
132. Chuanxiang Wang, Zhequan Ma, Zuqiang Wang, Shuping Ming, Yanbing Ding, Sufang Zhou, Hongyu Qian. Eriodictyol Attenuates MCAO-Induced Brain Injury and Neurological Deficits via Reversing the Autophagy Dysfunction. *Front Syst Neurosci.* 2021 May 26;15:655125.
133. Liao Li-Zhen, Zhi-Chong Chen, Sui-Sui Wang, Wen-Bin Liu, Xiao-Dong Zhuang. Klotho deficiency causes cardiac ageing by impairing autophagic and activating apoptotic activity. *Eur J Pharmacol.* 2021 Nov 15;911:174559.
134. Yu-Bo Ma, Ming Gao, Tong-Dian Zhang, Tie Chong, He-Cheng Li, Zi-Ming Wang, Lian-Dong Zhang. Oxidative Stress Disrupted Prepubertal Rat Testicular Development after Xenotransplantation. *Oxid Med Cell Longev.* 2021 Nov 17;2021:1699990.
135. Xuemei Piao, Jieru Zhou, Luan Xue. Triptolide decreases rheumatoid arthritis fibroblast-like synoviocyte proliferation, invasion, inflammation and presents a therapeutic effect in collagen-induced arthritis rats via inactivating lncRNA. *Int Immunopharmacol.* 2021 Oct;99:108010.
136. Weixin Hou, Yulin Hao, Wenlong Yang, Tian Tian, Peng Fang, Yuqiong Du, Lianyin Gao, Yanbin Gao, Qiuyun Zhang. The Jieduan-Niwan (JDNW) Formula Ameliorates Hepatocyte Apoptosis: A Study of the Inhibition of E2F1-Mediated Apoptosis Signaling Pathways in Acute-on-Chronic Liver Failure (ACLF) Using Rats. *Drug Des Devel Ther.* 2021 Sep 8;15:3845-3862.
137. Su Yang, Xingxing Zhang, Hengli Zhang, Xiangxiang Lin, Xijun Chen, Ying Zhang, Xiao Lin, Lijie Huang, Qichuan Zhuge. Dimethyl itaconate inhibits LPS-induced microglia inflammation and inflammasome-mediated pyroptosis via inducing autophagy and regulating the Nrf-2/HO-1 signaling pathway. *Mol Med Rep.* 2021 Sep;24(3):672.
138. Xiao-Guang Chen, Bing-Hua Dou, Jin-Dou An, Song Feng, Na Liu, Guang-Yao Sheng. MAGI2-AS3 restrains proliferation, glycolysis, and triggers apoptosis in acute lymphoblastic leukemia via regulating miR-452-5p/FOXN3 pathway. *Iran J Basic Med Sci.* 2022 Jan;25(1):46-52.
139. Ying Zhao, Wusheng Zhu, Ting Wan, Xiaohao Zhang, Yunzi Li, Zhenqian Huang, Pengfei Xu, Kangmo Huang, Ruidong Ye, Yi Xie, Xinfeng Liu. Vascular endothelium deploys caveolin-1 to regulate oligodendrogenesis after chronic cerebral ischemia in mice. *Nat Commun.* 2022 Nov 10;13(1):6813.
140. Xuan Wang, Yingqi Liu, Chencheng Xue, Yan Hu, Yuanyuan Zhao, Kaiyong Cai, Menghuan Li, Zhong Luo. A protein-based cGAS-STING nanoagonist enhances T cell-mediated anti-tumor immune responses. *Nat Commun.* 2022 Sep 28;13(1):5685.
141. Yuhong Pan, Wenjun Cai, Anchun Cheng, Mingshu Wang, Shun Chen, Juan Huang, Qiao Yang, Ying Wu, Di Sun, Sai Mao, Dekang Zhu, Mafeng Liu, Xinxin Zhao, Shaqiu Zhang, Qun Gao, Xumin Ou, Bin Tian, Zhongqiong Yin, Renyong Jia. Duck Tembusu virus infection induces mitochondrial-mediated and death receptor-mediated apoptosis in duck embryo fibroblasts. *Vet Res.* 2022 Jul 7;53(1):53.