

Disease models and human diseases for which beneficial effects of hydrogen have been documented

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Organs/ Diseases	Disease models / Human diseases	Authors / Reported year	Species				Administration				
			Cell	Rodent	Other animals	Human	Medium	Saline	Water	Gas	Others
Brain	Cerebral infarction	Ohsawa et al, 2007; Ono et al, 2011; Ji et al, 2011; Liu et al, 2011b; Cui et al, 2014; Zhao et al, 2015 Ono et al, 2017	○	○		○	○	○		○	
	Cerebral superoxide production	Sato et al, 2008		○						○	
	Restraint-induced dementia	Nagata et al, 2009		○						○	
	Cerebral ischemia-induced cognitive impairment	Ge et al, 2012		○						○	
	Sepsis-induced cognitive impairment	Zhou et al, 2012a; Liu et al, 2015		○					○	○	
	Hepatectomy-induced cognitive dysfunction	Tian et al, 2016		○					○		
	Hypoxia-induced neurocognitive impairment	Li et al, 2018		○						○	
	Traumatic brain injury-induced cognitive deficits	Hou et al, 2012		○					○		

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			Cell	Rodent	Other animals	Human	Medium	Saline	Water	Gas	Others
Brain	Gender-dependency in improvement of cognitive impairment	Hou et al, 2018		○						○	
	Alzheimer's disease	Li et al, 2010; Wang et al, 2011a; Ono et al, 2018; Zhang et al, 2019		○			○			○	○
	Senile dementia in senescence-accelerated mice	Gu et al, 2010		○						○	
	Parkinson's disease	Fu et al, 2009; Fujita et al, 2009; Ito et al, 2012; Yoritaka et al, 2013; Matsumoto et al, 2013; Yoshii et al, 2018; Noda et al, 2019		○			○			○	○
	Hemorrhagic infarction	Chen et al, 2010b		○							○
	Intracerebral hemorrhage	Manaenko et al, 2011; Manaenko et al, 2013; Choi et al, 2018		○							○
	Brain trauma	Ji et al, 2010		○							○
	Traumatic brain injury	Ji et al, 2012; Yuan et al, 2015; Liu et al, 2017; Fu et al, 2018; Yuan et al, 2018		○						○	○

Organs/ Diseases	Disease models / Human diseases	Authors / Reported year	Species				Administration						
			Cell	Rodent	Other animals	Human	Medium	Saline	Water	Gas	Others		
Brain	CO intoxication	Sun et al, 2011b; Wang et al, 2012a; Wang et al, 2012c; Shen et al, 2013		○							○		
	Transient global cerebral ischemia	Hugyecz et al, 2011		○								○	
	Common carotid artery occlusion-induced cerebral ischemia	Nagatani et al, 2012		○								○	
	Brain injury after subarachnoid hemorrhage	Zhan et al, 2012; Zhuang et al, 2012; Zhuang et al, 2013; Hong et al, 2014; Shao et al, 2015		○		○					○		○
	Cerebral vasospasm after subarachnoid hemorrhage	Hong et al, 2012		○								○	
	Deep hypothermic circulatory arrest-induced brain damage	Shen et al, 2011		○								○	
	Surgically induced brain injury	Eckermann et al, 2011; Xin et al, 2017		○								○	○
	Cerebral artery occlusion-induced ischemia	Li et al, 2012c		○								○	

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			Cell	Rodent	Other animals	Human	Medium	Saline	Water	Gas	Others
Brain	LPS-induced neuroinflammation and sickness behavior	Spulber et al, 2012	○	○			○			○	
	Brain Injury Induced by Cardiopulmonary Bypass	Chen et al, 2017			○						○
	Brain injury induced by bilateral common carotid artery occlusion	Nagatani et al, 2013			○						○
	Neurological outcome after cardiac arrest and resuscitation	Huo et al, 2014; Cole et al, 2019; Chen et al, 2019			○	○			○		○
	Neurogenerative changes induced by traumatic brain injury	Dohi et al, 2014			○						○
	Chlorpyrifos-induced neurotoxicity	Wang et al, 2014			○						○
	Neurological function in stroke	Takeuchi et al, 2015			○						○
	Ischemic brain injury	Han et al, 2015			○						○
	Hypoxia/Reoxygenation	Wei et al, 2015		○					○		
	ALS	Zhang et al, 2015			○						○

Organs/ Diseases	Disease models / Human diseases	Authors / Reported year	Species				Administration					
			Cell	Rodent	Other animals	Human	Medium	Saline	Water	Gas	Others	
Brain	Autoimmune encephalomyelitis	Zhao et al, 2016; Liu et al, 2018		○							○	
	Depression	Gao et al, 2017		○								○
	Depressive-like behavior	Zhang et al, 2016		○							○	
	Brain damage and inflammation after traumatic brain injury	Tian et al, 2016		○							○	
	Cerebral ischemia/reperfusion injury	Cui et al, 2016; Li et al, 2016; Gao et al, 2017; Wang et al, 2017; Wu et al, 2018; Huang et al, 2018; Chen et al, 2019; Huang et al, 2019		○						○		○
	Hypoxic-ischemic encephalopathy	Nemeth et al, 2016									○	
	Isoflurane-induced cognitive impairment	Li et al, 2017		○	○				○		○	
	Anxiety-like behaviors	Wen et al, 2017 Masuda et al, 2017			○					○	○	
	Cognitive Impairment	Lang et al, 2017; Nishimaki et al, 2017			○			○			○	○

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			Cell	Rodent	Other animals	Human	Medium	Saline	Water	Gas	Others		
Brain	Oxidative stress in hippocampus	Paulis et al, 2018		○								○	
	Neurological outcome after cerebral ischemia/reperfusion	Huang et al, 2018		○									○
	Vascular dementia	Jiang et al, 2018		○								○	
	Blast-induced brain injury	Satoh et al, 2018		○									○
	Autistic-like behavioral abnormalities	Guo et al, 2018		○								○	
	CO-induced brain injury	Xu et al, 2019		○								○	
	Hydrogen production by intestinal bacteria in Parkinson's disease	Suzuki et al, 2019		○									○
	Polarization of macrophages and microglia in stroke	Ning et al, 2018		○							○		
	Urinary 8-OHdG production in Parkinson's disease	Hirayama et al, 2018											○
	Psychometric fatigue	Mikami et al, 2019											○
	Asphyxia-induced cognitive deficit	Huang et al, 2019											○
	Radiation-induced cognitive dysfunction	Liu et al, 2019			○								○

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			Cell	Rodent	Other animals	Human	Medium	Saline	Water	Gas	Others	
Brain	Exercise-induced hippocampal inflammation	Nogueira et al, 2019		○								○
	Sepsis-induced memory loss	Jesus et al, 2020		○								○
	Sepsis-induced neuroinflammation	Zhuang et al, 2020		○								○
	Endothelial cell injury after subarachnoid hemorrhage	Zhuang et al, 2020		○								○
	Traumatic brain injury in diabetes	Li et al, 2020		○								○
	Brain metastases in lung cancer	Chen et al, 2019										○
Nerve/Spinal Cord	Spinal cord injury	Chen et al, 2010a; Wang et al, 2015; Chen et al, 2018		○							○	○
	Spinal cord ischemia/reperfusion	Huang et al, 2011b; Zhou et al, 2013				○					○	○
	Neuropathic pain	Chen et al, 2013; Kawaguchi et al, 2014; Gu et al, 2014; Chen et al, 2015; Wang et al, 2018; Chen et al, 2019		○							○	○
	Astrogliosis	Liu et al, 2014	○	○						○	○	

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Nerve/Spinal Cord	Remifentanil-induced hyperalgesia	Zhang et al, 2014a; Shu et al, 2015		○							○	
	Remifentanil-induced hypernociception	Zhang et al, 2014b		○							○	
	Death in neural cells	Kashiwagi et al, 2014	○								○	
	Peripheral nerve autografting	Zhang et al, 2016		○							○	
	Neuroblastoma cell death	Murakami et al, 2017	○								○	
	Post-herpetic neuralgia	Ma et al, 2017		○							○	
	Autonomic nerve function	Mizuno et al, 2018									○	
	Methamphetamine-induced neurotoxicity	Wen et al, 2019		○							○	
Eye	Glaucoma	Oharazawa et al, 2010		○								○
	Corneal alkali-burn	Kubota et al, 2011; Cejka et al, 2017		○	○						○	○
	Retina injury	Wei et al, 2012; Tian et al, 2013; Feng et al, 2012; Qi et al, 2015; Zhang et al, 2016		○							○	
	LPS-induced retinal microglia cells inflammation	Liu et al, 2013	○								○	

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Eye	Selenite-induced cataract	Yang et al, 2013		○						○		
	Optic nerve crush	Sun et al, 2014		○						○		
	Retinal ischemia-reperfusion injury	Liu et al, 2015; Wang et al, 2016; Wu et al, 2018		○						○		
	Retinal oxidative stress	Yokota et al, 2015		○						○		
	Photoreceptor degeneration	Chen et al, 2016		○						○		
	Corneal endothelial damage in phacoemulsification cataract surgery	Igarashi et al, 2016; Igarashi et al, 2019					○		○		○	
	Dry eye	Chu et al, 2017		○						○		
	Endotoxin-induced uveitis	Yan et al, 2017; Yan et al, 2018		○						○		○
	Retinitis pigmentosa	Yan et al, 2017		○						○		
	Retinal degeneration	Tao et al, 2017		○							○	
	Corneal photodamage	Cejka et al, 2017a						○				○
	UV-induced corneal photodamage	Cejka et al, 2017b						○			○	
	Branch retinal vein occlusion	Long et al, 2019		○								○
Retinal senescence	Li et al, 2019		○							○		

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Ear	Hearing loss	Kikkawa et al, 2009; Taura et al, 2010; Lin et al, 2011	○	○			○		○		
	Ouabain-induced auditory neuropathy	Qu et al, 2012a		○							○
	Noise-induced hearing loss	Zhou et al, 2012b; Kurioka et al, 2014; Chen et al, 2014		○				○		○	
	Cisplatin-induced ototoxicity	Qu et al, 2012b; Kikkawa et al, 2014	○	○			○				○
	Ototoxicity	Fransson et al, 2017		○							○
	Ischemia hearing loss	Ogawa et al, 2017		○				○			
	Inner ear damage	Pirttila et al, 2019		○							○
Lung	Oxygen-induced lung injury	Sun et al, 2011c; Huang et al, 2010; Zheng et al, 2010; Huang et al, 2011a; Kawamura et al, 2013		○				○		○	
	Lung transplantation	Kawamura et al, 2010; Kawamura et al, 2012; Zhou et al, 2013; Haam et al, 2018		○	○						○
	Paraquat-induced lung injury	Liu et al, 2011a; Li et al, 2020	○	○			○	○			
	Radiation-induced lung injury	Terasaki et al, 2011; Chuai et al, 2011		○							○

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Lung	Burn-induced lung injury	Qiu et al, 2010; Fang et al, 2011		○				○			
	Intestinal ischemia/reperfusion-induced lung injury	Mao et al, 2009		○				○			
	LPS-induced lung injury	Qiu et al, 2011; Xie et al, 2012a; Liang et al, 2012; Liu et al, 2015; Zhang et al, 2015; Dong et al, 2017; Wang et al, 2019; Fu et al, 2020	○	○			○	○	○	○	
	Lung ischemia/reperfusion injury	Li et al, 2012b; Shi et al, 2012; Takahashi et al, 2017; Zhang et al, 2019		○	○			○			
	Septic shock-induced lung and intestine injuries	Liu et al, 2013		○							○
	Hemorrhagic shock-induced lung injury	Shi et al, 2013; Du et al, 2014a; Moon et al, 2019		○				○			○
	Inflammatory response of cardiopulmonary bypass	Fujii et al, 2013		○							○
	Chronic obstructive pulmonary disease (COPD)	Ning et al, 2013; Liu et al, 2017; Liu et al, 2017; Lu et al, 2018		○				○			○

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Lung	Lung perfusion after cardiac death	Haam et al, 2015			○							○	
	Molecular changes in lung allografts	Tanaka et al, 2012		○								○	
	Lung injury associated with sepsis	Zhai et al, 2015; Tao et al, 2016; Yu et al, 2019; Zhai et al, 2019		○				○				○	
	Smoke inhalation-induced lung injury	Chen et al, 2015		○				○					
	Hemorrhagic shock-induced lung injury	Kohama et al, 2015		○								○	
	Lung transplantation	Noda et al, 2014; Liu et al, 2015; Saito et al, 2019		○								○	○
	Seawater instillation-induced acute lung injury	Diao et al, 2016										○	
	Air pollution-induced lung injury	Gong et al, 2016										○	
	Pulmonary Emphysema	Suzuki et al, 2017		○								○	
	Lung injury induced by limb ischemia/reperfusion	Zou et al, 2018		○								○	
Sepsis-induced lung injury	Dong et al, 2018		○								○		

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Lung	Naphthalene-induced lung injury	Terasaki et al, 2019		○								○	
	Bleomycin-induced pulmonary fibrosis	Gao et al, 2019		○									○
	Interstitial lung disease	Terasaki et al, 2019		○								○	
	PM2.5-induced lung injury	Feng et al, 2019		○									○
	Asthma and COPD	Wang et al, 2020											○
Trachea	Ovalbumin (OVA)-induced asthma	Xiao et al, 2013; Zhang et al, 2018; Huang et al, 2019; Zhao et al, 2020	..	○								○	○
	Inspiratory effort in patients with tracheal stenosis	Zhou et al, 2018											○
	Obliterative airway disease	Ozeki et al, 2019		○								○	
Heart	Acute myocardial infarction	Zhang et al, 2011; Sun et al, 2009; Hayashida et al, 2008; Yoshida et al, 2012; Sakai et al, 2012; Jing et al, 2014; Katsumata et al, 2017 Asanuma et al, 2017; Feng et al, 2018		○	○		○					○	○
	Cardiac transplantation	Nakao et al, 2010a; Noda et al, 2012; Noda et al, 2013		○								○	○

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			Cell	Rodent	Other animals	Human	Medium	Saline	Water	Gas	Others	
Heart	Left ventricular hypertrophy	Yu et al, 2012; Matsuoka et al, 2018		○				○		○		
	Radiation-induced cardiac injury	Qian et al, 2010a; Kura et al, 2019		○					○			
	Sleep apnea-induced cardiac hypoxia	Hayashi et al, 2011		○							○	
	Functional outcome of postcardiac arrest	Hayashida et al, 2012		○							○	
	Brain injury after cardiac arrest	Huang et al, 2013; Hayashida et al, 2014		○		○			○		○	
	Ischemia-reperfusion injury and nitrotyrosine production	Shinbo et al, 2013		○							○	
	Myocardial ischemia-reperfusion injury	Tan et al, 2013; Zhao et al, 2014; Zhang et al, 2015; Pan et al, 2015; Zalesak et al, 2017; Gao et al, 2017; Li et al, 2019; Yao et al, 2019; Li et al, 2019a; Li et al, 2019b; Li et al, 2019c; Li et al, 2020		○		○			○		○	○
	Left ventricular remodeling induced by hypoxia	Kato et al, 2014		○							○	

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Heart	Cardiac dysfunction in diabetes	Wu et al, 2015		○								○	
	Ischemia-induced myocardial injury	Xie et al, 2014	○					○					
	Post-cardiac arrest syndrome	Tamura et al, 2016; Tamura et al, 2020										○	
	Doxorubicin-induced heart failure	Wu et al, 2014		○								○	
	Doxorubicin-induced cardiac injury	Gao et al, 2017		○								○	
	LPS-induced heart failure	Tao et al, 2015		○								○	
	Cardiac function and neurological outcome after cardiac arrest	Wang et al, 2016		○									○
	Post Cardiac arrest myocardium injury	Wang et al, 2017										○	○
	Pressure overload-induced cardiac hypertrophy	Fan et al, 2018		○									○
	Neurological outcome after cardiac arrest	Chen et al, 2017		○									○

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			Cell	Rodent	Other animals	Human	Medium	Saline	Water	Gas	Others		
Heart	Cardiometabolic risk factor	Korovljevic et al, 2018				○						○	
	Myocardial injury caused by cardiopulmonary bypass	Chen et al, 2018		○								○	
	Myocardial injury and aquaporin expression	Song et al, 2018		○								○	
	Chronic heart failure	Chi et al, 2018		○								○	
	Hypoxia-induced cardiac dysfunction	Zhao et al, 2019		○								○	
Liver	Schistosomiasis-associated chronic liver inflammation	Gharib et al, 2001		○								○	
	Liver ischemia/reperfusion	Fukuda et al, 2007; Liu et al, 2014; Matsuno et al, 2014; Zhang et al, 2015; Li et al, 2017; Li et al, 2017; Lu et al, 2017; Zhang et al, 2018; Tamaki et al, 2018; Bai et al, 2018; Ge et al, 2019; Uto et al, 2019; Zhang et al, 2019; Maly et al, 2019		○	○						○	○	○
	Hepatitis	Kajiya et al, 2009a		○								○	

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Liver	Non-alcoholic steatohepatitis	Kawai et al, 2012; Zhai et al, 2017; Wang et al, 2017; Jackson et al, 2018; Korovljey et al, 2019	○	○		○					○
	Obstructive jaundice	Liu et al, 2010; Liu et al, 2016		○							○
	Carbon tetrachloride-induced hepatopathy	Sun et al, 2011a		○							○
	Radiation-induced adverse effects for liver tumors	Kang et al, 2011				○					○
	Hepatic gene expression	Nakai et al, 2011		○							○
	Liver injury during hepatectomy	Xiang et al, 2012			○						○
	Liver failure after hepatectomy	Tan et al, 2014		○							○
	Liver fibrosis	Koyama et al, 2013		○							○
	Chronic hepatitis B	Xia et al, 2013				○					○
	Endotoxin-induced liver dysfunction	Xu and Zhang, 2013		○							○
	Hemodynamics of cirrhosis	Lee et al, 2014		○							○
	Acetaminophen-induced hepatotoxicity	Zhang et al, 2015		○							○

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Liver	Liver regeneration	Yu et al, 2015		○								○
	Liver function after scald	Liu et al, 2014		○					○			
	Hypoxia/reoxygenation injury	Yu et al, 2015	○	○			○		○			
	Ethanol-induced fatty liver	Lin et al, 2017		○					○			
	Ischemia-reperfusion injury in fatty liver	Li et al, 2018		○					○			
	Sepsis-induced liver injury	Yan et al, 2019		○								
Kidney	Hemodialysis	Nakayama et al, 2007; Nakayama et al, 2009; Nakayama et al, 2010; Terawaki et al, 2014; Tange et al, 2015; Nakayama et al, 2017				○			○			○
	Peritoneal dialysis	Terawaki et al, 2013				○						○
	nephrotoxicity induced by an anti-cancer drug cisplatin	Nakashima-Kamimura et al, 2009; Kitamura et al, 2010; Matsushita et al, 2011b		○					○		○	
	Gentamicin-induced nephrotoxicity	Matsushita et al, 2011a		○					○			

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Kidney	Kidney transplantation	Cardinal et al, 2010; Kobayashi et al, 2019	○	○			○	○			
	Renal ischemia/reperfusion	Wang et al, 2011b; Shingu et al, 2010; Abe et al, 2012; Zeng et al, 2014; Li et al, 2016a; Li et al, 2016b; Nishida et al, 2018; Kawamura et al, 2020	○				○	○		○	○
	Melamine-induced urinary stone	Yoon et al, 2011b	○							○	
	Diabetic nephropathy	Katakura et al, 2012; Jiao et al, 2020	○							○	
	Chronic kidney disease	Zhu et al, 2011	○							○	
	Acute Kidney Injury (AKI)	Chen et al, 2017	○							○	
	Renal injury induced by unilateral ureteral obstruction	Xu et al, 2013	○							○	
	Ferric nitrilotriacetate-induced nephrotoxicity	Li et al, 2013	○							○	
	Cardio-renal injury in salt-sensitive rats	Zhu et al, 2013	○							○	
	Rhabdomyolysis in kidney injury	Gu et al, 2014	○							○	

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Kidney	Renal injury in spontaneous hypertensive rats (SHR)	Xin et al, 2014		○						○	
	Acute kidney injury during septic shock	Liu et al, 2014		○							○
	Contrast-induced kidney injury	Homma et al, 2015		○							○
	Nephrolithiasis	Peng et al, 2015		○							○
	Acute kidney injury in severe burn	Guo et al, 2015; Wang et al, 2018		○						○	
	Acute kidney injury after liver transplantation	Du et al, 2016		○						○	
	Kidney injury and fibrosis	Xing et al, 2017	○	○			○			○	
	Calcium oxalate-induced renal injury	Lu et al, 2018		○							○
	Polycystic kidney disease	Yamasaki et al, 2019		○							○
	Septic acute kidney injury	Yao et al, 2019		○							○
Cyclosporine A-induced nephrotoxicity	Lu et al, 2020		○							○	
Pancreas	Acute pancreatitis	Chen et al, 2010c; Zhang et al, 2012; Zhang et al, 2013; Ren et al, 2014; Zhou et al, 2016; Han et al, 2016	○	○				○	○		○

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Pancreas	Trauma-induced acute pancreatic	Ren et al, 2012		○						○	
	Taurocholate-induced pancreatitis	Shin et al, 2015		○						○	
	Ishemia/Reperfusion injury after pancreas transplantaion	Lou et al, 2015		○						○	
	Acute necrotizing pancreatitis	Shi et al, 2016		○						○	
Testicle	Testicular ischemia/reperfusion injury	Jiang et al, 2012a; Lee et al, 2012		○						○	○
	Radiation-induced testicular damage	Jiang et al, 2012b		○						○	
	Radiation-induced germ cell damage	Chuai et al, 2012a		○						○	
	Radiation-induced spermatogenesis and hematopoiesis	Chuai et al, 2012b		○						○	
	Nicotine-induced testicular injury	Li et al, 2013		○						○	
	Sperm motility	Nakata et al, 2015		○						○	
	Cigarette smoke-induced testicular injury	Chen et al, 2015		○						○	

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Testicle	Spinal cord hemisection- induced testicular injury	Ge et al, 2017		○						○		
	Spermatogenesis and sperm motility	Ku et al, 2020		○						○		
Ovary	Cisplatin-induced ovarian injury	Meng et al, 2015		○						○		
	Immune premature ovarian failure	He et al, 2016		○						○		
	Ovarian ischemia reperfusion injury	Gokalp et al, 2016		○						○		
Uterus	Endometriosis	He et al, 2016		○								○
Stomach	Stress-induced gastric ulceration	Liu et al, 2012		○						○		
	Aspirin-induced gastric injury	Xue et al, 2014; Zhang et al, 2014		○							○	
Intestine	Intestinal transplantation	Buchholz et al, 2008; Zheng et al, 2009; Buchholz et al, 2011		○				○	○		○	
	Ulcerative colitis	Kajiya et al, 2009b; He et al, 2013; Shen et al, 2017		○					○	○	○	

Organs/ Diseases	Disease models / Human diseases	Authors / Reported year	Species				Administration				
			Cell	Rodent	Other animals	Human	Medium	Saline	Water	Gas	Others
Intestine	Intestinal ischemia/reperfusion injury	Chen et al, 2011; Shigeta et al, 2015; Wu et al, 2017; Eryilmaz et al, 2019; Yao et al, 2019; Jiang et al, 2020		○				○		○	
	Intestinal injury in hemorrhagic shock	Du et al, 2015		○				○			
	Postoperative ileus	Okamoto et al, 2016		○				○			
	Intestinal Translocation	Ikeda et al, 2017		○				○			
	Radiation-induced gastrointestinal injury	Xiao et al, 2018		○						○	
	Intestinal environment	Higashimura et al, 2018		○						○	
	Mycotoxin-induced small intestine dysfunction	Xu et al, 2019		○						○	
	Relieving effect of gastrointestinal symptoms	Tanaka et al, 2018								○	
	Radiation-induced intestinal damage	Qiu et al, 2020		○	○				○	○	
Esophageal	Migration and apoptosis	Li et al, 2017	○							○	○
	Gastroesophageal reflux disease	Franceschelli et al, 2018						○		○	

Organs/ Diseases	Disease models / Human diseases	Authors / Reported year	Species				Administration					
			Cell	Rodent	Other animals	Human	Medium	Saline	Water	Gas	Others	
Blood vessel	Atherosclerosis	Ohsawa et al, 2008		○							○	
	Aortic atherosclerosis	Song et al, 2012		○							○	
	Neointima formation after carotid balloon-induced injury	Qin et al, 2012; Chen et al, 2013	○	○			○	○				
	Intimal hyperplasia in arterialized vein graft	Sun et al, 2012a		○							○	
	Vascular dysfunction	Zheng et al, 2012		○							○	
	Advanced glycation end product-induced endothelial cells injury	Jiang et al, 2013	○				○					
	Aneurysm induced by calcium chloride	Chen et al, 2013; Song et al, 2013; Chen et al, 2014		○							○	
	Endothelial function	Sakai et al, 2014							○			○
	Monocyte-endothelial cell adhesion and vascular endothelial permeability	Xie et al, 2015; Yu et al, 2015	○				○					
	Atherosclerotic plaque formation	Song et al, 2015a		○								○
	Proliferation and migration of vascular smooth muscle	Zhang et al, 2016	○	○			○					○
Vascular aging	Iketani et al, 2018		○								○	

Organs/ Diseases	Disease models / Human diseases	Authors / Reported year	Species				Administration						
			Cell	Rodent	Other animals	Human	Medium	Saline	Water	Gas	Others		
Blood vessel	Vascular remodeling	Kiyoi et al, 2020		○								○	
	Endothelial glycocalyx in hemorrhagic shock	Sato et al, 2020		○								○	
Muscle	Inflammatory and mitochondrial myopathies	Ito et al, 2011										○	
	Muscle fatigue	Aoki et al, 2012; DA Ponte et al, 2017; Botek et al, 2019										○	
	Gastrocnemius muscle atrophy	Fujita et al, 2011		○								○	
	Ischemia-reperfusion injury in skeletal muscle	Huang et al, 2015		○								○	
	Soft tissue injury	Ostojic et al, 2014										○	
	Oxidative stress after racing exercise	Yamazaki et al, 2015; Nogueira et al, 2018		○		○						○	○
	Duchenne muscular dystrophy	Hasegawa et al, 2016		○									○
Bone/ Cartilage	NO-induced cartilage toxicity	Hanaoka et al, 2011	○									○	
	Microgravity-induced bone loss	Sun et al, 2012b		○								○	
	Osteopenia	Guo et al, 2012		○								○	
	TNF α -induced osteoblast injury	Cai et al, 2013	○									○	

Organs/ Diseases	Disease models / Human diseases	Authors / Reported year	Species				Administration					
			Cell	Rodent	Other animals	Human	Medium	Saline	Water	Gas	Others	
Bone/ Cartilage	Viability of osteochondral tissue	Yamada et al, 2014	○				○					
	Osteoclast differentiation	Li et al, 2014	○				○					
	Steroid-associated femoral head necrosis	Huang et al, 2016; Li et al, 2017			○			○				
	Osteoradionecrosis	Chen et al, 2020	○	○			○			○		
Tendon	Tendon adhesion and inflammatory	Meng et al, 2018		○				○				
Joint	Rheumatoid arthritis	Ishibashi et al, 2012; Ishibashi et al, 2014; Meng et al, 2016		○		○		○	○			
	Psoriasis-associated arthritis	Ishibashi et al, 2015				○		○	○	○		
	Osteoarthritis	Cheng et al, 2020		○						○		
Tooth	Periodontitis	Kasuyama et al, 2011; Azuma et al, 2015		○		○				○		
	Lipid deposition of aorta in periodontitis	Ekuni et al, 2012		○						○		
	Periodontal tissues with aging	Tomofuji et al, 2014		○						○		
	Oxidative stress in gingival fibroblast	Xiao et al, 2016	○					○				

Organs/ Diseases	Disease models / Human diseases	Authors / Reported year	Species				Administration					
			Cell	Rodent	Other animals	Human	Medium	Saline	Water	Gas	Others	
Tooth	Gingival oxidative stress and alveolar bone resorption	Yoneda et al, 2017		○							○	
	Oral biofilm-dependent disease	Kim et al, 2017	○ (bacteria)				○				○	
	Gingival oxidative stress	Shamim 2018	○						○			
Skin	UV radiation-induced cell-injury in fibroblast and wrinkle formation in keratinocytes	Kato et al, 2012	○				○		○			○
	UV radiation-induced skin injury	Yoon et al, 2011a; Guo et al, 2012; Zhang et al, 2018	○	○				○	○			○
	Acute erythematous skin disease	Ono et al, 2012							○			
	Ischemia/reperfusion injury in skin flap	Zhao et al, 2013		○					○			
	UVB-mediated skin injury	Ignacio et al, 2013a		○								○
	Pressure ulcer	Li et al, 2013	○					○		○		
	Atopic dermatitis	Ignacio et al, 2013b; Yoon et al, 2014 Kajisa et al, 2017	○	○					○	○		
	Radiation-induced dermatitis and skin injury	Watanabe et al, 2014; Zhou et al, 2018		○							○	○

Organs/ Diseases	Disease models / Human diseases	Authors / Reported year	Species				Administration				
			Cell	Rodent	Other animals	Human	Medium	Saline	Water	Gas	Others
Skin	Burn-wound progression	Guo et al, 2015		○				○			
	Burn-induced inflammation	Wang et al, 2015		○				○			
	Skin ischemia/reperfusion injury	Liu et al, 2015; Fang et al, 2018; Don et al, 2019; Hao et al, 2019		○				○		○	
	Local radiation-induced dermatitis	Mei et al, 2014		○				○			
	Skin Aging	Wu et al, 2017	○					○			
	Psoriasis	Zhu et al, 2018				○					○
	Cleansing effect of keratin- plug	Tanaka et al, 2018				○					○
	Cutaneous ischemia/reperfusion injury in a model of pressure ulcer	Fang et al, 2018		○							○
	Pemphigus vulgaris	Yang et al, 2019				○			○		
Metabolism	Diabetes mellitus type I	Li et al, 2011; Amitani et al, 2013		○		○		○		○	
	Diabetes mellitus type II	Kajiyama et al, 2008; Wang et al, 2012; Zhang et al, 2018		○		○		○	○	○	
	Metabolic syndrome	Nakao et al, 2010b; Hashimoto et al, 2011; Song et al, 2013; LeBaron et al, 2020		○		○			○		
	Hypercholesterolemia	Zong et al, 2012; Song et al, 2015b		○		○		○			

Organs/ Diseases	Disease models / Human diseases	Authors / Reported year	Species				Administration						
			Cell	Rodent	Other animals	Human	Medium	Saline	Water	Gas	Others		
Metabolism	Diabetes/obesity	Kamimura et al, 2011		○								○	
	Erectile dysfunction in diabetes mellitus	Fan et al, 2012		○								○	
	Diabetic retinopathy	Feng et al, 2012; Xiao et al, 2012		○								○	
	Diabetic neuropathy	Jiao et al, 2019		○								○	
	Fatty acid uptake and lipid accumulation in hepatic cells	Iio et al, 2013		○								○	
	Fatty acid metabolism	Kamimura et al, 2016		○								○	
	Bone loss in diabetic rats	Guo et al, 2017		○								○	
	Obesity	Nakasone et al, 2017; Korovljevic et al, 2018										○	
Perinatal disorders	Neonatal cerebral hypoxia	Cai et al, 2008; Domoki et al, 2010; Cai et al, 2009; Yang et al, 2016; Varga et al, 2018; Htun et al, 2019; Wu et al, 2019		○	○		○				○	○	○
	Preeclampsia	Yang et al, 2011; Ushida et al, 2016		○							○	○	
	Brain injury during maternal hypoxia	Liu et al, 2011		○								○	
	Hyperoxia-induced retinopathy in neonate	Huang et al, 2012		○								○	

Organs/ Diseases	Disease models / Human diseases	Authors / Reported year	Species				Administration						
			Cell	Rodent	Other animals	Human	Medium	Saline	Water	Gas	Others		
Perinatal disorders	Anesthetic-induced cognitive impairment in neonate	Yonamine et al, 2013		○								○	
	Necrotizing enterocolitis in neonate	Sheng et al, 2013		○					○				
	Fetal hippocampal damage	Mano et al, 2014		○							○		
	Neonatal germinal matrix hemorrhage	Lekic et al, 2012		○								○	
	LPS-induced fetal lung injury	Hattori et al, 2015		○							○		
	Neurovascular dysfunction	Oláh et al, 2015										○	
	Deficits in neonatal maternal behavior caused by inhalation anesthetic	Takaenoki et al, 2015		○									○
	Neonatal bronchopulmonary dysplasia	Muramatsu et al, 2016		○									○
	LPS-induced fetal brain injury	Imai et al, 2016		○									○
	Hypoxia-ischemia neonatal brain injury	Bai et al, 2016; Wu et al, 2019		○							○		○
	Placental stress induced by water restriction	Shi et al, 2018		○									○

Organs/ Diseases	Disease models / Human diseases	Authors / Reported year	Species				Administration				
			Cell	Rodent	Other animals	Human	Medium	Saline	Water	Gas	Others
Perinatal disorders	Pregnancy gingivitis	Shi et al, 2018		○						○	
	Neonatal hypoxic-ischemic brain injury	Wang et al, 2020		○							○
Inflammation/ Allergy	Type I allergy	Itoh et al, 2009		○						○	
	Sepsis	Xie et al, 2010a; Li et al, 2012a; Xie et al, 2012; Liu et al, 2014a; Liu et al, 2014b; Li et al, 2014; Li et al, 2015a; Li et al, 2015b; Yu et al, 2017; Iketani et al, 2016; Hong et al, 2017; Ikeda et al, 2017; Saramago et al, 2018		○					○	○	○
	Zymosan-induced inflammation	Xie et al, 2010b; Hong et al, 2016		○							○
	Carrageenan edema and TNF- α production in macrophage	Xu et al, 2012	○	○			○	○			
	LPS/IFN γ -induced NO production	Itoh et al, 2011	○	○			○			○	
	Inflammation in LPS- stimulated macrophages	Chen et al, 2013	○				○				

Organs/ Diseases	Disease models / Human diseases	Authors / Reported year	Species				Administration				
			Cell	Rodent	Other animals	Human	Medium	Saline	Water	Gas	Others
Inflammation/ Allergy	Allergic-rhinitis	Zhao et al, 2017; Yu et al, 2017; Xu et al, 2017; Xu FF, et al, 2017; Jin et al, 2018; Fang et al, 2018		○	○	○		○		○	
	LPS-induced inflammation	Ren et al, 2016	○				○				
Cancer	Growth of tongue carcinoma cells	Saitoh et al, 2008; Saitoh et al, 2009	○				○				
	Lung cancer cells-induced angiogenesis	Ye et al, 2008	○				○				
	Radiation-induced thymic lymphoma	Zhao et al, 2011		○				○			
	Killing effect of cancer cells	Kagawa et al, 2012	○								○
	Antitumor effect	Dole et al, 1975; Zhao et al, 2019; Chen et al, 2019; Akagi et al, 2018		○						○	○
	Enhancement of antitumor effect in combination therapy	Runtuwene et al, 2015		○						○	
	Liver function of colorectal cancer patients	Yang et al, 2017						○			
	Glioblastoma	Liu et al, 2019		○					○		○
	Gallbladder cancer	Chen et al, 2019									○

Organs/ Diseases	Disease models / Human diseases	Authors / Reported year	Species				Administration					
			Cell	Rodent	Other animals	Human	Medium	Saline	Water	Gas	Others	
Cancer	Antitumor effect on lung cancer	Chen et al, 2020				○						○
	Endometrial cancer	Yang et al, 2020	○	○			○					○
	Lung cancer progression	Wang et al, 2018	○	○			○					○
Hypertension	Monocrotaline-induced pulmonary hypertension	Wang et al, 2011c; He et al, 2013; Kishimoto et al, 2015			○				○			○
	Hypoxia-induced hypertension	Guan et al, 2018			○							○
Others	Decompression sickness	Ni et al, 2011			○				○			
	Viability of pluripotent stromal cells	Kawasaki et al, 2010	○									○
	Radiation-induced cell damage	Qian et al, 2010b; Qian et al, 2010c	○						○			
	Oxidized LDL-induced cell toxicity	Song et al, 2011	○						○			
	High glucose-induced oxidative stress	Yu et al, 2011	○						○			
	AAPH-induced oxidative stress	Yanagihara et al, 2005			○							○
	Life span	Yan et al, 2010; Klichko et al, 2019				○						○

Organs/ Diseases	Disease models / Human diseases	Authors / Reported year	Species				Administration					
			Cell	Rodent	Other animals	Human	Medium	Saline	Water	Gas	Others	
Others	Severe exercise-induced oxidative stress	Koyama et al, 2008; Tsubone et al, 2013; Dobashi et al, 2020		○		○					○	
	Exercise-induced metabolic acidosis	Ostojic et al, 2014				○					○	
	Exercise performance	LeBaron et al, 2019				○					○	
	Running performance	Javorac et al, 2019				○						○
	Platelet aggregation	Takeuchi et al, 2012		○		○		○	○		○	
	Radiation-induced apoptosis	Yang et al, 2012	○							○		
	Radical production and blood fluidity	Kato et al, 2012	○								○	
	Graft versus-host disease (GVHD) in bone marrow transplantation	Qian et al, 2013		○							○	
	Chronic GVHD	Qian and Shen, 2016; Qian et al, 2016		○		○				○	○	
	Aplastic anemia	Zhao et al, 2013		○							○	
	Radiation-induced immune dysfunction	Zhao et al, 2014		○							○	
	Acute peritonitis	Zhang et al, 2014		○								○

Organs/ Diseases	Disease models / Human diseases	Authors / Reported year	Species				Administration					
			Cell	Rodent	Other animals	Human	Medium	Saline	Water	Gas	Others	
Others	Hemorrhage shock	Du et al, 2014; Matsuoka et al, 2017		○				○			○	
	Hematopoietic stem-cell transplantation	Yuan et al, 2015		○				○				
	Signaling pathway	Sobue et al, 2015		○					○		○	
	Tissue concentration	Liu et al, 2014; Yamamoto et al, 2019		○				○	○		○	
	Human lymphocyte cells against 12C6+ heavy ion radiation.	Yang et al, 2013	○					○				
	Bladder outlet obstruction	Miyazaki et al, 2015		○				○				
	Oral palatal wound	Tamaki et al, 2016		○						○		
	Cell death and senescence	Han et al, 2016; Han et al, 2017	○					○				
	Cellular senescence	Hara et al, 2016; Zhang et al, 2018; Sakai et al, 2019	○	○				○	○			
	Hidden blood loss	Qian et al, 2017		○				○				
	Irradiation-induced hematopoietic stem cell injury	Zhang et al, 2017		○				○				
	Reactive oxygen scavenging activity in cultured cell	Hamasaki et al, 2017	○					○				
	Immune activity	Hu et al, 2017			○						○	

Organs/ Diseases	Disease models / Human diseases	Authors / Reported year	Species				Administration					
			Cell	Rodent	Other animals	Human	Medium	Saline	Water	Gas	Others	
Others	Oxidative Stress	Lee et al, 2017; Liu et al, 2018; Lu et al, 2019	○				○					
	Postoperative Intra-Abdominal Adhesion band formation	Liu et al, 2017		○				○				
	Growth suppression induced by mycotoxin-contaminated diet	Zheng et al, 2018			○					○		
	Antifatigue effect	Ara et al, 2018; Watanabe et al, 2018		○					○			
	Meta-analysis of gene expression	Nishiwaki et al, 2018		○						○		
	Alleviation of oxygen toxicity	Yu et al, 2018	○					○				
	Modulation of gene expression	Sobue et al, 2017		○						○		
	Wound repair	Li et al, 2018	○					○				
	Oxygen glucose deprivation and reperfusion-induced apoptosis	Mo et al, 2018	○					○				
	Antioxidant activity and gut flora	Sha et al, 2018							○			○
Xenobiotic-metabolizing system	Yao et al, 2019		○								○	

Organs/ Diseases	Disease models / Human diseases	Authors / Reported year	Species				Administration					
			Cell	Rodent	Other animals	Human	Medium	Saline	Water	Gas	Others	
Others	Free radical-induced cell death	Iuchi et al, 2019	○				○					
	Visceral fat and skin blotch	Asada et al, 2019				○						○
	Mitochondrial function	Gvozdjakova et al, 2019		○						○		
	LDL-induced inflammation	Yang et al, 2018	○				○					
	Ankle sprain	Javorac et al, 2020				○				○		
	Antifatigue effect	Botek et al, 2020				○				○		
	Preparation conditions of hydrogen water and oxidation-reduction potential in saliva	Tanaka et al, 2020				○				○		
	Suppression of superoxide generation	Ishibashi et al, 2020	○				○					

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