Abstract: BACKGROUND: Peripheral arterial disease (PAD) affects millions of Americans and leads to critical limb ischemia (CLI) in the most severe cases. Investigators have demonstrated the utility of hydrogen sulfide for restoring perfusion in rodent models of chronic ischemia. We sought to determine the minimum effective dose (MED) of sulfide necessary to restore perfusion in the rat hindlimb, to assess the persistence of limb perfusion after cessation of treatment, and to compare perfusion measurements between laser doppler and ultrasound methods. METHODS: In 3 separate experiments, sodium sulfide (1.0, 0.5, or 0.25 mg/kg twice daily for 14 days, 0.25 mg/kg twice daily for 7 days, 0.5 mg/kg once daily for 7 days, or 0.25 mg/kg twice daily for 3 days) or vehicle was administered after left femoral artery ligation and transection. Hindlimb perfusion was assessed by laser doppler flowmetry and contrast enhanced ultrasound over the duration of each study, and cellular proliferation and vascular density were assessed by immunohistochemical means in the initial experiment. RESULTS: Intravenous sodium sulfide at 0.25, 0.5, or 1.0 mg/kg twice daily for 2 weeks significantly enhanced the recovery of blood flow to the ischemic hindlimb by 7 days. The enhancement of blood flow with 1.0 mg/kg dosing was coincident with an increase in cellular proliferation and vascular density in the ischemic tissue. In a final experiment, i.v. administration of sodium sulfide at 0.5 mg/kg once daily for 7 days or 0.25 mg/kg twice daily for 7 days significantly elevated blood flow and skeletal muscle perfusion in the ischemic hindlimb, whereas 0.25 mg/kg twice daily for 3 days had no effect. This enhancement of blood flow appeared long lived, as blood flow remained elevated 3 weeks after cessation of treatment. CONCLUSIONS: These data, together with other published observations, demonstrate the efficacy of hydrogen sulfide in restoring perfusion to chronically ischemic tissue and establish a minimum efficacious dose in the rat hindlimb model

Abstract: T-type Ca2+ channels (Cav3.1, 3.2 and 3.3) strongly influence proliferation of various cell types, including vascular smooth muscle cells (VSMCs) and certain cancers. We have recently shown that the gasotransmitter carbon monoxide (CO) inhibits T-type Ca2+ channels and, in so doing, attenuates proliferation of VSMC. We have also shown that the T-type Ca2+ channel Cav3.2 is selectively inhibited by hydrogen sulfide (H2S) whilst the other channel isoforms (Cav3.1 and Cav3.3) are unaffected. Here, we explored whether inhibition of Cav3.2 by H2S could account for the anti-proliferative effects of this gasotransmitter. H2S suppressed proliferation in HEK293 cells expressing Cav3.2, as predicted by our previous observations. However, H2S was similarly effective in suppressing proliferation in wild type (non-transfected) HEK293 cells and those expressing the H2S insensitive channel, Cav3.1. Further studies demonstrated that T-type Ca2+ channels in the smooth muscle cell line A7r5 and in human coronary VSMCs strongly influenced proliferation. In both cell types, H2S caused a concentration-dependent inhibition of proliferation, yet by far the dominant T-type Ca2+ channel isoform was the H2S-insensitive channel, Cav3.1. Our data indicate that inhibition of T-type Ca2+ channel-mediated proliferation by H2S is independent of the channels’ sensitivity to H2S.
Abstract: High sensitivity, selectivity, and reliability have been achieved from ZnSnO3/ZnO nanowire (NW) piezo-nanogenerator (NG) as self-powered gas sensor (SPGS) for detecting liquefied petroleum gas (LPG) at room temperature (RT). After being exposed to 8000 ppm LPG, the output piezo-voltage of ZnSnO3/ZnO NW SPGS under compressive deformation is 0.089 V, much smaller than that in air ambiance (0.533 V). The sensitivity of the SPGS against 8000 ppm LPG is up to 83.23, and the low limit of detection is 600 ppm. The SPGS has lower sensitivity against H2S, H2, ethanol, methanol and saturated water vapor than LPG, indicating good selectivity for detecting LPG. After two months, the decline of the sensing performance is less than 6%. Such piezo-LPG sensing at RT can be ascribed to the new piezo-surface coupling effect of ZnSnO3/ZnO nanocomposites. The practical application of the device driven by human motion has also been simply demonstrated. This work provides a novel approach to fabricate RT-LPG sensors and promotes the development of self-powered sensing system.

Abstract: AIM: To study the effect of hydrogen sulfide (H2S) on severe acute pancreatitis (SAP) in a rat model. METHODS: Sprague-Dawley (SD) rats were administered an intraperitoneal injection of saline containing 20% L-Arg (250 mg/100 g) hourly for over 2 h to induce SAP. The rats were treated with DL-propargylglycine (PAG, 50 mg/kg) or different dosages of NaHS (5 mg/kg, 10 mg/kg, 20 mg/kg or 100 mg/kg). PAG or NaHS was administered 1 h before induction of pancreatitis. Rats were sacrificed 24 h after the last L-Arg injection. Blood and pancreas tissues were collected. RESULTS: The H2S and cystathionine-gamma-lyase mRNA levels in SAP rats were significantly lower than those in the control group, and treatment with PAG further reduced the H2S level. Nevertheless, H2S was significantly increased after NaHS administration compared with the SAP group, and the degree of upregulation was associated with the NaHS dosage. NaHS reduced the levels of plasma amylase, interleukin-6 and myeloperoxidase in pancreatic tissue. NaHS suppressed the degradation of IkappaBalpha and the activity of nuclear factor-kappaB, as well as the phosphorylation of PI3K/AKT. CONCLUSION: H2S plays an anti-inflammatory role in SAP in vivo.

Abstract: The release of hydrogen sulfide (H2S) during sludge drying is a major environmental problem because of its toxicity to human health. A series of experiments were performed to investigate the mechanisms and factors controlling the H2S release. Results of this study show that: (1) the biomass and activity of sulfate-reducing bacteria (SRB) in sludge were the major factors controlling the amount of H2S release, (2) the sludge drying temperature had an important effect on both the extent and the timing of H2S release from the sludge, and (3) decreasing sludge pH increased the H2S release. Based on the findings from this study, a new system that integrates sludge drying and H2S gas treatment was developed, by which 97.5% of H2S and 99.7% of smoke released from sludge treatments was eliminated.

Abstract: Hydrogen sulfide (H2S) has been long recognized as a highly poisonous gas that is rapidly lethal in intoxicating dosage. However, discoveries during the last decade on the endogenous synthesis of H2S in the mammalian system and its protective role in combating cellular necrosis, apoptosis, oxidative stress, inflammation as well as promoting angiogenesis and modulation of mitochondrial respiration in the setting of myocardial
ischemia and reperfusion injury have prompted vast interest in the possibility of developing new therapies based around mimicry or facilitation of endogenous H2S for cardioprotection. These observations have inspired rapid development of H2S-releasing drugs in hopes of swift clinical translation in patients with cardiovascular disease. This review will discuss our current understanding of the protective signaling pathways elicited by H2S in the heart with an emphasis on the versatile benefits of this gasotransmitter and its potential for clinical translation in patients with cardiovascular disease.

(7) Fix SM, Borden MA, Dayton PA. Therapeutic gas delivery via microbubbles and liposomes. J Control Release 2015 Apr 23;209:139-49. Abstract: Gaseous molecules including nitric oxide, hydrogen sulfide, carbon monoxide and oxygen mediate numerous cell signaling pathways and have important physiological roles. Several noble gasses have been shown to elicit biological responses. These bioactive gasses hold great therapeutic potential, however, their controlled delivery remains a significant challenge. Recently, researchers have begun using microbubbles and liposomes to encapsulate such gasses for parenteral delivery. The resultant particles are acoustically active, and ultrasound can be used to stimulate and/or image gas release in a targeted region. This review provides a summary of recent advances in therapeutic gas delivery using microbubbles and liposomes.

(8) Headland SE, Norling LV. The resolution of inflammation: Principles and challenges. Semin Immunol 2015 Apr 21. Abstract: The concept that chemokines, cytokines and pro-inflammatory mediators act in a co-ordinated fashion to drive the initiation of the inflammatory reaction is well understood. The significance of such networks acting during the resolution of inflammation however is poorly appreciated. In recent years, specific pro-resolving mediators were discovered which activate resolution pathways to return tissues to homeostasis. These mediators are diverse in nature, and include specialized lipid mediators (lipoxins, resolvins, protectins and maresins) proteins (annexin A1, galectins) and peptides, gaseous mediators including hydrogen sulphide, a purine (adenosine), as well as neuromodulator release under the control of the vagus nerve. Functionally, they can act to limit further leukocyte recruitment, induce neutrophil apoptosis and enhance efferocytosis by macrophages. They can also switch macrophages from classical to alternatively activated cells, promote the return of non-apoptotic cells to the lymphatics and help initiate tissue repair mechanisms and healing. Within this review we highlight the essential cellular aspects required for successful tissue resolution, briefly discuss the pro-resolution mediators that drive these processes and consider potential challenges faced by researchers in the quest to discover how inflammation resolves and why chronic inflammation persists.

(9) Li F, Zeng O, Luo J, Wu ZX, Xiao T, Zhang JJ, et al. [Effects of hydrogen sulfide on myocardial fibrosis and MAPK1/3 and MMP-8 expression in diabetic rats]. Nan Fang Yi Ke Da Xue Xue Bao 2015 Apr;35(4):549-52. Abstract: OBJECTIVE: To explore the effects of hydrogen sulfide (H(2)S) on myocardial fibrosis and expressions of MAPK1/3 and MMP-8 expression in diabetic rats. METHODS: Forty adult male SD rats were randomized into 4 groups, namely the control group, diabetes mellitus group (STZ group), diabetes mellitus with H(2)S treatment group (STZ+H(2)S group), and normal rats with H(2)S treatment group (H(2)S group). Diabetes was induced by intraperitoneal injections of 40 mg/kg streptozotocin (STZ). The rats in the control group received daily intraperitoneal injections of saline, and those in STZ+H(2)S group and H(2)S group were given NaHS (100 micromol/kg) injections. After 8 weeks, the pathologies of cardiac fibrosis were examined with HE staining, and the expressions of collagen I, MAPK1/3 and MMP-8 were analyzed with Western blotting. RESULTS: Compared with the control group, the diabetic rats showed increased collagen content and obvious interstitial fibrosis in the myocardial tissue with significantly increased expression levels of collagen I, MAPK1/3 and MMP-8 (P<0.05); all these changes were obviously reversed by treatment with H(2)S (P<0.05). Collagen I, MAPK1/3 and MMP-8 expression levels and the degree of
myocardial fibrosis were comparable between H(2)S group and control group (P>0.05). CONCLUSION: Hydrogen sulfide can attenuate cardiac fibrosis in diabetic rats, and the mechanism may involve the inhibition of MAPK1/3/MMP-8 signal pathway.

(10) Tkach SM, Balabantseva HP, Levchenko AR. [The up-to-date methods of management of NSAIDs-induced injuries of small intestine]. Lik Sprava 2014 May;(5-6):38-47. Abstract: In the article the incidence, pathogenesis, clinical features, diagnostic, prevention and treatment of NSAIDs-induced injuries of small intestine are presented. The different strategies of management of NSAID-induced enteropathy, such as use of PPI, COX-2-inhibitors, prostaglandins, antibiotics and probiotics, new combination of NSAIDs with phosphatidylcholine, NO or H2S, food supplements and other drugs are discussed.

(11) Guarrasi J, Trask C, Kirychuk S. A systematic review of occupational exposure to hydrogen sulfide in livestock operations. J Agromedicine 2015;20(2):225-36. Abstract: This systematic review summarizes the current state of knowledge in hydrogen sulfide (H2S) concentrations within intensive livestock operations. The review was undertaken to better understand H2S concentrations in intensive livestock operations, in relation to the American Conference of Governmental Industrial Hygienists (ACGIH) limit reduction to a 1 ppm time-weighted average (TWA). Several online academic databases were searched using two conceptual groups of search terms: "livestock" and "hydrogen sulfide." Industry gray literature was additionally identified via targeted searches of online agriculture-specific Web sites. Title, abstract, and full-text screening were performed to select articles reporting H2S measurements made within livestock facilities. Forty-five articles were included in this review. The bulk (70%) of articles described swine operations, whereas the remaining represented poultry and dairy operations. Although 14% of the articles described task-based monitoring of H2S, the majority of articles (86%) involved only area monitoring. Weighted means from all three livestock types were below 1 ppm, although swine operations displayed a wider range of exposure (from 0 to 97 ppm). Despite most mean task-based exposures being close to 1 ppm, the peak concentrations measurements may be higher during power washing (97 ppm) and miscellaneous tasks (11.4 ppm). This review provides a novel overview of H2S levels in intensive livestock operations, including information on task-based measurements. The review highlights numerous influences that produce a wide variability of H2S levels in intensive livestock operations. The review also highlights the need for research focused on personal monitoring of daily worker exposures to hydrogen sulfide in intensive livestock operations.

(12) Jin Z, Chan H, Ning J, Lu K, Ma D. The role of hydrogen sulfide in pathologies of the vital organs and its clinical application. J Physiol Pharmacol 2015 Apr;66(2):169-79. Abstract: Hydrogen sulfide (H2S) is one of the more recently recognised gaseous transmitters that have been shown to be involved in a large range of cellular functions. While H2S generally has pro-survival and anti-apoptotic effects, at higher concentrations, this effect is reversed and it becomes anti-proliferative and pro-apoptotic instead. H2S is also involved in a number of organ specific functions such as thermoregulation, modulating myocardial activity and broncho-dilation. H2S has organ protective effects in ischaemia, acting as a vasodilator and negative inotrope to reduce blood pressure. H2S generally has a protective effect in acute inflammation and oxidative stress from causes such as allergy and toxins. In chronic organ pathology, low H2S levels have been observed in a number of different diseases, while there is evidence that H2S may be beneficial in a number of chronic organ degenerations. A number of studies on human tissue and cell line conducted in the recent years shows H2S exerting largely similar effects in humans as those in animals. This may indicate that the pharmacological potential of H2S modulators could have therapeutic value in a large range of acute conditions such as ischaemia, toxin exposure as well as chronic conditions such as hypertension, lung diseases and neurodegenerative disease.
Abstract: Hydrogen Sulfide Sensing In their Communication on page 7002 ff., M. Licchelli, R. Martinez-Manez, et al. report the synthesis, characterization, and sensing behavior of a new hybrid material functionalized with a Cu(II) -macrocyclic derivative that is capped, through electrostatic interactions, with the bulky anion hexametaphosphate. Of all the chemicals tested, only HS(-) was able to induce pore opening and dye release. The fluorogenic response obtained was ascribed to a demetalization reaction, selectively induced by HS(-) ion

Abstract: Water condensing as liquid drops within the fluid bulk has traditionally been the only scenario accepted in the industrial analysis of hydrate risks. We have applied a combination of absolute thermodynamics and molecular dynamics modeling to analyze the five primary routes of hydrate formation in a rusty pipeline carrying dense carbon dioxide with methane, hydrogen sulfide, argon, and nitrogen as additional impurities. We have revised the risk analysis of all possible routes in accordance with the combination of the first and the second laws of thermodynamics to determine the highest permissible content of water. It was found that at concentrations lower than five percent, hydrogen sulfide will only support the formation of carbon dioxide-dominated hydrate from adsorbed water and hydrate formers from carbon dioxide phase rather than formation in the aqueous phase. Our results indicate that hydrogen sulfide leaving carbon dioxide for the aqueous phase will be able to create an additional hydrate phase in the aqueous region adjacent to the first adsorbed water layer. The growth of hydrate from different phases will decrease the induction time by substantially reducing the kinetically limiting mass transport across the hydrate films. Hydrate formation via adsorption of water on rusty walls will play the decisive role in hydrate formation risk, with the initial concentration of hydrogen sulfide being the critical factor. We concluded that the safest way to eliminate hydrate risks is to ensure that the water content of carbon dioxide is low enough to prevent water dropout via the adsorption mechanism

Abstract: Mesenchymal stem cells (MSCs) have the potential to facilitate cardiac repair following acute myocardial infarction. However, MSC therapy is limited by apoptosis of the stem cells following transplantation. Hydrogen sulfide (H2S) has recently been proposed as an endogenous mediator of cell apoptosis in various systems. The aim of the present study was to investigate the mechanism underlying the antiapoptotic effect of the endogenous cystathionine gammalyase (CSE)/H2S system in MSCs cultivated in conditions of hypoxia and serum deprivation (H/SD). Western blotting was performed in order to determine the expression of proteins associated with the mitochondrial injury pathway, endoplasmic reticulum stress and the phosphatidylinositol 3kinase (PI3K)/Akt signaling pathway. It was demonstrated that H/SD is able to significantly induce apoptosis in MSCs. CSE overexpression, which enhances the endogenous H2S level, protects MSCs from H/SD induced apoptosis via attenuation of the mitochondrial injury pathway, inhibition of endoplasmic reticulum stress and activation of the PI3K/Akt signaling pathway. In conclusion, the present findings suggest that modulation of the CSE/H2S system may have a therapeutic approach with which to promote the viability of transplanted MSCs

Abstract: Reflexes initiated by the carotid body, the principal O2-sensing organ, are critical for maintaining cardiorespiratory homeostasis during hypoxia. O2 sensing by the carotid body requires carbon monoxide (CO) generation by heme oxygenase-2 (HO-2) and hydrogen sulfide (H2S) synthesis by cystathionine-gamma-lyase (CSE). We report that O2 stimulated the generation of CO, but not that of H2S, and required two cysteine residues in the heme regulatory motif (Cys(265) and Cys(282)) of HO-2. CO stimulated protein kinase G (PKG)-dependent phosphorylation of Ser(377) of CSE, inhibiting the production of H2S. Hypoxia decreased the inhibition of CSE by reducing CO generation resulting in increased H2S, which stimulated carotid body neural activity. In carotid bodies from mice lacking HO-2, compensatory increased abundance of nNOS (neuronal nitric oxide synthase) mediated O2 sensing through PKG-dependent regulation of H2S by nitric oxide. These results provide a mechanism for how three gases work in concert in the carotid body to regulate breathing.


Abstract: Oxygen sensing by the carotid body is essential in vertebrates to adapt to reduced arterial oxygen tension. In this issue of Science Signaling, Yuan et al. report an intricate signaling system to transduce a physical parameter-oxygen tension-into a biological cellular signal (neural discharge) through changes in the production of carbon monoxide (CO), the second messenger cyclic guanosine monophosphate, and hydrogen sulfide (H2S).


Abstract: Hydrogen sulfide (H2S) is one of the important parameters for characterizing water pollution. Therefore, fast and effective detection method is in great need. Fluorescence analysis method gains wide attention because of unparalleled advantages. A new colorimetric and fluorescent "turn-on" probe for H2S detection based on thiolysis by H2S was reported. 2-(2'-Hydroxyphenyl) benzimidazole (HBI), a kind of excited-state intramolecular proton transfer dye was chosen as the fluorophore because of large Stokes shift and high fluorescence quantum yield. It was found that the fluorescence intensity of testing system increased with the addition of H2S and accompanied with a color change from pale yellow to purple. The visual detection limit was 3 micromol x L(-1). The new fluorescent probe showed a good selectivity for H2S over other anions and a good fluorescence response in a relatively wide pH range. The response process was finished in five minutes with a 100-fold fluorescence enhancement. The probe provides a new method for the detection of H2S.


Abstract: In order to obtain the candidate strains of deodorizing microorganism, three optimization strains with relatively higher deodorizing capacity were isolated from landfill leachate, which were given the labels of CC3, CC7, CC13 and CC16. According to the results of morphological observation, physiological and biochemical tests, 16S rDNA sequence homology analysis, the strains CC3, CC7, CC13 and CC16 were identified as Pediococcus acidilactici, Bacillus megaterium, Lactobacillus acidophilus and Alcaligenes faecalis respectively. When the strains CC7, CC13 and CC16 were mixed with the inoculation rate was 1:1.5:0.5, the removal rates of ammonia and hydrogen sulfide were 83.56% and 70.25%. The optimal conditions of deodorizing by single factor test were deodorization time of 60 hours, sausage of 5%, temperature of 30 degrees C, initial pH of 6.5.
Abstract: To investigate the effects and potential mechanisms of hyperoside (Hyp) on the vascular endothelium function in middle cerebral artery (MCA) ex vivo in rats. Isolated arterial segments from MCAs of rats were used for surveying vasomotoricity in a pressurized chamber. Transmembrane potential was recorded by using glass microelectrodes to evaluate hyperpolarization. Hyp (1 x 10(-6)-1 x 10(-4) mol . L-1) was utilized to observe the effect on 1 x 10(-7) mol . L-1 U46619-preconstricted MCA in rats. The results showed that 1 x 10(-6)-1 x 10(-4) mol . L-1 Hyp significantly induced concentration-dependent vasodilatation and hyperpolarization, leading to the maximal diastolic ratio of (73. 2 +/- 6. 1)% and maximal changes in membrane potentials of (-13. 2 +/- 2. 2) mV. Hyp still elicited vasorelaxation and hyperpolarization by removal of endothelium in MCA of rat, which was notably attenuated as compared with vascular endothelium-intact group (P <0. 01). In the MCAs preconstricted by U46619 (1 x 10(-7) mol . L-1), Hyp (1 x 10(-6)-1 x 10(-4) mol . L-1) produced concentration-dependent vasorelaxation and hyperpolarization that were partially attenuated by 3 x 10(-5) mol . L-1 L-NAME (a NOS inhibitor) plus 1 x 10(-5) mol . L-1 PGI2 , (a synthetase inhibitor). The residual effects were further decreased by 1 x 10(-3) mol . L-1 TEA (an inhibitor of Ca2+-activated potassium channel) or 1 x 10(-5) mol . L-1 PPG (a blocker of endogenous H2S synthese-CSE). Similarly, 1 x 10(-5)-1 x 10(-3) mol . L-1 NaHS (a donor of exogenous H2S) or 1 x 10(-5)-1 x 10(-3) mol . L-1 L-Cys (the substrate of endogenous H2S synthesis) obviously evoked dose-dependent vasodilatation and hyperpolarization of MCA in rats. These findings indicated that Hyp may induce endothelium-dependent and endothelium-independent responses. And the endothelium-dependent vasodilatation may be related to the increases of endogenous H2S that has been promoted Hyp in the endotheliocyte of MCAs, and activated Kca and opening of Kca channels, resulting in the hyperpolarization of vascular smooth muscle cell membrane and subsequent reduction of Ca2+ influx and vasodilation.

Abstract: We report a study on effect of film thickness on NO2 sensing properties of sprayed WO3 thin films. WO3 thin films varying in thicknesses are deposited onto the glass substrates by simple spray pyrolysis technique by varying the volume of spray solution. Thin film gas sensors are characterized by using X-ray diffraction (XRD), X-ray photoelectron spectroscopy (XPS), scanning electron microscopy (SEM), atomic force microscopy (AFM) and photoluminescence (PL) techniques to study their physical properties. Film having thickness 745nm has shown highest gas response of 97% with 12 and 412s response and recovery times, respectively towards 100ppm NO2 concentration. Gas response of 20% is observed towards 10ppm NO2 at 200 degrees C operating temperature. Sensitivity of the optimal sensor is 0.83%/ppm when operating at 200 degrees C with 10ppm lower detection limit. The response of the sensor is reproducible and WO3 films are highly selective towards NO2 in presence of mist of various interfering gases viz. H2S, NH3, LPG, CO and SO2.

Abstract: Circadian clocks and metabolism are inextricably intertwined, where central and hepatic circadian clocks coordinate metabolic events in response to light-dark and sleep-wake cycles. We reveal an additional key element involved in maintaining host circadian rhythms, the gut microbiome. Despite persistence of light-dark signals, germ-free mice fed low or high-fat diets exhibit markedly impaired central and hepatic circadian clock gene expression and do not gain weight compared to conventionally raised counterparts.
Examination of gut microbiota in conventionally raised mice showed differential diurnal variation in microbial structure and function dependent upon dietary composition. Additionally, specific microbial metabolites induced under low- or high-fat feeding, particularly short-chain fatty acids, but not hydrogen sulfide, directly modulate circadian clock gene expression within hepatocytes. These results underscore the ability of microbially derived metabolites to regulate or modify central and hepatic circadian rhythm and host metabolic function, the latter following intake of a Westernized diet.


Abstract: LINKED ARTICLES: This article is part of a themed section on Pharmacology of the Gasotransmitters. To view the other articles in this section visit http://dx.doi.org/10.1111/bph.2015.172.issue-6


Abstract: Lumbar disc herniation (LDH) is a major cause of discogenic low back pain and sciatica, but the underlying mechanisms remain largely unknown. Hydrogen sulfide (H2S) is becoming recognized for its involvement in a wide variety of processes including inflammation and nociception. The present study was designed to investigate the roles of the H2S signaling pathway in the regulation of expression and function of purinergic receptors (P2XRs) in dorsal root ganglion (DRG) neurons from rats with LDH. LDH was induced by implantation of autologous nucleus pulposus (NP), harvested from rat tail, in lumbar 5 and 6 spinal nerve roots. Implantation of autologous NP induced persistent pain hypersensitivity, which was partially reversed by an intrathecal injection of A317491, a potent inhibitor of P2X3Rs and P2X2/3Rs. The NP induced persistent pain hypersensitivity was associated with the increased expression of P2X3Rs, but not P2X1Rs and P2X2Rs, receptors in L5-6 DRGs. NP implantation also produced a 2-fold increase in ATP-induced intracellular calcium signals in DRG neurons when compared to those of controls (P < 0.05). Interestingly, NP implantation significantly enhanced expression of the endogenous hydrogen sulfide producing enzyme, cystathionine-beta-synthetase (CBS). Systematic administration of O-(Carboxymethyl) hydroxylamine hemihydrochloride (AOAA), an inhibitor of CBS, suppressed the upregulation of P2X3R expression and the potentiation of ATP-induced intracellular calcium signals in DRG neurons (P < 0.05). Intrathecal injection of AOAA markedly attenuated NP induced- persistent pain hypersensitivity. Our results suggest that sensitization of P2X3Rs, which is likely mediated by CBS-H2S signaling in primary sensory neurons, contributes to discogenic pain. Targeting CBS/H2S-P2X3R signaling may represent a potential treatment for neuropathic pain caused by LDH.


Abstract: BACKGROUND AND PURPOSE: Meningeal blood flow is controlled by calcitonin gene-related peptide (CGRP) released from trigeminal afferents and nitric oxide (NO) mainly produced in arterial endothelium. The vasodilatory effect of NO may be due to the NO sibling nitroxyl (HNO), generated through the reaction with hydrogen sulfide (H2S). We investigated the involvement of HNO in CGRP release and meningeal blood flow.

EXPERIMENTAL APPROACH: Blood flow in the exposed rat dura mater was recorded by laser Doppler flowmetry. CGRP release from the dura mater in the hemisected rat head was quantified using an ELISA. NO and H2S were localised histochemically with specific sensors.

KEY RESULTS: Topical administration of the NO donor diethylamine-NONOate increased meningeal blood flow by 30%. Preadministration of oxamic acid, an inhibitor of H2S synthesis, reduced this effect. Administration of Na2S increased the flow by 20%. This effect was abolished by the CGRP receptor antagonist CGRP8-37 or the TRPA1 antagonist HC030031 and reduced when endogenous NO synthesis was blocked. Na2S dose-dependently increased CGRP release 2-3-fold. Co-administration of
diethylamine-NONOate facilitated CGRP release, while inhibition of endogenous NO or H2S synthesis lowered basal CGRP release. NO and H2S were mainly localised in arterial vessels, HNO additionally in nerve fibre bundles. HNO staining was lost after the treatment with L-NMMA and oxamic acid. CONCLUSIONS AND IMPLICATIONS: NO and H2S cooperatively increase meningeal blood flow by forming HNO, which activates TRPA1 receptor channels of trigeminal fibres inducing CGRP release. The proposed role of the HNO-TRPA1-CGRP signalling for the pathophysiology of headaches is discussed.

(26) Blackler RW, De PG, Manko A, Da Silva GJ, Flannigan KL, Bercik P, et al. Deciphering the Pathogenesis of NSAID-Enteropathy Using Proton Pump Inhibitors and a Hydrogen Sulfide-Releasing NSAID. Am J Physiol Gastrointest Liver Physiol 2015 Apr 16;ajpgi. Abstract: The small intestine is a significant site of ulceration and bleeding induced by nonsteroidal anti-inflammatory drugs (NSAIDs). The pathogenesis is poorly understood. The present study explored the roles of bile, bacteria and enterohepatic circulation to NSAID-enteropathy, using both a conventional NSAID (naproxen) and a gastrointestinal-safe naproxen derivative (ATB-346), as well as proton pump inhibitors. Rats were treated orally with naproxen or equimolar doses of ATB-346 over a 5-day period, with or without PPI administration, and intestinal damage was quantified. The cytotoxicity of bile from the rats was evaluated in vitro. Biliary excretion of naproxen and ATB-346 was determined. The impact of the NSAIDs and of PPIs on the composition of the intestinal microbiota was examined by deep sequencing of 16s rRNA. Naproxen caused significant intestinal damage and inflammation, while ATB-346 did not. Naproxen, but not ATB-346, dose-dependently increased the cytotoxicity of bile, and it was further increased by PPI co-administration. While biliary excretion of naproxen was significant in naproxen-treated rats, it was greatly reduced in rats treated with ATB-346. The enteric microbiota of naproxen-treated rats was distinct from that in vehicle- or ATB-346-treated rats, and PPI administration caused significant intestinal dysbiosis. The increase in cytotoxicity of bile induced by naproxen and PPIs may contribute significantly to intestinal ulceration and bleeding. Some of these effects may occur secondary to significant changes in the jejunal microbiota induced by both naproxen and PPIs.

(27) Deng M, Zhang M, Huang X, Ma J, Hu L, Lin G, et al. A gas chromatography-mass spectrometry based study on serum metabolomics in rats chronically poisoned with hydrogen sulfide. J Forensic Leg Med 2015 May;32:59-63. Abstract: Hydrogen sulfide poisoning is a common occupational hazard, whose mortality and incidence rates are first and second, respectively, among occupational poisoning incidents in China. The main target organs of its toxicity are in the central nervous system and respiratory system. However, there are currently no specific direct tests that can be used to diagnose poisoned patients. In this study, we developed a serum metabolomic method using orthogonal partial least squares-discriminate analysis (OPLS-DA), based on gas chromatography-mass spectrometry (GC/MS) to evaluate the effect of chronic poisoning by hydrogen sulfide in rats. The OPLS-DA data demonstrated that the model group (n = 60) differed significantly from the control group (n = 30), suggesting that the metabolic profiles of the two groups are markedly different. Alterations in the levels of some metabolites such as citrate, galactose, lactate, mannose, inositol, urea, phosphate, alanine and valine were detected by OPLS-DA analysis. We observed changes in metabolic pathways including lipid metabolism, energy metabolism and amino metabolism in the model group. Our results indicate that GC/MS-based metabolomic methods may provide novel detection means for chronic hydrogen sulfide poisoning.

hydrosulfide (SH, n = 32), and propargylglycine groups (PPG, n = 32) according to the random number table. Rats in group SI were sham injured without fluid resuscitation. Rats in the latter 3 groups were inflicted with 30% TBSA full-thickness scald (referred to as burn below) on the back and intraperitoneally injected with 40 mL/kg balanced salt solution immediately after injury. Rats in groups SH and PPG were respectively intraperitoneally injected with SH (56 micromol/kg) and PPG (45 mg/kg) within 1 hour post injury. From post injury day (PID) 2, SH (56 micromol/kg) and PPG (45 mg/kg) were respectively intraperitoneally injected once a day to rats in groups SH and PPG. Eight rats from groups BC, SH, and PPG were sacrificed on PID 2, 7, 14 and 21, and ceca samples were collected. Ceca samples were added to the appropriate culture medium after being homogenized and diluted, for the culture of Bifidobacterium, Lactobacillus, Enterococcus, Enterobacter, and Candida albicans. The content of bacteria was calculated after the bacteria number was counted. The same procedure was performed for rats in group SI. Data were processed with logarithmic function, one-way analysis of variance, analysis of variance of factorial design, and SNK-q test. RESULTS: On each PID, the content of Bifidobacterium and Lactobacillus in the ceca of each group with burned rats was less than that of group SI (with q values from 4.12 to 20.74, P values below 0.05); while the content of Enterococcus, Enterobacter, and Candida albicans was more than that of group SI (with q values from 2.84 to 68.29, P values below 0.05). Compared with that of group BC, the content of Bifidobacterium and Lactobacillus in the ceca of rats in group SH were increased on each PID (with q values from 2.88 to 17.57, P values below 0.05). In group SH, the content of Bifidobacterium peaked as (6.54 +/- 0.35) lg (CFU/g) on PID 7, the content of Lactobacillus peaked as (7.25 +/- 0.71) lg (CFU/g) on PID 21. Compared with that of group BC, the content of Enterococcus, Enterobacter, and Candida albicans in the ceca of rats in group SH was reduced on each PID (with q values from 2.79 to 29.59, P values below 0.05). Compared with that of group BC, the content of Bifidobacterium and Lactobacillus in the ceca of rats in group PPG was decreased on each PID (with q values from 2.82 to 46.56, P values below 0.05); while the content of Enterococcus, Enterobacter, and Candida albicans was significantly increased on each PID (with q values from 2.93 to 41.42, P values below 0.05). In group PPG, the content of Enterococcus peaked as (9.41 +/- 0.22) lg (CFU/g) on PID 21, the content of Enterobacter peaked as (9.96 +/- 0.24) lg (CFU/g) on PID 14, and that of Candida albicans peaked as (3.94 +/- 0.84) lg (CFU/g) on PID 14. CONCLUSIONS: Exogenous hydrogen sulfide can subdue the growth of pathogenic bacteria while promote that of probiotics, thus helping maintain the integrity of intestinal biological barrier of rats with burn injury


Abstract: Bismethylmercury sulfide (MeHg)2S has been found to be a detoxified metabolite of methylmercury (MeHg) that is produced by SH-SY5Y cells and in livers of rats exposed to MeHg. (MeHg)2S could be formed through the interactions between MeHg and sulfur species such as hydrogen sulfide (H2S or HS-), but the origin of its sulfur has not been fully identified. We herein examined the formation of (MeHg)2S through interactions between MeHg and persulfides, polysulfides, and protein preparations. Investigations using HPLC/atomic absorption spectrophotometry and EI-MS revealed that NaHS and Na2S4 react readily with MeHg to give (MeHg)2S, and similar results were found using GSH persulfide (GSSH) formed endogenously or generated enzymatically in vitro. (MeHg)2S was also formed by incubation of MeHg with liver and heart cytosolic fractions prepared from wild-type mice but not with those from mice lacking cystathionine gamma-lyase (CSE) that catalyzes the formation of cysteine persulfide. Consistent with this, (MeHg)2S was detected in a variety of tissues taken from wild-type mice intraperitoneally injected with MeHg in vivo but not in those from MeHg-injected CSE knockout mice. By separating liver fractions by column chromatography, we found numerous proteins that contain persulfides: one of the proteins was identified as being glutathione S-transferase pi 1. These results
indicate that the formation of (MeHg)2S can be attributed to interactions between MeHg and endogenous free persulfide species, as well as protein-bound cysteine persulfide.

(30) Laban NA, Dao A, Foght J. DNA Stable Isotope Probing of oil sands tailings pond enrichment cultures reveals different key players for toluene degradation under methanogenic and sulfidogenic conditions. FEMS Microbiol Ecol 2015 Apr 1. Abstract: Oil sands tailings ponds are anaerobic repositories of fluid wastes produced by extraction of bitumen from oil sands ores. Diverse indigenous microbiota biodegrade hydrocarbons (including toluene) in situ, producing methane, carbon dioxide and/or hydrogen sulfide, depending on electron acceptor availability. Stable Isotope Probing of cultures enriched from tailings associated specific taxa and functional genes to

(31) Yun SJ, Chae SH, Kim H, Park JC, Park JH, Han GH, et al. Synthesis of Centimeter-Scale Monolayer Tungsten Disulfide Film on Gold Foils. ACS Nano 2015 Apr 20. Abstract: We report the synthesis of centimeter-scale monolayer WS2 on gold foil by chemical vapor deposition. The limited tungsten and sulfur solubility in gold foil allows monolayer WS2 film growth on gold surface. To ensure the coverage uniformity of monolayer WS2 film, the tungsten source-coated substrate was placed in parallel with Au foil under hydrogen sulfide atmosphere. The high growth temperature near 935 degrees C helps to increase a domain size up to 420 mum. Gold foil is reused for the repeatable growth after bubbling transfer. The WS2-based field effect transistor reveals an electron mobility of 20 cm2 V-1 s-1 with high on-off ratio of approximately 108 at room temperature, which is the highest reported value from previous reports of CVD-grown WS2 samples. The on-off ratio of integrated multiple FETs on the large area WS2 film on SiO2 (300 nm)/Si substrate shows within the same order, implying reasonable uniformity of WS2 FET device characteristics over a large area of 3 x 1.5 cm2

(32) Chan SJ, Chai C, Lim TW, Yamamoto M, Lo EH, Lai MK, et al. Cystathionine beta-Synthase Inhibition Is a Potential Therapeutic Approach to Treatment of Ischemic Injury. ASN Neuro 2015 Apr;7(2). Abstract: Hydrogen sulfide (H2S) has been reported to exacerbate stroke outcome in experimental models. Cystathionine beta-synthase (CBS) has been implicated as the predominant H2S-producing enzyme in central nervous system. When SH-SY5Y cells were transfected to overexpress CBS, these cells were able to synthesize H2S when exposed to high levels of enzyme substrates but not substrate concentrations that may reflect normal physiological conditions. At the same time, these cells demonstrated exacerbated cell death when subjected to oxygen and glucose deprivation (OGD) together with high substrate concentrations, indicating that H2S production has a detrimental effect on cell survival. This effect could be abolished by CBS inhibition. The same effect was observed with primary astrocytes exposed to OGD and high substrates or sodium hydrosulfide. In addition, CBS was upregulated and activated by truncation in primary astrocytes subjected to OGD. When rats were subjected to permanent middle cerebral artery occlusion, CBS activation was also observed. These results imply that in acute ischemic conditions, CBS is upregulated and activated by truncation causing an increased production of H2S, which exacerbate the ischemic injuries. Therefore, CBS inhibition may be a viable approach to stroke treatment

(33) Rios EC, Szczesny B, Soriano FG, Olah G, Szabo C. Hydrogen sulfide attenuates cytokine production through the modulation of chromatin remodeling. Int J Mol Med 2015 Jun;35(6):1741-6. Abstract: Hydrogen sulfide (H2S) is an endogenous gaseous biological mediator, which regulates, among others, the oxidative balance of cells under normal physiological conditions, as well as in various diseases. Several previous studies have reported that H2S attenuates inflammatory mediator production. In this study, we investigated the role of H2S in chromatin modulation in an in vitro model of lipopolysaccharide (LPS)-induced inflammation and evaluated its effects on inflammatory cytokine production. Tamm-Horsfall
protein 1 (THP-1) differentiated macrophages were pre-treated with sodium hydrosulfide (NaHS) (an H2S donor) at 0.01, 0.1, 0.5 or 1 mM for 30 min. To stimulate cytokine production, the cells were challenged with bacterial LPS (1 microg/ml) for 1, 4, 8 or 24 h. Histone H3 acetylation was analyzed by chromatin immunoprecipitation (ChIP), cytokine production was measured by ELISA and histone deacetylase (HDAC) activity was analyzed using a standard biochemical assay. H2S inhibited the production of interleukin-6 (IL-6) and tumor necrosis factor-alpha (TNF-alpha) in a concentration-dependent manner; it was most effective at the two highest concentrations used. This effect was associated with a decrease in histone H3 acetylation at the IL-6 and TNF-alpha promoters in the cells exposed to H2S or H2S + LPS. The findings of the present study suggest that H2S suppresses histone acetylation, which, in turn, inhibits chromatin openness, leading to a decrease in the gene transcription of various pro-inflammatory cytokines. Therefore, this mechanism may contribute to the previously demonstrated anti-inflammatory effects of H2S and various H2S donors


Abstract: BACKGROUND: Antibiotics used as growth promoters in livestock has been banned in European Union since 2006. Alternatives of antibiotics have focused on phytogenic plants, such as herb and medicinal plant. No studies have evaluated use of fermented medicinal plants (FMP) made up of Gynura procumbens, Rehmannia glutinosa, and Scutellaria baicalensis in weanling pigs. Therefore, an experiment was conducted to determine the effects of FMP on growth performance, nutrient digestibility, fecal noxious gas emissions, and diarrhea score in weanling pigs. RESULTS: FMP supplementation increased (P < 0.05) average daily gain, average daily feed intake, gain:feed, apparent total tract digestibility of dry matter, nitrogen, and gross energy compared with NC treatment, while a linear effect (P < 0.05) was observed on those criteria. Ammonia, total mercaptans, and hydrogen sulfide concentrations were decreased (P < 0.05) by the supplementation of FMP compared with NC. Additionally, diarrhea score was lower (P < 0.05) by FMP addition compared with NC during d 0 to 7 and d 8 to 14. CONCLUSION: These results suggested that FMP could be used as alternative of antibiotics by enhancing growth performance, nutrient digestibility, and decreasing fecal noxious gas emission and early diarrhea score of weanling pigs


Abstract: Inflammatory cytokines are crucial factors in the onset of osteoarthritis (OA). The pro-inflammatory cytokine, interleukin-1beta (IL-1beta), is capable of stimulating a few cartilage degradation mediators and is of importance to the pathogenesis of OA. It has been demonstrated that hydrogen sulfide (H2S) exerts an inhibitory effect on inflammation. Thus, in the present study, we aimed to investigate the therapeutic effects of H2S in OA. For this purpose, an in vitro model of cartilage inflammation was created. Human OA chondrocytes were cultured and pre-treated with H2S (0.06-1.5 mM) with or without IL-1beta (10 ng/ml) and then Griess reagent was used to quantify the production of nitric oxide (NO). Using enzyme-linked immunosorbent assay, we quantified the production of prostaglandin E2 (PGE2) and matrix metalloproteinase-13 (MMP-13). In addition, we determined the gene expression of inducible nitric oxide synthase (iNOS), cyclooxygenase-2 (COX-2) and MMP-13 using reverse transcription-quantitative polymerase chain reaction and the expression of signaling molecules related to mitogen-activated protein kinases (MAPKs) and nuclear factor-kappaB (NF-kappaB) by western blot analysis. Our results revealed that H2S markedly reversed the effects of IL-1beta on the gene expression of COX-2, MMP-13 and iNOS and on the production of MMP-13, PGE2 and NO. In addition, H2S inhibited the activation of the extracellular signal-regulated kinase (ERK)/IkappaBalpha/NF-kappaB pathway which was induced by
IL-1 beta. On the whole, the results of the present study suggest that H2S exerts chondroprotective effects. Thus, H2S may have potential for use in the treatment of patients suffering from OA.

Abstract: The overall rate constant for \( H + CH_3SH \) has been studied over 296-1007 K in an Ar bath gas using the laser flash photolysis method at 193 nm. H atoms were generated from CH3SH and in some cases NH3. They were detected via time-resolved resonance fluorescence. The results are summarized as \( k = (3.45 +/- 0.19) \times 10^{-11} \text{ cm}^3 \text{ molecule}^{-1} \text{ s}^{-1} \exp(-6.92 +/- 0.16 \text{ kJ mol}^{-1} / \text{RT}) \) where the errors in the Arrhenius parameters are the statistical uncertainties at the 2sigma level. Overall error limits of +/-9% for k are proposed. In the overlapping temperature range there is very good agreement with the resonance fluorescence measurements of Wine et al. Ab initio data and transition state theory yield moderate accord with the total rate constant, but not with prior mass spectrometry measurements of the main product channels leading to CH3S + H2 and CH3 + H2S by Amano et al.

Abstract: Earth-abundant material, kesterite Cu2ZnSnS4 (CZTS), demonstrates the tremendous potential to serve as the absorber layer for the bifacial thin-film solar cell. The exploration of appropriate sulfurization conditions including annealing temperature is significant to gain insight into the growth mechanism based on the substrates using transparent conductive oxides (TCO) and improve device performance. The kesterite solar absorbers were fabricated on ITO substrates by sulfurizing co-electroplated Cu-Zn-Sn-S precursors in argon diluted H2S atmosphere at different temperatures (475-550 degrees C) for 30 min. Experimental proof, including cross-section scanning electron microscopy, X-ray photoelectron spectroscopy, X-ray diffraction, UV-vis-NIR transmission spectrum, and Raman and far-infrared spectroscopy, is presented for the crystallization of CZTS on an ITO substrate and the interfacial reaction between the ITO back contact and CZTS absorber. The complete conversion of precursor into CZTS requires at least 500 degrees C sulfurization temperature. The aggressive interfacial reaction leading to the out-diffusion of In into CZTS to a considerable extent, formation of tin sulfides, and electrically conductive degradation of ITO back contact occurs at the sulfurization temperatures higher than 500 degrees C. The bifacial devices obtained by 520 degrees C sulfurization exhibit the best conversion efficiencies and open circuit voltages. However, the presence of non-ohmic back contact (secondary diode), the short minority lifetime, and the high interfacial recombination rates negatively limit the open circuit voltage, fill factor, and efficiency, evidenced by illumination/temperature-dependent J-V, frequency-dependent capacitance-voltage (C-V-f), time-resolved PL (TRPL), and bias-dependent external quantum efficiency (EQE) measurements.

(38) Santiago M, Gardner RC. The IRC7 gene encodes cysteine desulphydrase activity and confers on yeast the ability to grow on cysteine as a nitrogen source. Yeast 2015 Apr 14.
Abstract: Although cysteine desulphydrase activity has been purified and characterized from Saccharomyces cerevisiae, the gene encoding this activity in vivo has never been defined. We show that the full-length IRC7 gene, encoded by the YFR055W open reading frame, encodes a protein with cysteine desulphydrase activity. Irc7p purified to homogeneity is able to utilize l-cysteine as a substrate, producing pyruvate and hydrogen sulphide as products of the reaction. Purified Irc7p also utilized l-cystine and some other cysteine conjugates, but not l-cystathionine or l-methionine, as substrates. We further show that, in vivo, the IRC7 gene is both necessary and sufficient for yeast to grow on l-cysteine as a nitrogen source, and that overexpression of the gene results in increased H2S production. Strains overexpressing IRC7 are also hypersensitive to a toxic analogue.
S-ethyl-l-cysteine. While IRC7 has been identified as playing a critical role in converting cysteine conjugates to volatile thiols that are important in wine aroma, its biological role in yeast cells is likely to involve regulation of cysteine and redox homeostasis. Copyright (c) 2015 John Wiley & Sons, Ltd


Abstract: AIMS: H2S is known to confer cardioprotection; however, the pathways mediating its effects in vivo remain incompletely understood. The purpose of the present study is to evaluate the contribution of cGMP-regulated pathways in the infarct-limiting effect of H2S in vivo. METHODS AND RESULTS: Anaesthetized rabbits were subjected to myocardial ischaemia (I)/reperfusion (R), and infarct size was determined in control or H2S-exposed groups. The H2S donor sodium hydrosulfide (NaHS, an agent that generates H2S) increased cardiac cGMP and reduced the infarct size. The cGMP-dependent protein kinase (PKG)-I inhibitor DT2 abrogated the protective effect of NaHS, whereas the control peptide TAT or l-nitroarginine methyl ester (I-NAME) did not alter the effect of NaHS. Moreover, the KATP channel inhibitor, glibenclamide, partially reversed the effects of NaHS, whereas inhibition of mitochondrial KATP did not modify the NaHS response. NaHS enhanced phosphorylation of phospholamban (PLN), in a PKG-dependent manner. To further investigate the role of PLN in H2S-mediated cardioprotection, wild-type and PLN KO mice underwent I/R. NaHS did not exert cardioprotection in PLN KO mice. Unlike what was observed in rabbits, genetic or pharmacological inhibition of eNOS abolished the infarct-limiting effect of NaHS in mice. CONCLUSIONS: Our findings demonstrate (i) that administration of NaHS induces cardioprotection via a cGMP/PKG/PLN pathway and (ii) contribution of nitric oxide to the H2S response is species-specific.


Abstract: Zero valent iron (ZVI) packed anaerobic granular sludge reactors have been developed for improved anaerobic wastewater treatment. In this work, a mathematical model is developed to describe the enhanced methane production and sulfate reduction in anaerobic granular sludge reactors with the addition of ZVI. The model is successfully calibrated and validated using long-term experimental data sets from two independent ZVI-enhanced anaerobic granular sludge reactors with different operational conditions. The model satisfactorily describes the chemical oxygen demand (COD) removal, sulfate reduction and methane production data from both systems. Results show ZVI directly promotes propionate degradation and methanogenesis to enhance methane production. Simultaneously, ZVI alleviates the inhibition of un-dissociated H2S on acetogens, methanogens and sulfate reducing bacteria (SRB) through buffering pH (Fe(0) + 2H(+) = Fe(2+) + H2) and iron sulfide precipitation, which improve the sulfate reduction capacity, especially under deterioration conditions. In addition, the enhancement of ZVI on methane production and sulfate reduction occurs mainly at relatively low COD/[Formula: see text] ratio (e.g., 2-4.5) rather than high COD/[Formula: see text] ratio (e.g., 16.7) compared to the reactor without ZVI addition. The model proposed in this work is expected to provide support for further development of a more efficient ZVI-based anaerobic granular system.


Abstract: Bacterial infections of the residual dentin or infected pulp tissue are responsible for most cases of endodontic treatment failures. Persisting microorganisms in necrotic pulp tissue produce sulphur components such as methyl mercaptan and hydrogen sulfide as well as thioether derivatives. Although there is emerging evidence that these sulphur compounds stimulate immune cells and induce the inflammatory cascade, the
immunological mechanisms of local and systemic inflammation have not been described. In this retrospective study we evaluated the ex-vivo immune response of peripheral blood mononuclear cells to sulphur compounds in 53 patients with clinical or radiologic endodontic treatment failure, 20 patients with clinical discomfort or radiological findings without previous endodontic treatment and a control group of 31 patients who had received successful endodontic treatment at least five years previously. Patients with endodontic abnormalities showed significantly higher ex-vivo sulphur compound-stimulated interferon-gamma (IFN-gamma) and interleukin-10 (IL-10) levels as compared to the control group. The association between ex-vivo-stimulated cytokines and endodontically derived sulphur compounds was further substantiated by the fact that the number of IFN-gamma and/or IL-10-positive patients decreased significantly 3-8 months after re-treatment of the root canal or tooth extraction. Furthermore, serum tumor necrosis factor-alpha (TNF-alpha) levels were higher in patients than in controls, and at the same time, the TNFA -308 G/A polymorphism was associated with endodontic treatment failure in our study population. We conclude that a cellular immune response to sulphur compounds contributes to the inflammatory process observed in relation to endodontic treatment failures.

Abstract: Hydrogen sulfide (H2S) is a familiar toxic gas that smells of rotten eggs. After the identification of endogenous H2S in the mammalian brain two decades ago, studies of this molecule uncovered physiological roles in processes such as neuromodulation, vascular tone regulation, cytoprotection against oxidative stress, angiogenesis, anti-inflammation, and oxygen sensing. Enzymes that produce H2S, such as cystathionine beta-synthase, cystathionine gamma-lyase, and 3-mercaptopyruvate sulfurtransferase have been studied intensively and well characterized. Polysulfides, which have a higher number of inner sulfur atoms than that in H2S, were recently identified as potential signaling molecules that can activate ion channels, transcription factors, and tumor suppressors with greater potency than that of H2S. This article focuses on our contribution to the discovery of these molecules and their metabolic pathways and mechanisms of action.

Abstract: INTRODUCTION: Shewanella spp. are emerging human pathogens, the predominant species being Shewanella algae. Shewanella skin and soft tissue infections are more commonly seen in immunocompromised patients with a pre-existing cutaneous ulcer and most often associated with exposure to marine environments. AIM: The study was conducted to investigate the epidemiological and clinical characteristics of Shewanella skin and soft tissue infections (SSTIs) for a period of five years. MATERIALS AND METHODS: All Gram-negative non-fermenting motile isolates which produced pigmented colonies and positive for oxidase and H2S were further identified with Vitek 2 system. RESULTS: A total of 16 patients with SSTIs due to Shewanella species were identified during the period from 2010 to 2014. Majority of patients were urban, elderly and fisher men. Shewanella algae (n=12, 75%) was the predominant isolate. Skin or mucosal portal of entry was found in all patients and seawater contact was recorded in 56.25% of the patients. 81% of infections were polymicrobial, common concomitant pathogens being gut and marine flora. Peripheral vascular diseases were the predominant risk factors with comorbidities like diabetes, hypertension and hepatobiliary diseases. Third generation cephalosporins, meropenem and gentamicin were the most effective antibiotics while two of the isolates were multidrug resistant. 75% of the infected patients recovered completely and three patients died of complications. CONCLUSION: Shewanella algae should be considered as an emerging pathogen of SSTIs mainly in patients with chronic ulcers and at times be multidrug resistant. These infections have a good clinical outcome if prompt medical, surgical and supportive treatment is offered.
Mijuskovic A, Kokic AN, Dusic ZO, Slavic M, Spasic MB, Blagojevic D. Chloride channels mediate sodium sulphide-induced relaxation in rat uteri. Br J Pharmacol 2015 Apr 8. Abstract: BACKGROUND AND PURPOSE: Hydrogen sulphide reduces uterine contractility and is of potential interest to treat uterine disorders. The aim of this study was to explore the mechanism of sodium sulphide (Na2S)-induced relaxation of rat uterus, investigating importance of redox effects and ion channel-mediated mechanisms, as well as interactions between these two mechanisms. EXPERIMENTAL APPROACH: Organ bath studies were employed to perform pharmacological assessment of Na2S effects by using uterine strips that were exposed to Na2S with or without: Cl- channel blockers (DIDS, NFA, IAA-94, T16Ainh-A01, TA), raised KCl (15 mM and 75mM), K+ channel inhibitors (glibenclamide, TEA, 4-AP), L-type Ca2+ channel activator (S-Bay K 8644), propranolol and methylene blue. Antioxidative enzyme activities were measured in homogenates of treated uteri. Expression studies of the bestrophin channel 1 (BEST-1) were performed by Western blotting and RT-PCR. KEY RESULTS: Na2S caused concentration-dependent reversible relaxation of spontaneously active and calcium-induced uteri, affecting both amplitude and frequency of contractions. Uteri exposed to 75 mM KCl were less sensitive to Na2S compared to uteri under 15mM KCl. DIDS abolished Na2S-induced relaxation. Relaxation was not affected by other modulators, or by the absence of extracellular H

Finnbjornsdottir RG, Oudin A, Elvarsson BT, Gislason T, Rafnsson V. Hydrogen sulfide and traffic-related air pollutants in association with increased mortality: a case-crossover study in Reykjavik, Iceland. BMJ Open 2015;5(4):e007272. Abstract: OBJECTIVES: To study the association between daily mortality and short-term increases in air pollutants, both traffic-related and the geothermal source-specific hydrogen sulfide (H2S). DESIGN: Population-based, time stratified case-crossover. A lag time to 4 days was considered. Seasonal, gender and age stratification were calculated. Also, the best-fit lag when introducing H2S >7 microg/m(3) was selected by the Akaike Information Criterion (AIC). SETTING: The population of the greater Reykjavik area (n=181 558) during 2003-2009. PARTICIPANTS: Cases were defined as individuals living in the Reykjavik capital area, 18 years or older (N=138 657), who died due to all natural causes (ICD-10 codes A00-R99) other than injury, poisoning and certain other consequences of external causes, or cardiovascular disease (ICD-10 codes I00-I99) during the study period. MAIN OUTCOME MEASURE: Percentage increases in risk of death (IR%) following an interquartile range increase in pollutants. RESULTS: The total number of deaths due to all natural causes was 7679 and due to cardiovascular diseases was 3033. The interquartile range increased concentrations of H2S (2.6 microg/m(3)) were associated with daily all natural cause mortality in the Reykjavik capital area. The IR% was statistically significant during the summer season (lag 1: IR%=5.05, 95% CI 0.61 to 9.68; lag 2: IR%=5.09, 95% CI 0.44 to 9.97), among males (lag 0: IR%=2.26, 95% CI 0.23 to 4.44), and among the elderly (lag 0: IR%=1.94, 95% CI 0.12 to 1.04; lag 1: IR%=1.99, 95% CI 0.21 to 1.04), when adjusted for traffic-related pollutants and meteorological variables. The traffic-related pollutants were generally not associated with statistical significant IR%. CONCLUSIONS: The results suggest that ambient H2S air pollution may increase mortality in Reykjavik, Iceland. To the best of our knowledge, ambient H2S exposure has not previously been associated with increased mortality in population-based studies and therefore the results should be interpreted with caution. Further studies are warranted to confirm or refute whether H2S exposure induces premature deaths.

Wallace JL, Wang R. Hydrogen sulfide-based therapeutics: exploiting a unique but ubiquitous gasotransmitter. Nat Rev Drug Discov 2015 May;14(5):329-45. Abstract: Hydrogen sulfide (H2S) has become recognized as an important signalling molecule throughout the body, contributing to many physiological and pathological processes. In recent years, improved methods for measuring H2S levels and the availability of a wider range of H2S donors and more selective inhibitors of H2S synthesis have helped to more accurately identify the many biological effects of this highly reactive gaseous mediator. Animal studies of several H2S-releasing drugs have demonstrated considerable...
promise for the safe treatment of a wide range of disorders. Several such drugs are now in clinical trials.

Abstract: In the present study, we investigate the inhibitory effect of novel H2S donors, AP67 and AP72 on isolated bovine posterior ciliary arteries (PCAs) under conditions of tone induced by an adrenoceptor agonist. Furthermore, we examined the possible mechanisms underlying the

Abstract: Biooxidation of refractory gold-bearing pyrite-arsenopyrite flotation concentrate was optimized and abundance of predominant groups in the community other thermophilic acidophilic chemolithotrophic microorganisms at various stages of bioleaching was determined. The optimal parameters for growth and leaching/oxidation of the mineral components of the concentrate were pH 1.4, 1.6-1.8; 47.5 degrees C; and the following salt concentrations in the liquid phase (g/L): K2HPO4.3H2O, 0.53; (NH4)2SO4, 1.6 and MgSO4.7H2O, 2.5 (or (NH4)2SO4, 1.23; ammophos, 0.41; KOH, 0.1) with 0.03% yeast extract. The optimal conditions resulted in high growth rate, high levels of iron and arsenic leaching, of Fe2+ and S(2-)/S0 oxidation, and predominance of Acidithiobacillus caldus, Sulfobacillus spp., and Ferroplasma spp. in the community.

(49) Paniushkina AE, Tsaplina IA, Grigor'eva NV, Kondrat'eva TF. [Thermoacidophilic microbial community oxidizing the gold-bearing flotation concentrate of a pyrite-arsenopyrite ore]. Mikrobiologiya 2014 Sep;83(5):552-64.
Abstract: An aboriginal community of thermophilic acidophilic chemolithotrophic microorganisms (ACM) was isolated from a sample of pyrite gold-bearing flotation concentrate at 45-47 degrees C and pH 1.8-2.0. Compared to an experimental thermoacidophilic microbial consortium formed in the course of cultivation in parallel bioreactors, it had lower rates of iron leaching and oxidation, while its rate of sulfur oxidation was higher. A new thermophilic acidophilic microbial community was obtained by mutual enrichment with the microorganisms from the experimental and aboriginal communities during oxidation of sulfide ore flotation concentrate at 47 degrees C. The dominant bacteria of this new ACM community were Acidithiobacillus caldus strains (the most active sulfur oxidizers) and Sulfobacillus thermotolerans strains (active oxidizers of both iron and sulfur), while iron-oxidizing archaea of the family Ferroplasmaceae and heterotrophic bacteria Alicyclobacillus tolerans were the minor components. The new ACM community showed promise for leaching/oxidation of sulfides from flotation concentrates at high pulp density (S:L = 1:4).

Abstract: Oxidation of flotation concentrate of a pyrrhotite-rich sulfide ore by acidophilic chemolithoautotrophic microbial communities at 35, 40, and 45 degrees C was investigated. According to the physicochemical parameters of the liquid phase of the pulp, as well as the results of analysis of the solid residue after biooxidation and cyanidation, the community developed at 40 degrees C exhibited the highest rate of oxidation. The degree of gold recovery at 35, 40, and 45 degrees C was 89.34, 94.59, and 83.25%, respectively. At 40 degrees C, the highest number of microbial cells (6.01 x 10(9) cells/mL) was observed. While temperature had very little effect on the species composition of microbial communities, except for the absence of Leptospirillum ferriphilum at 35 degrees C, the
shares of individual species in the communities varied with temperature. Relatively high numbers of Sulfobacillus thermosulfidooxidans, the organism oxidizing iron and elemental sulfur at higher rates than other acidophilic chemolithotrophic species, were observed at 40 degrees C

Abstract: ETHNOPHARMACOLOGICAL RELEVANCE: Caesalpinia pyramidalis Tul. (Fabaceae), known as "catingueira", is an endemic tree of the Northeast region of Brazil. This plant, mainly inner bark and flowers, has been used in traditional medicine to treat gastritis, heartburn, indigestion, stomachache, dysenteries, and diarrheas. MATERIALS AND METHODS: The ethanol extract of C. pyramidalis inner bark was used in rats via oral route, at the doses of 30, 100, and 300mg/kg, in the ethanol-induced ulcer model and some of the mechanisms underlying to the gastroprotective effect of this plant investigated. RESULTS: The ethanol extract of C. pyramidalis inner bark (100mg/kg) produced reduction (P<0.001) on the total lesion area in the ethanol-induced gastric damage. The gastroprotective response caused by the ethanol extract (100mg/kg) was significantly attenuated (P<0.05) by intraperitoneal treatment of rats with DL-Propargylglycine (PAG, a cystathionine-gamma-lyase inhibitor; 25mg/kg), but not by Nw-nitro-l-arginine methyl ester hydrochloride (L-NAME, an inhibitor of nitric oxide synthase; 70mg/kg), and confirmed by microscopic evidence. The ethanol extract significantly decreased the number of mucosal mast cells compared to vehicle-treated group. The inflammatory cells of the ethanol extract (100mg/kg)-treated ulcerated rats exhibited an upregulation of interleukin (IL)-4 protein expression and downregulation of inducible nitric oxide synthase (iNOS) expression, observed by immunohistochemistry and flow cytometer. CONCLUSIONS: The present results suggest that the ethanol extract of C. pyramidalis produced dose-related gastroprotective response on ethanol-induce ulcer in rats through mechanisms that involved an interaction with endogenous hydrogen sulfide and reduction of inflammatory process with imbalance between pro-inflammatory and anti-inflammatory mediators, supporting the popular usage of this plant

(52) Murav'ev MI, Fomchenko NV, Kondrat'eva TV. [Investigation of stages of chemical leaching and biooxidation during the extraction of gold from sulfide concentrates]. Prikl Biokhim Mikrobiol 2015 Jan;51(1):65-72.
Abstract: We examined the chemical leaching and biooxidation stages in a two-stage biooxidation process of an auriferous sulfide concentrate containing pyrrhotite, arsenopyrite and pyrite. Chemical leaching of the concentrate (slurry density at 200 g/L) by ferric sulfate biosolvent (initial concentration at 35.6 g/L), which was obtained by microbial oxidation of ferrous sulfate for 2 hours at 70 degrees C at pH 1.4, was allowed to oxidize 20.4% of arsenopyrite and 52.1% of sulfur. The most effective biooxidation of chemically leached concentrate was observed at 45 degrees C in the presence of yeast extract. Oxidation of the sulfide concentrate in a two-step process proceeded more efficiently than in one-step. In a two-step mode, gold extraction from the precipitate was 10% higher and the content of elemental sulfur was two times lower than in a one-step process

(53) [Habitat and incidence of respiratory organs diseases in the Samara population]. Gig Sanit 2014 Jul;(4):33-6.
Abstract: There was performed the assessment of habitat quality for Samara population. Risk factors for prevalence of respiratory diseases (pneumonia, allergic rhinitis, asthma) in children, teenagers and adults were revealed to be formaldehyde, phenol, hydrogen sulfide in the ambient, cadmium and copper in the soil

Abstract: This study aims to propose a holistic, life cycle assessment (LCA) of urban wastewater systems (UWS) based on a comprehensive inventory including detailed construction and operation of sewer systems and wastewater treatment plants (WWTPs). For the first time, the inventory of sewers infrastructure construction includes piping materials and aggregates, manholes, connections, civil works and road rehabilitation. The operation stage comprises energy consumption in pumping stations together with air emissions of methane and hydrogen sulphide, and water emissions from sewer leaks. Using a real case study, this LCA aims to quantify the contributions of sewer systems to the total environmental impacts of the UWS. The results show that the construction of sewer infrastructures has an environmental impact (on half of the 18 studied impact categories) larger than both the construction and operation of the WWTP. This study highlights the importance of including the construction and operation of sewer systems in the environmental assessment of centralised versus decentralised options for UWS.

Abstract: A weakly fluorescent complex derived from a binaphthol-benzimidazole ligand was designed and synthesized for hydrogen sulfide at different pH conditions. It was demonstrated that the probe showed the same reactivity to various hydrogen sulfide species in a broad range of pH values to generate highly fluorescent product through a displacement reaction mechanism, whereas the product's fluorescence spectrum exhibited a hypsochromic shift of approximately 73 nm (2393 cm(-1)) as pH increased from neutral to basic, which can be used for distinguishing the various species of hydrogen sulfide. This turn-on fluorescence probe was highly selective and sensitive to hydrogen sulfide with a detection limit of 0.11 μM. It was then applied for evaluating the total content of sulfide (including hydrogen sulfide, hydrosulfide, and sulfide) as well as for the visual detection of gaseous H2S in air using a simple test paper strip.

Abstract: A FRET-ICT dual-quenching probe with large off-on fluorescent response upon H2S treatment is reported. The probe can be used for bioimaging of endogenous H2S in living cells.

Abstract: Dinitrosyl iron complexes (DNICs) have been recognized as storage and transport agents of nitric oxide capable of selectively modifying crucial biological targets via its distinct redox forms (NO(+), NO(*) and NO(-)) to initiate the signaling transduction pathways associated with versatile physiological and pathological responses. For decades, the molecular geometry and spectroscopic identification of {Fe(NO)2}(9) DNICs ([Fe(NO)x]n where n is the sum of electrons in the Fe 3d orbitals and NO pi* orbitals based on Enemark-Feltham notation) in biology were limited to tetrahedral (CN = 4) and EPR g-value approximately 2.03, respectively, due to the inadequacy of structurally well-defined biomimetic DNICs as well as the corresponding spectroscopic library accessible in biological environments. The developed synthetic methodologies expand the scope of DNICs into nonclassical square pyramidal and trigonal bipyramidal (CN = 5) and octahedral (CN = 6) {Fe(NO)2}(9) DNICs, as well as two/three accessible redox couples for mononuclear {Fe(NO)2}(9/10) and dinuclear [[{Fe(NO)2}(9/10)-{Fe(NO)2}(9/10)] DNICs with biologically relevant S/O/N ligation modes. The unprecedented molecular geometries and electronic states of structurally well-defined DNIC models provide the foundation to construct a spectroscopic library for uncovering the identity of DNICs in biological environments as well as to determine the electronic structures of the {Fe(NO)2} core in
qualitative and quantitative fashions by a wide range of spectroscopic methods. On the basis of (15)N NMR, electron paramagnetic resonance (EPR), IR, cyclic voltammetry (CV), superconducting quantum interference device (SQUID) magnetometry, UV-vis, single-crystal X-ray crystallography, and Fe/S K-edge X-ray absorption and Fe Kβ X-ray emission spectroscopies, the molecular geometry, ligation modes, nuclearity, and electronic states of the mononuclear \{\text{Fe(NO)}_2\}(9/10) and dinuclear \{[\text{Fe(NO)}_2(9/10)-\text{Fe(NO)}_2(9/10)]\} DNICs could be characterized and differentiated. In addition, Fe/S K-edge X-ray absorption spectroscopy of tetrahedral DNICs deduced the qualitative assignment of Fe/NO oxidation states of \{\text{Fe(NO)}_2\}(9) DNICs as a resonance hybrid of \{\text{Fe(II)((*)NO)(NO(-))}\}(9) and \{\text{Fe(III)(NO(-))}_2\}(9) electronic states; the quantitative NO oxidation states of \{(\text{PhS})_3\text{Fe(NO)}\}(-), \{(\text{PhS})_2\text{Fe(NO)}_2\}(-), and \{(\text{PhO})_2\text{Fe(NO)}_2\}(-) were further achieved by newly developed valence to core Fe Kβ X-ray emission spectroscopy as \(-0.58 +/- 0.18\), \(-0.77 +/- 0.18\), and \(-0.95 +/- 0.18\), respectively. The in-depth elaborations of electronic structures provide credible guidance to elucidate (a) the essential roles of DNICs modeling the degradation and repair of [Fe-S] clusters under the presence of NO, (b) transformation of DNIC into S-nitrosothiol (RSNO)/N-nitrosamine (R2NNO) and NO(+)/NO(*)/NO(-), (c) nitrite/nitrate activation producing NO regulated by redox shuttling of \{\text{Fe(NO)}_2\}(9) and \{\text{Fe(NO)}_2\}(10) DNICs, and (d) DNICs as H2S storage and cellular permeation pathway of DNIC/Roussin’s red ester (RRE) for subsequent protein S-nitrosylation. The consolidated efforts on biomimetic synthesis, inorganic spectroscopy, chemical reactivity, and biological functions open avenues to the future designs of DNICs serving as stable inorganic NO(+)/NO(*)/NO(-) donors for pharmaceutical applications.


Abstract: We report on a quartz-enhanced photoacoustic (QEPAS) gas sensing system for hydrogen sulphide (H2S) detection. The system architecture is based on a custom quartz tuning fork (QTF) optoacoustic transducer with a novel geometry and a quantum cascade laser (QCL) emitting 1.1 mW at a frequency of 2.913 THz. The QTF operated on the first flexion resonance frequency of 2871 Hz, with a quality factor Q = 17,900 at 20 Torr. The tuning range of the available QCL allowed the excitation of a H2S rotational absorption line with a line-strength as small as \(S = 1.13.10^{-22}\) cm/mol. The measured detection sensitivity is 30 ppm in 3 seconds and 13 ppm for a 30 seconds integration time, which corresponds to a minimum detectable absorption coefficient \(\alpha_{\text{min}}\) = 2.3.10^{-7} cm^{-1} and a normalized noise-equivalent absorption NNEA = 4.4.10^{-10} W.cm^{-1} Hz^{1/2}, several times lower than the values previously reported for near-IR and mid-IR H2S QEPAS sensors.


Abstract: BACKGROUND: In 2006, three farmers died at the bottom of an agricultural shallow well where the atmosphere contained only 6% oxygen. This study aimed to document the variability of levels of oxygen and selected hazardous gases in the atmosphere of wells, and to identify ambient conditions associated with the low-oxygen situation. METHODS: A cross-sectional survey, conducted in June 2007 and July 2007, measured the levels of oxygen, carbon monoxide, hydrogen sulfide, and explosive gas (percentage of lower explosive limit) at different depths of the atmosphere inside 253 wells in Kamphaengphet and Phitsanulok provinces. Ambient conditions and well use by farmers were recorded. Carbon dioxide was measured in a subset of wells. Variables independently associated with low-oxygen condition (<19.5%) were identified using multivariate logistic regression. RESULTS: One in five agricultural shallow wells had a low-oxygen status, with oxygen concentration decreasing with increasing depth within the well. The deepest-depth oxygen reading ranged from 0.0% to 20.9%. Low levels of other hazardous gases were detected in a small number of wells. The low-oxygen status was independently associated
with the depth of the atmosphere column to the water surface [odds ratio (OR) = 13.5 for 8-11 m vs. <6 m], depth of water (OR = 0.17 for 3-<8 m vs. 0-1 m), well cover (OR = 3.95), time elapsed since the last rainfall (OR = 7.44 for >2 days vs. <1 day), and location of well in sandy soil (OR = 3.72). Among 11 wells tested, carbon dioxide was detected in high concentration (>25,000 ppm) in seven wells with a low oxygen level. CONCLUSION: Oxygen concentrations in the wells vary widely even within a small area and decrease with increasing depth


Abstract: Postmortem imaging consists in the non-invasive examination of bodies using medical imaging techniques. However, gas volume quantification and the interpretation of the gas collection results from cadavers remain difficult. We used whole-body postmortem multi-detector computed tomography (MDCT) followed by a full autopsy or external examination to detect the gaseous volumes in bodies. Gases were sampled from cardiac cavities, and the sample compositions were analyzed by headspace gas chromatography-mass spectrometry/thermal conductivity detection (HS-GC-MS/TCD). Three categories were defined according to the presumed origin of the gas: alteration/putrefaction, high-magnitude vital gas embolism (e.g., from scuba diving accident) and gas embolism of lower magnitude (e.g., following a traumatic injury). Cadaveric alteration gas was diagnosed even if only one gas from among hydrogen, hydrogen sulfide or methane was detected. In alteration cases, the carbon dioxide/nitrogen ratio was often >0.2, except in the case of advanced alteration, when methane presence was the best indicator. In the gas embolism cases (vital or not), hydrogen, hydrogen sulfide and methane were absent. Moreover, with high-magnitude vital gas embolisms, carbon dioxide content was >20%, and the carbon dioxide/nitrogen ratio was >0.2. With gas embolisms of lower magnitude (gas presence consecutive to a traumatic injury), carbon dioxide content was <20% and the carbon dioxide/nitrogen ratio was often <0.2. We found that gas analysis provided useful assistance to the postmortem imaging diagnosis of causes of death. Based on the quantifications of gaseous cardiac samples, reliable indicators were determined to document causes of death. MDCT examination of the body must be performed as quickly as possible, as does gas sampling, to avoid generating any artifactual alteration gases. Because of cardiac gas composition analysis, it is possible to distinguish alteration gases and gas embolisms of different magnitudes


Abstract: Sewers emit hydrogen sulfide and various volatile organic sulfur and carbon compounds, which require control and mitigation. In the last 5-10 years, extensive research was conducted to optimize existing sulfide abatement technologies based on newly developed in-depth understanding of the in-sewer processes. Recent advances have also led to low-cost novel solutions targeting sewer biofilms. Online control has been demonstrated to greatly reduce the chemical usage. Dynamic models for both the water, air and solid (concrete) phases have been developed and used for the planning and maintenance of sewer systems. Existing technologies primarily focused on ‘hotspots’ in sewers. Future research should aim to achieve network-wide corrosion and emission control and management of sewers as an integrated component of an urban water system


Abstract: The greenhouse effect of methane is 26 times worse than that of carbon dioxide, and wastewater containing high concentrations of sulfate is harmful to water, soil and plants. Therefore, anaerobic oxidation of methane driven by sulfate is one of the effective ways for methane reduction. In this paper, with sulfate as the electron accepter, a microbial
A consortium capable of oxidating methane under anaerobic condition was cultured. The diversity and characteristics of bacterial and archaeal community were investigated by PCR-DGGE, and phylogenetic analysis of the dominant microorganisms was also carried out. The DGGE fingerprints showed that microbial community structure changed distinctly, and the abundance of methane-oxidizing archaea and sulfate-reducing bacteria increased in the acclimatization system added sulfate. After acclimatization, the bacterial diversity increased, while archaea diversity decreased slightly. The representative bands in the DGGE profiles were excised and sequenced. Results indicated that the dominant species in the acclimatization system were Spirochaetes, Desulfuromonadales, Methanosarcinales, Methanoseta. Methane converted into carbon dioxide while sulfate transformed into hydrogen sulfide and sulfur in the process of anaerobic methane oxidation accompanied by sulphate reduction.

(63) Lechuga TJ, Zhang H, Sheibani L, Karim M, Jia J, Magness RR, et al. Estrogen Replacement Therapy in Ovariectomized Nonpregnant Ewes Stimulates Uterine Artery Hydrogen Sulfide Biosynthesis by Selectively Upregulating Cystathionine beta Synthase Expression. Endocrinology 2015 Mar 31;en20151086. Abstract: Estrogens dramatically dilate numerous vascular beds with the greatest response in the uterus. Endogenous hydrogen sulfide (H2S) is a potent vasodilator and pro-angiogenic second messenger, which is synthesized from L-cysteine by cystathionine beta-synthase (CBS) and cystathionine gamma-lyase (CSE). We hypothesized that estrogen replacement therapy (ERT) selectively stimulates H2S biosynthesis in uterine artery (UA) and other systemic arteries. Intact and endothelium-denuded UA, mesenteric, and carotid arteries were obtained from ovariectomized (OVX) nonpregnant ewes (n=5/group) receiving vehicle or estradiol-17beta replacement therapy (ERT). Total RNA and protein were extracted for measuring CBS and CSE, and H2S production was determined by the methylene blue assay. Paraffin-embedded UA rings were used to localize CBS and CSE proteins by immunofluorescence microscopy. ERT significantly stimulated CBS mRNA and protein without altering CSE mRNA or protein in intact and denuded UA. Quantitative immunofluorescence microscopic analyses showed CBS and CSE protein localization in endothelium and smooth muscle and confirmed that ERT stimulated CBS, but not CSE protein expression in UA endothelium and smooth muscle. ERT also stimulated CBS, but not CSE, mRNA and protein expression in intact and denuded mesenteric, but not and carotid, arteries in OVX ewes. Concomitantly, ERT stimulated uterine and mesenteric, but not carotid, artery H2S production. ERT-stimulated UA H2S production was completely blocked by a specific CBS, but not CSE inhibitor. Thus, ERT selectively stimulates uterine and mesentery, but not carotid, artery H2S production by specifically upregulating CBS expression, implicating a role of H2S in estrogen-induced vasodilation and post-menopausal women's health.

(64) Wang L, Tang ZP, Zhao W, Cong BH, Lu JQ, Tang XL, et al. MiR-22/Sp-1 links estrogens with upregulation of cystathionine gamma-lyase in myocardium which contributes to estrogenic cardioprotection against oxidative stress. Endocrinology 2015 Mar 31;en20141362. Abstract: Hydrogen sulfide (H2S), generated in the myocardium predominantly via cystathionine-gamma-lyase (CSE), is cardioprotective. Our previous study has shown that estrogens enhance CSE expression in myocardium of female rats. The present study aims to explore the mechanisms by which estrogens regulate CSE expression, in particular, clarify the role of estrogen receptor subtypes and transcriptional factor responsible for the estrogenic effects. We found that either CSE inhibitor or CSE siRNA attenuated the protective effect of 17beta-estradiol (E2) against.

Abstract: AIMS: Hydrogen sulfide (H2S) inhibits the proliferation of vascular smooth muscle cells (VSMCs). However, how cystathionine-gamma-lyase (CSE), a major enzyme that produces H2S, is regulated remains unknown. Whether calcium-sensing receptor (CaSR) inhibits the proliferation of VSMCs by regulating the endogenous CSE/H2S pathway in diabetic rat has not been previously investigated. METHODS AND RESULTS: The morphological and ultrastructure alterations were tested by transmission electron microscopy, changes in the H2S concentration and the relaxation of the mesenteric secondary artery loop of diabetic rats were determined by Multiskan spectrum microplate spectrophotometer and isometric force transducer. Additionally, the expression levels of CaSR, CSE and Cyclin D1 in the mesenteric arteries of rats were examined by western blotting. The intracellular calcium concentration, the expression of p-CaMK II (phospho-calmodulin kinases II), CSE activity, the concentration of endogenous H2S and the proliferation of cultured VSMCs from rat thoracic aortas were measured by using confocal microscope, western blotting, microplate spectrophotometer, MTT and BrdU, respectively. The VSMC layer thickened, the H2S concentration dropped, the relaxation of the mesenteric secondary artery rings weakened, and the expression of CaSR and CSE decreased whereas the expression of Cyclin D1 increased in diabetic rats compared with the control group. The [Ca(2+)]i of VSMCs increased upon treatment with CaSR agonists (10 microM Calindol and 2.5 mM CaCl2), while it decreased upon administration of calhex231, U73122 and 2-APB. The expression of p-CaMK II and CSE increased upon treatment with CaSR agonists in VSMCs. CSE activity and the endogenous H2S concentration decreased in response to high glucose, while it increased with treatment of CaSR agonists. The proliferation rate increased in response to high glucose, and CaSR agonists or NaHS significantly reversed the proliferation of VSMCs caused by high glucose.

CONCLUSIONS: Our results demonstrated that CaSR regulated the endogenous CSE/H2S pathway to inhibit the proliferation of VSMCs in both diabetic and high glucose models. (c) 2015 S. Karger AG, Basel

Tian J, Pan F, Xue R, Zhang W, Fang X, Liu Q, et al. A highly sensitive room temperature H2S gas sensor based on SnO2 multi-tube arrays bio-templated from insect bristles. Dalton Trans 2015 Apr 21;44(17):7911-6. Abstract: A tin oxide multi-tube array (SMTA) with a parallel effect was fabricated through a simple and promising method combining chemosynthesis and biomimetic techniques; a biomimetic template was derived from the bristles on the wings of the Alpine Black Swallowtail butterfly (Papilio maackii). SnO2 tubes are hollow and porous structures with micro-pores regularly distributed on the wall. The morphology, the delicate microstructure and the crystal structure of this SMTA were characterized by super resolution digital microscopy, scanning electron microscopy, transmission electron microscopy and X-ray diffraction. The SMTA exhibits a high sensitivity to H2S gas at room temperature. It also exhibits a short response/recovery time, with an average value of 14/30 s at 5 ppm. In particular, heating is not required for the SMTA in the gas sensitivity measurement process. On the basis of these results, SMTA is proposed as a suitable new material for the design and fabrication of room-temperature H2S gas sensors.