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Abstract: Human mesenchymal stem cells (hMSCs), the precursors of osteoblasts during osteogenesis, play a role in the balance of bone formation and resorption, but their functioning in uremia has not been well defined. To study the effects of the uremic milieu on osteogenic properties, we applied an in vitro assay culturing hMSCs in osteogenic medium supplemented with serum from healthy donors and from uremic patients on hemodialysis. Compared to control, serum from uremic patients induces, in hMSC cultures, a modification of several key regulators of bone remodeling, in particular a reduction of the ratio Receptor Activator of Nuclear factor Kappa B Receptor (RANKL) over osteoprotegerin, indicating an adaptive response of the system to favor osteogenesis over osteoclastosis. However, the levels of osteopontin, osteocalcin, and collagen type I, are increased in cell medium, while BMP-2, and alizarin red staining were decreased, pointing to a reduction of bone formation favoring resorption. Selected uremic toxins, such as p-cresylsulfate, p-cresylglucuronide, parathyroid hormone, indoxyl sulfate, asymmetric dimethylarginine, homocysteine, were able to mimic some of the effects of whole serum from uremic patients. Serum from cinacalcet-treated patients antagonizes these effects. Hydrogen sulfide (H2S) donors as well as hemodialysis treatment are able to induce beneficial effects. In conclusion, bone modifications in uremia are influenced by the capability of the uremic milieu to alter hMSC osteogenic differentiation. Cinacalcet, H2S donors and a hemodialysis session can ameliorate the hampered calcium deposition

Abstract: Abstract Rationale. We have recently reported that infusion of a solution containing methemoglobin (MetHb) during exposure to hydrogen sulfide results in a rapid and large decrease in the concentration of the pool of soluble/diffusible H2S in the blood. However, since the pool of dissolved H2S disappears very quickly after H2S exposure, it is unclear if the ability of MetHb to “trap” sulfide in the blood has any clinical interest and relevance in the treatment of sulfide poisoning. Methods. In anesthetized rats, repetition of short bouts of high level of H2S infusions was applied to allow the rapid development of an oxygen deficit. A solution containing MetHb (600 mg/kg) or its vehicle was administered 1 min and a half after the end of H2S intoxication. Results. The injection of MetHb solution increased methemoglobinemia to about 6%, almost instantly, but was unable to affect the blood concentration of soluble H2S, which had already vanished at the time of infusion, or to increase combined H2S. In addition, H2S-induced O2 deficit and lactate production as well as the recovery of carotid blood flow and blood pressure were similar in treated and control animals. Conclusion. Our results do not support the view that administration of MetHb or drugs-induced methemoglobinemia during the recovery phase following severe H2S intoxication in sedated rats can restore cellular oxidative metabolism, as the pool of diffusible sulfide, accessible to MetHb, disappears rapidly from the blood after H2S exposure

Abstract: In this study, to simulate a biogas desulfurization process, a modified Monod-Gompertz kinetic model incorporating a dissolved oxygen (DO) effect was proposed for a sulfur-oxidizing bacterial (SOB) strain, Acidithiobacillus thiooxidans, under extremely acidic conditions of pH 2. The kinetic model was calibrated and validated using experimental data obtained from a bubble-column bioreactor. The SOB strain was effective for H2S degradation, but the H2S removal efficiency dropped rapidly at DO concentrations less than 2.0 mg/L. A low H2S loading was effectively treated with oxygen supplied in a range of 2%-6%, but a H2S guideline of 10 ppm could not be met, even with an oxygen supply greater than 6%, when the H2S loading was high at a short gas retention time of 1 min and a H2S inlet concentration of 5000 ppm. The oxygen supply should be increased in the aerobic desulfurization to meet the H2S guideline; however, the excess oxygen above the optimum was not effective because of the decline in oxygen efficiency. The model estimation indicated that the maximum H2S removal rate was approximately 400 ppm/%-O2 at the influent oxygen concentration of 4.9% under the given condition. The kinetic model with a low DO threshold for the interacting substrates was a useful tool to simulate the effect of the oxygen supply on the H2S removal and to determine the optimal oxygen concentration.


Abstract: Hydrogen sulfide (H2S) has emerged as an important biological signaling molecule in the last decade. During the growth of this field, significant controversy has arisen centered on the physiological concentrations of H2S. Recently, a monobromobimane (mBB) method has been developed for the quantification of different biologically-relevant sulfide pools. Based on the prevalence of the mBB method for sulfide quantification, we expand on this method to report the use of dibromobimane (dBB) for sulfide quantification. Reaction of H2S with dBB results in formation of highly-fluorescent bimane thioether (BTE), which is readily quantifiable by HPLC. Additionally, the reaction of sulfide with dBB to form BTE is significantly faster than the reaction of sulfide with mBB to form sulfide dibimane. Using the dBB method, BTE levels as low as 0.6 pM can be detected. Upon use of the dBB method in wild-type and CSE/- mice, however, dBB reports significantly higher sulfide levels than those measured using mBB. Further investigation revealed that dBB is able to extract sulfur from other sulfhydryl sources including thiols. Based on mechanistic studies, we demonstrate that dBB extracts sulfur from thiols with alpha- or beta-hydrogens, thus leading to higher BTE formation than from sulfide alone. Taken together, the dBB method is a highly sensitive method for H2S but is not compatible for use in studies in which other thiols are present.


Abstract: In pulmonary epithelia, beta-adrenergic agonists regulate the membrane abundance of the epithelial sodium channel (ENaC) and thereby control the rate of transepithelial electrolyte absorption. This is a crucial regulatory mechanism for lung liquid clearance at birth and thereafter. This study investigated the influence of the gaseous signalling molecule hydrogen sulfide (H2S) on beta-adrenergic agonist regulated pulmonary sodium and liquid absorption. Application of the H2S-liberating molecule Na2S (50 microM) to the alveolar compartment of rat lungs in situ decreased baseline liquid absorption and abrogated the stimulation of liquid absorption by the beta-adrenergic agonist terbutaline. There was no additional effect of Na2S over that of the ENaC inhibitor amiloride. In electrophysiological Ussing chamber experiments with native lung epithelia...
(Xenopus laevis), Na2S inhibited the stimulation of amiloride-sensitive current by terbutaline. beta-adrenergic agonists generally increase ENaC abundance by cAMP-formation and activation of protein kinase A (PKA). Activation of this pathway by forskolin and 3-isobutyl-1-methylxanthine increased amiloride-sensitive currents in H441 pulmonary epithelial cells. This effect was inhibited by Na2S in a dose-dependent manner (5-50 microM). Na2S had no effect on cellular ATP concentration, cAMP formation, and activation of PKA. By contrast, Na2S prevented the cAMP-induced increase in ENaC activity in the apical membrane of H441 cells. H441 cells expressed the H2S-generating enzymes cystathionine-beta-synthase, cystathionine-gamma-lyase and 3-mercaptopyruvate sulfurtransferase, and produced H2S amounts within the employed concentration range. These data demonstrate that H2S prevents the stimulation of ENaC by cAMP/PKA and thereby inhibits the pro-absorptive effect of beta-adrenergic agonists on lung liquid clearance.

Abstract: BACKGROUND AND PURPOSE: Hydrogen sulfide (H2S), an endogenous volatile mediator with pleiotropic functions, promotes vasorelaxation, exerts anti-inflammatory actions and governs angiogenesis. Previously, the SH-containing angiotensin converting enzyme inhibitor (ACEI) zofenopril, has been identified as effective in preserving endothelial function and inducing angiogenesis among ACEI. Based on H2S donor property of the active metabolite zofenoprilat, the objective of this study was to evaluate whether zofenoprilat-induced angiogenesis was due to increased H2S availability. EXPERIMENTAL APPROACH: Human umbilical vein endothelial cells (HUVECs) were used for in vitro studies of angiogenesis, while the Matrigel plug assay was used for in vivo assessment. KEY RESULTS: HUVECs exposed to zofenoprilat showed an increase in all functional features of the angiogenic process in vitro. As zofenoprilat induced the expression of CSE (cystathionine-gamma-lyase) and the continuous production of H2S, CSE inhibition or silencing blocked zofenoprilat to induce angiogenesis, both in vitro and in vivo. The molecular mechanisms underlying H2S/zofenoprilat induced angiogenesis were dependent on Akt, eNOS and ERK1/2 cascades. ATP-sensitive potassium (KATP) channels, the molecular target described to mediate part of the vascular functions of H2S, were involved in the upstream activation of Akt, and ERK1/2. Moreover, FGF-2 upregulation was dependent on CSE derived H2S response to H2S and KATP activation. CONCLUSIONS AND IMPLICATIONS: In conclusion, zofenoprilat induced a constant H2S production that stimulates the angiogenic process through a KATP channel/Akt/eNOS/ERK1/2 pathways. Thus, zofenopril can be considered as a proangiogenic drug acting through H2S release and production, useful in cardiovascular pathologies where vascular functions need to be reestablished and functional angiogenesis induced.

Abstract: KEY POINTS: We evaluated the hypothesis that an increase in the hydrogen sulphide concentration in pulmonary artery smooth muscle cells (PASMCs) causes hypoxic pulmonary vasoconstriction (HPV) by examining the effects of the sulphide donor cysteine and sulphide-synthesis blockers on HPV in isolated rat intrapulmonary arteries (IPAs). Cysteine (1 mm) enhanced HPV and also the contraction to prostaglandin F2alpha (PGF2alpha) and both effects were abolished by the cystathionine gamma-lyase (CSE) blocker propargylglycine (PAG, 1 mm), which had little or no non-selective effect on contraction at this concentration. Neither PAG nor the cysteine aminotransferase (CAT) antagonist aspartate affected HPV in normal physiological saline solution (PSS), or in PSS containing physiological concentrations of cysteine, cystine and glutamate, whereas dithiothreitol (DTT), proposed to enhance HPV by converting mitochondrial thiosulphate to
sulphide, instead abolished HPV. PAG markedly diminished whereas DTT did not affect cysteine-induced sulphide release from liver pieces. The results do not support the proposal that hydrogen sulphide plays a role in HPV. ABSTRACT: An increase in the H2 S (hydrogen sulphide, hereafter sulphide) concentration in pulmonary artery smooth muscle cells (PASMCs) has been proposed to mediate hypoxic pulmonary vasoconstriction (HPV). We evaluated this hypothesis in isolated rat intrapulmonary arteries (IPAs) by examining the effects of the sulphide precursor cysteine and sulphide-synthesis blockers on HPV and also on normoxic pulmonary vasoconstriction (NPV) stimulated by prostaglandin F2alpha (PGF2alpha) and by the drug LY83583, which causes contraction in IPAs by increasing cellular reactive oxygen species levels. Experiments with several blockers of cystathionine gamma-lyase (CSE), the enzyme responsible for sulphide synthesis in the vasculature, demonstrated that propargylglycine (PAG, 1 mm) had little or no effect on the NPV caused by PGF2alpha or LY83583. Conversely, other CSE antagonists tested, aminoxyacetic acid (AOAA, 100 mum), beta-cyanoalanine (BCA, 500 mum) and hydroxylamine (HA, 100 mum), altered the NPV to PGF2alpha (BCA increased, HA inhibited) and/or LY83583 (BCA increased, AOAA and HA inhibited). Preincubating IPAs in physiological saline solution (PSS) containing 1 mm cysteine increased the amplitude of the NPV to PGF2(alpha) by approximately 50%, and had a similar effect on HPV elicited by hypoxic challenge with 0% O2. The enhancement of both responses by cysteine was abolished by pretreatment with 1 mm PAG. Measurements carried out with an amperometric electrode demonstrated that incubation with 1 mm cysteine under anoxic conditions (to minimize sulphide oxidation) greatly potentiated the release of sulphide from pieces of rat liver and that this release was strongly antagonized by PAG, indicating that at this concentration PAG could enter cells intact and antagonize CSE. PAG at 1 mm had no effect on HPV recorded in control PSS, or in PSS supplemented with physiological concentrations of cysteine (10 mum), cysteine (50 mum) and glutamate (100 mum) in order to prevent the possible depletion of intracellular cysteine during experiments. Application of a combination of 1 mm cysteine and 1 mm alpha-ketoglutarate to promote sulphide synthesis via the cysteine aminotransferase/mercaptopyruvate sulphurtransferase (CAT/MST) pathway caused an increase in HPV similar to that observed for cysteine. This was partially blocked by the CAT antagonist aspartate (1 mm) and also by PAG. However, HPV was not increased by 1 mm alpha-ketoglutarate alone, and HPV in the absence of alpha-ketoglutarate and cysteine was not attenuated by aspartate. Pretreatment of IPAs with dithiothreitol (DTT, 1 mm), proposed to promote the conversion of mitochondrial thiosulphate to sulphide, did not increase the release of sulphide from pieces of rat liver in either the presence or the absence of 1 mm cysteine, and virtually abolished HPV. The results provide evidence that the sulphide precursor cysteine can promote both NPV and HPV in rat IPA by generating sulphide via a PAG-sensitive pathway, presumably CSE. However, HPV evoked under control conditions was unaffected by the blockade of CSE. Moreover, HPV was not affected by the CAT antagonist aspartate and was blocked rather than enhanced by DTT. The data therefore indicate that sulphide generated by CSE or CAT/MST or from thiosulphate is unlikely to contribute to O2 sensing during HPV in these arteries.

(8) Duan XC, Liu SY, Guo R, Xiao L, Xue HM, Guo Q, et al. Cystathionine-beta-Synthase Gene Transfer Into Rostral Ventrolateral Medulla Exacerbates Hypertension via Nitric Oxide in Spontaneously Hypertensive Rats. Am J Hypertens 2015 Jan 26. Abstract: BACKGROUND: Rostral ventrolateral medulla (RVLM) plays a crucial role in the central regulation of cardiovascular functions. Cystathionine-beta-synthase (CBS) is a major hydrogen sulfide (H2S)-generating enzyme that has been identified mainly in the brain. The present study was designed to examine CBS expression and determine its roles and mechanisms of regulating sympathetic outflow and blood pressure (BP) in the RVLM in spontaneously hypertensive rats (SHR). METHODS AND RESULTS: CBS expression was decreased in the RVLM in SHR compared to Wistar-Kyoto (WKY) rats. Accumulating evidences suggest that H2S interacts with nitric oxide (NO) to regulate cardiovascular function. Therefore, we hypothesize that the decrease in CBS expression in the RVLM may be involved in the disorder of l-arginine/NO pathway, which subsequently affects BP in
SHR. Overexpression of CBS in the RVLM caused significant increases in BP, heart rate, and urinary norepinephrine excretion in SHR but not in WKY. Acute experiments were carried out at day 7 after gene transfer. NO metabolite levels, neuronal NO synthase, and gamma-amino butyric acid were decreased in SHR after CBS gene transfer. Furthermore, pressor responses to microinjection of NG-monomethyl-l-arginine into RVLM were blunt in SHR transfected with AdCBS compared to SHR transfected with AdEGFP.

CONCLUSIONS: Overexpression of CBS in the RVLM elicits enhanced pressor responses in SHR, but not in WKY, and the NO system is involved in these effects. The results suggest that alterations of H2S signaling in the brain may be associated with the development of hypertension

(9) Davoli A, Greco V, Spalloni A, Guatteo E, Neri C, Ricciardo RG, et al. Evidence of Hydrogen Sulphide involvement in Amyotrophic Lateral Sclerosis. Ann Neurol 2015 Jan 27. Abstract: Objective: Amyotrophic lateral sclerosis (ALS) is a motor neuron disease whose pathophysiological deficits, causing impairment in motor function, are largely unknown. Here we propose that hydrogen sulphide (H2S), as a glial-released inflammatory factor, contributes to the ALS-mediated motor neuron death. Methods: Hydrogen sulphide concentrations were analyzed in the cerebrospinal fluid (CSF) of 37 sporadic ALS patients and 14 age- and gender-matched controls, in tissues of a familial ALS (fALS) mouse model and in spinal cord culture media by means of a specific and innovative HPLC method. The effects of H2S on motor neurons cultures was analyzed immunohistochemically and by patch-clamp recordings and microfluorometry. Results: We have found significantly high level of H2S in the spinal fluid of the ALS patients. Consistently we found increased levels of H2S in the tissues and in the media from mice spinal cord cultures bearing the fALS mutation SOD1G93A. In addition, NaHS, a H2S donor, added to spinal culture, obtained from control C57BL/6J mice, is toxic for motor neurons, and induces an intracellular Ca2+ increase, attenuated by the intracytoplasmatic application of ATP. We further show that H2S is mainly released by astrocytes and microglia. Interpretation: This study unravels H2S as an astrogial mediator of motor neuron damage possibly involved in the cellular death characterizing ALS. This article is protected by copyright. All rights reserved

(10) Choi SJ, Choi C, Kim SJ, Cho HJ, Hakim M, Jeon S, et al. Highly Efficient Electronic Sensitization of Non-oxidized Graphene Flakes on Controlled Pore-loaded WO3 Nanofibers for Selective Detection of H2S Molecules. Sci Rep 2015;5:8067. Abstract: Tailoring of semiconducting metal oxide nanostructures, which possess controlled pore size and concentration, is of great value to accurately detect various volatile organic compounds in exhaled breath, which act as potential biomarkers for many health conditions. In this work, we have developed a very simple and robust route for controlling both the size and distribution of spherical pores in electrospun WO3 nanofibers (NFs) via a sacrificial templating route using polystyrene colloids with different diameters (200 nm and 500 nm). A tentacle-like structure with randomly distributed pores on the surface of electrospun WO3 NFs were achieved, which exhibited improved surface area as well as porosity. Porous WO3 NFs with enhanced surface area exhibited high gas response (Rair/Rgas = 43.1 at 5 ppm) towards small and light H2S molecules. In contrast, porous WO3 NFs with maximized pore diameter showed a high response (Rair/Rgas = 2.8 at 5 ppm) towards large and heavy acetone molecules. Further enhanced sensing performance (Rair/Rgas = 65.6 at 5 ppm H2S) was achieved by functionalizing porous WO3 NFs with 0.1 wt% non-oxidized graphene (NOGR) flakes by forming a Schottky barrier (DeltaPhi = 0.11) at the junction between the WO3 NFs (Phi = 4.56 eV) and NOGR flakes (Phi = 4.67 eV), which showed high potential for the diagnosis of halitosis

acyl azide to the corresponding amide, which subsequently undergoes an intramolecular spirocyclization to alter the large π-conjugated system of CB fluorophore. Compared with the traditional azide-based H2S probes, the proposed probe utilizes the acyl azide as the recognition moiety and exhibits a rapid response (approximately 1 min) towards H2S, which is superior to most of the azide-based H2S probes. Preliminary fluorescence imaging experiments show that probe 1 has potential to track H2S in living cells.


Abstract: Drug abuse is a widespread problem affecting both teenagers and adults. Nitrous oxide is becoming increasingly popular as an inhalation drug, causing harmful neurological and hematological effects. Some gas chromatography-mass spectrometry (GC-MS) methods for nitrous oxide measurement have been previously described. The main drawbacks of these methods include a lack of sensitivity for forensic applications; including an inability to quantitatively determine the concentration of gas present. The following study provides a validated method using HS-GC-MS which incorporates hydrogen sulfide as a suitable internal standard allowing the quantification of nitrous oxide. Upon analysis, sample and internal standard have similar retention times and are eluted quickly from the molecular sieve 5A PLOT capillary column and the Porabond Q column therefore providing rapid data collection whilst preserving well defined peaks. After validation, the method has been applied to a real case of N2O intoxication indicating concentrations in a mono-intoxication.


Abstract: Due to frequent droughts and rapid population growth in urban areas, the adoption of practices to reduce the usage of fresh water is on the rise. Reduction in usage of fresh water can be achieved through various local water management practices (WMP) such as Water Demand Management (WDM) and use of alternative water sources such as Greywater Recycling (GR) and Rainwater Harvesting (RH). While the positive effects of WMPs have been widely acknowledged, the implementation of WMPs is also likely to lower the wastewater flow and increase the concentration of contaminants in sewage. These in turn can lead to increases in sewer problems such as odour and corrosion. This paper analyses impacts of various WMP scenarios on wastewater flow and contaminant load. The Urban Volume and Quality (UVQ) model was used to simulate wastewater flow and the associated wastewater contaminants from different WMP scenarios. The wastewater parameters investigated were those which influence odour and corrosion problems in sewerage networks due to the formation of hydrogen sulphide. These parameters are: chemical oxygen demand (COD), nitrate (NO3-), sulphate (SO42-), sulphide (S2-) and iron (Fe) that were contributed by the households (not including the biochemical process in sewer pipe). The results will help to quantify the impact of WMP scenarios on odour and corrosion in sewerage pipe networks. Results show that the implementation of a combination of WDM and GR had highly increased the concentration of all selected contaminant that triggered the formation of hydrogen sulphide, namely COD, sulphate and sulphide. On the other hand, the RH scenario had the least increase in the concentration of the contaminants, except iron concentrations. The increase in iron concentrations is actually beneficial because it inhibits the formation of hydrogen sulphide.


Abstract: BACKGROUND: The study was designed to explore the significance of endogenous H2S in the development of high-salt-induced hypertension in rats. METHODS: High-salt-induced hypertension rat model was made by feeding Dahl rat high-salt diet.
containing 8% NaCl for 8 weeks with SD rats as control. SBP and aorta structure in rats were observed. Endogenous H2S content and expression of cystathionine beta-lyase (CBS), cystathionine gamma-lyase and mercaptopyruvate sulfurtransferase in renal tissues were detected. Mechanisms for the impact of high-salt on CBS/H2S in renal tissues were studied, targeting HIF-1alpha pathway. The effect of H2S on RAS in serum and renal tissue of rats were tested. RESULTS: High-salt reduced endogenous H2S content and inhibited the expression of CBS in renal tissue in salt-sensitive Dahl rats. H2S donor, however, inhibited salt-sensitive hypertension, reversed aortic structural remodeling and inhibited activation of the RAS system in renal tissues in Dahl rats. Expression of HIF-1alpha was decreased but expression of PHD2 was increased in renal tissue of Dahl rats with high-salt diet, whereas they did not alter in renal tissue of SD rats with high-salt diet. Ex vivo experiment showed that inhibitor of HIF-1alpha degradation could rescue down-regulated CBS/H2S pathway in renal tissue of Dahl rats with high-salt. In contrast, inhibitor of HIF-1alpha activity decreased the CBS/H2S pathway in the renal tissue of SD rats treated with high-salt. CONCLUSIONS: Down-regulated CBS/H2S pathway in renal tissues under high-salt insult might be an important pathogenesis of salt-sensitive hypertension.

(15) Sonobe T, Haouzi P. Sulfide Intoxication-Induced Circulatory Failure is Mediated by a Depression in Cardiac Contractility. Cardiovasc Toxicol 2015 Jan 24. Abstract: Hydrogen sulfide (H2S) intoxication produces a rapid cardio-circulatory failure leading to cardiac arrest. In non-lethal forms of sulfide exposure, the presence of a circulatory shock is associated with long-term neurological sequelae. Our aim was to clarify the mechanisms of H2S-induced circulatory failure. In anesthetized, paralyzed, and mechanically ventilated rats, cardiac output, arterial pressure and ventricular pressures were determined while NaHS was infused to increase arterial concentration of soluble H2S (CgH2S) from undetectable to levels leading to circulatory failure. Compared to control/saline infusion, blood pressure started to decrease significantly along with a modest drop in peripheral vascular resistance (-19 +/- 5 %, P < 0.01), when CgH2S reached about 1 muM. As CgH2S exceeded 2-3 muM, parameters of ventricular contractility diminished with no further reduction in peripheral resistance. Whenever H2S exposure was maintained at a higher level (CgH2S over 7 muM), a severe depression of cardiac contractility was observed, leading to asystole within minutes, but with no evidence of peripheral vasoplegia. The immediate and long-term neurological effects of specifically counteracting sulfide-induced cardiac contractility depression following H2S exposure remain to be investigated.

(16) Krejcova T, Smelcova M, Petr J, Bodart JF, Sedmikova M, Nevoral J, et al. Hydrogen Sulfide Donor Protects Porcine Oocytes against Aging and Improves the Developmental Potential of Aged Porcine Oocytes. PLoS One 2015;10(1):e0116964. Abstract: Porcine oocytes that have matured in in vitro conditions undergo the process of aging during prolonged cultivation, which is manifested by spontaneous parthenogenetic activation, lysis or fragmentation of aged oocytes. This study focused on the role of hydrogen sulfide (H2S) in the process of porcine oocyte aging. H2S is a gaseous signaling molecule and is produced endogenously by the enzymes cystathionine-beta-synthase (CBS), cystathionine-gamma-lyase (CSE) and 3-mercaptoppyruvate sulfurtransferase (MPST). We demonstrated that H2S-producing enzymes are active in porcine oocytes and that a statistically significant decline in endogenous H2S production occurs during the first day of aging. Inhibition of these enzymes accelerates signs of aging in oocytes and significantly increases the ratio of fragmented oocytes. The presence of exogenous H2S from a donor (Na2S.9H2O) significantly suppressed the manifestations of aging, reversed the effects of inhibitors and resulted in the complete suppression of oocyte fragmentation. Cultivation of aging oocytes in the presence of H2S donor positively affected their subsequent embryonic development following parthenogenetic activation. Although no unambiguous effects of exogenous H2S on MPF and MAPK activities were detected and the intracellular mechanism underlying H2S activity remains unclear, our study clearly demonstrates the role of H2S in the regulation of porcine oocyte aging.

Abstract: Among various fluorescence nanomaterials, the II-VI semiconductor nanocrystals (usually called quantum dots, QDs) should be very promising in sensing application because of their high quantum yields, capability for surface property manipulation, and unlimited possible chemical reactions. Herein, we present a fluorescence probe for hydrogen sulfide, which was prepared by first encapsulating inorganic cadmium telluride (CdTe) QDs in silica nanospheres, and subsequently engineering the silica surface with functional molecules azidocoumarin-4-acetic acid reactive to hydrogen sulfide. The nanohybrid probe exhibited two fluorescence bands centered at 452 and 657 nm, respectively. The red fluorescence at 657 nm of the nanohybrid probe is stable against H2S, while the blue fluorescence is specifically sensitive to H2S. The probe showed a distinct fluorescence color evolution from light magenta to blue upon exposure to different amounts of H2S, and a detection limit of 7.0 nM was estimated in aqueous solution. We further applied the nanohybrid probe for visual detection of gaseous H2S with a low concentration of 0.5 ppm using glass indicating spots sensors, suggesting its potential application for gaseous H2S sensing. Such an efficient on-site visual determination of gaseous hydrogen sulfide (H2S) is highly demanded in on-site environmental monitoring and protection.


Abstract: The role of sulfhydryl (S-H) group as hydrogen bond donor is not as well studied as that of hydroxyl (O-H). In this work we report on the hydrogen-bonding properties of S-H donor in 1:1 complexes of H2S with diethyl ether (Et2O), dibutyl ether (Bu2O), and 1,4-dioxane (DO). The complexes were prepared in supersonic jet and investigated using infrared predissociation spectroscopy based on VUV photoionization detection. The IR spectra of all the complexes showed the presence of a broad, intensity-enhanced, and red-shifted hydrogen-bonded S-H stretching transition. The S-H stretching frequency was red-shifted by 46, 63, and 49 cm⁻¹ in H2S-Et2O, H2S-Bu2O, and H2S-DO complexes, respectively, suggesting that all the complexes are S-H...O bound. Computationally, two different S-H...O bound structures, namely, "coplanar" and "perpendicular", were obtained as the minimum energy structures for these complexes at the MP2/6-311++G** level, with the former being the global minimum. However, with Dunning-type basis sets (aug-cc-pVDZ and aug-cc-pVTZ) only the perpendicular structures were found to be stable at the MP2 level. The large widths of the bound S-H stretch observed in the experimental spectra (fwhm of 35 to 80 cm⁻¹) were attributed to inhomogeneous broadening due to multiple conformations of the alkyl chains in the coplanar and perpendicular structures populated in the jet. The frequency shifts in the hydrogen-bonded S-H stretching mode as well as the bond dissociation energies of all S-H...Y (Y horizontal lineO,S) complexes of H2S, which includes the H2S dimer and H2S-methanol (H2S-MeOH) complexes reported in our previous work (ChemPhysChem 2013, 14, 905-914), were found to scale linearly with the proton affinity of the acceptor molecule. In this regard the S-H group, like O-H, is found to conform to the widely accepted acid-base nature of hydrogen-bonding interactions.


Abstract: Abstract Biogas can be used in the engines of transport vehicles and blended into natural gas networks, but it also requires the removal of carbon dioxide, hydrogen sulphide, and moisture. Biogas purification process flow diagrams have been developed for a process enabling the use of a dolomite suspension, as well as for solutions obtained by filtration of the suspension, to obtain biogas free of hydrogen sulphide and with a carbon dioxide content that does not exceed 2%. The cost of biogas purification was evaluated on the base of data on biogas production capacity and biogas production cost obtained from local water treatment facilities. It has been found that, with the use of dolomite suspension, the cost of biogas purification is approximately 6 times lower than using a chemical sorbent.
such as monoethanolamine. The results showed a travelling costs using biogas purified by
dolomite suspension are nearly 1.5 time lower than travelling costs using gasoline and
slightly lower than travelling costs using mineral diesel fuel

(20) Bhuiyan Al, Papajani VT, Paci M, Melino S. Glutathione-garlic sulfur conjugates: slow
hydrogen sulfide releasing agents for therapeutic applications. Molecules
Abstract: Natural organosulfur compounds (OSCs) from Allium sativum L. display
antioxidant and chemo-sensitization properties, including the in vitro inhibition of tumor cell
proliferation through the induction of apoptosis. Garlic water- and oil-soluble allyl sulfur
compounds show distinct properties and the capability to inhibit the proliferation of tumor
cells. In the present study, we optimized a new protocol for the extraction of water-soluble
compounds from garlic at low temperatures and the production of glutathionyl-OSC
conjugates during the extraction. Spontaneously, Cys/GSH-mixed-disulfide conjugates are
produced by in vivo metabolism of OSCs and represent active molecules able to affect
cellular metabolism. Water-soluble extracts, with (GSGaWS) or without (GaWS) glutathione
conjugates, were here produced and tested for their ability to release hydrogen sulfide
(H2S), also in the presence of reductants and of thiosulfate:cyanide sulfurtransferase (TST)
enzyme. Thus, the TST catalysis of the H2S-release from garlic OSCs and their conjugates
has been investigated by molecular in vitro experiments. The antiproliferative properties of
these extracts on the human T-cell lymphoma cell line, HuT 78, were observed and related
to histone hyperacetylation and downregulation of GAPDH expression. Altogether, the
results presented here pave the way for the production of a GSGaWS as new,
slowly-releasing hydrogen sulfide extract for potential therapeutic applications

(21) Liu Y, Zhang Y, Ni BJ. Evaluating Enhanced Sulfate Reduction and Optimized Volatile
Fatty Acids (VFA) Composition in Anaerobic Reactor by Fe (III) Addition. Environ Sci
Technol 2015 Jan 29.
Abstract: Anaerobic reactors with ferric iron addition have been experimentally
demonstrated to be able to simultaneously improve sulfate reduction and organic matter
degradation during sulfate-containing wastewater treatment. In this work, a mathematical
model is developed to evaluate the impact of ferric iron addition on sulfate reduction and
organic carbon removal as well as the volatile fatty acids (VFA) composition in anaerobic
reactor. The model is successfully calibrated and validated using independent long-term
experimental data sets from the anaerobic reactor with Fe (III) addition under different
operational conditions. The model satisfactorily describes the sulfate reduction, organic
carbon removal and VFA production. Results show Fe (III) addition induces the microbial
reduction of Fe (III) by iron reducing bacteria (IRB), which significantly enhances sulfate
reduction by sulfate reducing bacteria (SRB) and subsequently changes the VFA
composition to acetate-dominating effluent. Simultaneously, the produced Fe (II) from IRB
can alleviate the inhibition of undissociated H2S on microorganisms through iron sulfide
precipitation, resulting in further improvement of the performance. In addition, the
enhancement on reactor performance by Fe (III) is found to be more significantly favored at
relatively low organic carbon/

the fatty liver in obese mice through improving lipid metabolism and antioxidant potential.
Abstract: BACKGROUND: Nonalcoholic fatty liver disease (NAFLD) is the most common
liver disease in the world. Hydrogen sulfide (H2S) plays an important role in physiology and
pathophysiology of liver. However, whether exogenous H2S could mitigate the hepatic
steatosis in mice remains unclear. The aim of this study is to evaluate the effects of H2S on
fatty liver. METHODS: C57BL/6 mice were fed with either a high-fat diet (HFD) or a normal
fat diet (NFD) for 16 weeks. After 12 weeks of feeding, the HFD-fed mice were injected one
time per day with NaHS or saline for the followed 4 weeks. RESULTS: Compared to NFD,
HFD could induce an accumulation of lipids in liver and a damage of hepatic structure.
Compared to saline treatment, in the liver of HFD fed mice H2S treatment could significantly (1) recover the structure; (2) decrease the accumulation of lipids including triglyceride (TG) and total cholesterol (TC); (3) decrease the expression of fatty acid synthase (FAS) and increase the expression of carnitine palmitoyltransferase-1 (CPT-1); (4) reduce malondialdehyde (MDA) levels; (5) increase the activities of superoxide dismutase (SOD) and glutathione peroxidase (GPx). CONCLUSION: H2S could mitigate the fatty liver by improving lipid metabolism and antioxidant potential in HFD-induced obese mice.

(23) Grosche A, Sekaran H, Perez-Rodriguez I, Starovoytov V, Vetriani C. Cetia pacifica gen. nov., sp. nov., a novel chemolithoautotrophic, thermophilic, nitrate-ammonifying bacterium from a deep-sea hydrothermal vent. Int J Syst Evol Microbiol 2015 Jan 20. Abstract: A thermophilic, anaerobic, chemolithoautotrophic bacterium, strain TB-6T, was isolated from a deep-sea hydrothermal vent located on the East Pacific Rise at 9 degrees N. The cells were Gram-staining-negative, rod-shaped with one or more polar flagella. Cell size was approximately 1-1.5 m in length and 0.5 m in width. Strain TB-6T grew between 45 and 70 degrees C (optimum 55-60 degrees C), 0 and 40g NaCl l-1 (optimum 20-30 g l-1) and pH 4.5 and 7.5 (optimum pH 5.5-6.0). Generation time under optimal conditions was 2 hours. Growth of strain TB-6T occurred with H2 as the energy source, CO2 as the carbon source, and nitrate or sulfur as electron acceptors, with formation of ammonium or hydrogen sulfide, respectively. Acetate, D-(+)-glucose, casamino acids, sucrose and yeast extract were not used as carbon and energy sources. Inhibition of growth occurred in the presence of lactate, peptone and tryptone under a H2/CO2 (80:20; 200 kPa) gas phase. Thiosulfate, sulfate, arsenate, selenate and oxygen were not used as electron acceptors. The G + C content of the genomic DNA was 36.8 mol%. Phylogenetic analysis of the 16S rRNA gene of strain TB-6T showed that this organism branched separately from the three closest genera Caminibacter, Nautilia, and Lebetimonas, within the family Nautiliaceae. Strain TB-6T contained several unique fatty acids in comparison to other members of the Nautiliaceae. Based on experimental evidence, it is proposed that the organism represents a novel genus within the family Nautiliaceae, Cetia pacifica, gen. nov., sp. nov. The type strain is EPR-TB-6T (=DSM 27783T =JCM 19563T)


(25) Trabue S, Kerr B. Emissions of greenhouse gases, ammonia, and hydrogen sulfide from pigs fed standard diets and diets supplemented with dried distillers grains with solubles. J Environ Qual 2014 Jul;43(4):1176-86. Abstract: Swine producers are supplementing animal diets with increased levels of dried distillers grains with solubles (DDGS) to offset the cost of a standard corn-soybean meal (CSBM) diet. However, the environmental impact of these diets on emissions of greenhouse gases, ammonia (NH), and hydrogen sulfide (HS) is largely unknown. Twenty-four pigs (103.6 kg initial body weight) were fed a standard CSBM diet or a CSBM diet containing 35% DDGS for 42 d. Pigs were fed and their manure was collected twice daily over the 42-d trial. Pigs fed diets containing DDGS had reduced manure pH (< 0.01), increased surface crust coverage (< 0.01), increased manure dry matter content (< 0.01), and increased manure C (< 0.01), N (< 0.01), and S (< 0.01) contents. Animals fed DDGS diets also had significantly higher concentrations of total ammoniacal nitrogen (< 0.01) and sulfide (< 0.01) in their manure compared with animals fed CSBM diets. Manure emissions of NH (< 0.01) and HS (< 0.05) were significantly higher in animals fed the CSBM diet. There was no dietary treatment effect for methane or nitrous oxide emissions from manure. This study demonstrates that diets containing DDGS can significantly affect manure composition and potentially lower emissions of NH and HS.

Abstract: The reporting of ammonia (NH) and hydrogen sulfide (HS) emissions from dairies to the federal government depends on the magnitude of the emissions. However, little is known about their daily NH and HS emissions and what influences those emissions. Emissions of NH and HS from two manure storage basins at a 4400-head western free-stall dairy were measured intermittently over 2 yr. Each basin went through stages of filling, drying, and then removal of the manure during the study period. Emissions were determined using backward Lagrangian Stochastic and vertical radial plume methods. Ammonia emissions ranged from 35 to 59 kg d in one basin and from 86 to 90 kg d in a second basin, corresponding to a range of 7 to 19 g d head. Basin NH emissions were highest during initial filling and when the manure was removed. Mean HS emissions ranged from 5 to 22 kg d (1.1-4.6 g d head). Basin HS emissions were highest when the basin was filling. Crusting of the basin surface reduced NH but not HS emissions. The cessation of basin filling reduced HS but not NH emissions. Air temperature and wind conditions were correlated with NH emissions. Barometric pressure decreases were correlated with episodic HS emissions. The variability in emissions with stage of manure handling and storage and meteorological conditions indicates that determining the maximum daily emissions and the annual emissions from such waste basins requires consideration of each stage in conjunction with the climatic conditions during the stage.


Abstract: Hydrogen sulfide (H2S) has been shown to have a sympathoinhibitory effect in the rostral ventrolateral medulla (RVLM). The present study examined the function of cystathionine-beta-synthase (CBS)/H2S system in the RVLM which plays a crucial role in the control of blood pressure and sympathetic nerve activity. Adenovirus vectors encoding CBS (AdCBS) or enhanced green fluorescent protein (AdEGFP) were transfected into the RVLM in normotensive rats. Identical microinjection of AdCBS into the RVLM had no effect on systolic blood pressure and heart rate (HR) in conscious rats. Acute experiments were performed at day 7 after gene transfer in anesthetized rats. Microinjection of the CBS inhibitors, hydroxylamine (HA) or amino-oxyacetate, into the RVLM produced an increase in the renal sympathetic nerve activity (RSNA), mean arterial pressure (MAP), and HR. There was a potentiation of the increases in RSNA, MAP, and HR due to the CBS inhibitors in AdCBS injected rats compared to AdEGFP injected rats. Pretreatment with pinacidil, a KATP channel activator, abolished the effects of HA in two groups. Microinjection of glibenclamide, a KATP channel blocker, produced increases in RSNA, MAP, and HR in AdCBS injected rats. No changes in behavior were observed in AdEGFP injected rats. Furthermore, Western blot analysis indicated an increase in the expression of SUR2 and Kir6.1 in AdCBS injected rats. These results suggest that the increase in KATP channels in the RVLM may be responsible for the greater sympathetic outflow and pressor effect of HA in AdCBS injected rats compared to AdEGFP injected rats.


Abstract: The formation of hydrogen sulfide in biofilms and sediments in sewer systems can cause severe pipe corrosion and health hazards, and requires expensive programs for its prevention. The aim of this study is to propose a new control strategy and the optimal condition for sulfide elimination by intermittent nitrate dosing in sewer sediments. The study was carried out based on lab-scale experiments and batch tests using real sewer sediments. The intermittent nitrate dosing mode and the optimal control condition were investigated. The results indicated that the sulfide-intermittent-elimination strategy by nitrate dosing is advantageous for controlling sulfide accumulation in sewer sediment. The oxidation-reduction potential is a sensitive indicator parameter that can reflect the control effect and the minimum N/S (nitrate/sulfide) ratio with slight excess nitrate is necessary for
optimal conditions of efficient sulfide control with lower carbon source loss. The optimal control condition is feasible for the sulfide elimination in sewer systems.

Abstract: The restriction of proteins has recently emerged as the most important factor for the beneficial effects of calorie restriction. Hine et al. now provide strong evidence for the role of the hydrogen sulfide (H2S) gas in the protective effects of calorie and protein restriction against ischemia/reperfusion injury (IRI) but also implicate H2S in longevity extension in model organisms.

Abstract: Technology advances in the field of small, unmanned aerial vehicles and their integration with a variety of sensor packages and instruments, such as miniature mass spectrometers, have enhanced the possibilities and applications of what are now called unmanned aerial systems (UAS). With such technology, in situ and proximal remote sensing measurements of volcanic plumes are now possible without risking the lives of scientists and personnel in charge of close monitoring of volcanic activity. These methods provide unprecedented, and otherwise unobtainable, data very close in space and time to eruptions, to better understand the role of gas volatiles in magma and subsequent eruption products. Small mass spectrometers, together with the world’s smallest turbo molecular pump, have being integrated into NASA and University of Costa Rica UAS platforms to be field-tested for in situ volcanic plume analysis, and in support of the calibration and validation of satellite-based remote sensing data. These new UAS-MS systems are combined with existing UAS flight-tested payloads and assets, such as temperature, pressure, relative humidity, SO2, H2S, CO2, GPS sensors, on-board data storage, and telemetry. Such payloads are capable of generating real time 3D concentration maps of the Turrialba volcano active plume in Costa Rica, while remote sensing data are simultaneously collected from the ASTER and OMI space-borne instruments for comparison. The primary goal is to improve the understanding of the chemical and physical properties of emissions for mitigation of local volcanic hazards, for the validation of species detection and abundance of retrievals based on remote sensing, and to validate transport models.

Abstract: BACKGROUND: Hydrogen sulfide (H2S) exhibits both physiological and toxicological roles in the biological systems. Acute exposure to high levels of H2S is life threatening while long-term exposure to ambient levels of H2S elicits human health effects. OBJECTIVE: To study the harmful effects of long-term exposure to low levels of H2S on human blood cells. METHODS: 110 adult workers from Iran who were occupationally exposed to 0-90 ppb H2S for 1-30 years were studied. The participants aged between 18 and 60 years and were exposed directly or indirectly to sulfur compounds (exposed group). The origin of H2S was natural gas processing plants. A control group consisting of 110 males who were not in contact with H2S was also studied. For all participants, hematological profile including total hemoglobin and red blood cell count and sulfhemoglobin, methemoglobin levels were measured. RESULTS: Among all parameters evaluated in this study the mean methemoglobin and sulfhemoglobin levels were significantly higher among workers who were exposed to sulfur compounds than the control group. Major differences throughout the study period for sulfhemoglobinemia among exposed groups were observed. CONCLUSION: Long-term exposure to even low levels of H2S in workplaces may have potential harmful effects on human health.

Abstract: PURPOSE OF REVIEW: Hydrogen sulfide (H2S), a colorless gas that is endogenously generated in mammals from cysteine, has important biological functions. Within the vasculature it regulates vessel tone and outgrowth of new vessels. This review summarizes recent literature on H2S signaling in the vasculature and its therapeutic potential in vascular disorders RECENT FINDINGS: H2S is able to induce vasorelaxation via ATP-sensitive potassium channels in vascular smooth muscle cells. Large-conductance calcium-dependent K-channels and Kv7 voltage-gated K-channels are also involved in H2S signaling. Vascular endothelial growth factor is the key downstream mediator that is involved in H2S induced angiogenesis. By having both direct effects on its receptor and increasing the bioavailability of vascular endothelial growth factor, H2S is proangiogenic. H2S-based therapies in vascular diseases are an expanding area of research. The applications of several compounds, such as natural donors and synthetic slow release compounds, have been extensively studied in vascular diseases such as hypertension, ischemia-reperfusion disorders and preeclampsia. SUMMARY: H2S has a key role in vascular homeostasis during physiology and in pathological states. H2S-based therapies may have a role in several vascular diseases

Schneider N, Bouttemy M, Genevee P, Lincot D, Donsanti F. Deposition of ultra thin CuInS2 absorber layers by ALD for thin film solar cells at low temperature (down to 150 degrees C). Nanotechnology 2015 Feb 6;26(5):054001.

Abstract: Two new processes for the atomic layer deposition of copper indium sulfide (CuInS2) based on the use of two different sets of precursors are reported. Metal chloride precursors (CuCl, InCl3) in combination with H2S imply relatively high deposition temperature (Tdep = 380 degrees C), and due to exchange reactions, CuInS2 stoechiometry was only achieved by depositing In2S3 layers on a CuxS film. However, the use of acac- metal precursors (Cu(acac)2, In(acac)3) allows the direct deposition of CuInS2 at temperature as low as 150 degrees C, involving in situ copper-reduction, exchange reaction and diffusion processes. The morphology, crystallographic structure, chemical composition and optical band gap of thin films were investigated using scanning electronic microscope, x-ray diffraction under grazing incidence conditions, x-ray fluorescence, energy dispersive spectrometry, secondary ion mass spectrometry, x-ray photoelectron spectroscopy and UV-vis spectroscopy. Films were implemented as ultra-thin absorbers in a typical CIS-solar cell architecture and allowed conversion efficiencies up to 2.8%


Abstract: Odorous volatile organic compounds (VOC) and hydrogen sulfide (H2S) are emitted together with ammonia (NH3) from manure slurry applied as a fertilizer, but little is known about the composition and temporal variation of the emissions. In this work, a laboratory method based on dynamic flux chambers packed with soil has been used to measure emissions from untreated pig slurry and slurry treated by solid-liquid separation and ozonation. Proton-transfer-reaction mass spectrometry (PTR-MS) was used to provide time resolved data for a range of VOC, NH3 and H2S. VOC included organic sulfur compounds, carboxylic acids, phenols, indoles, alcohols, ketones and aldehydes. H2S emission was remarkably observed to take place only in the initial minutes after slurry application, which is explained by its high partitioning into the air phase. Long-term odor effects are therefore assessed to be mainly due to other volatile compounds with low odor threshold values, such as 4-methylphenol. PTR-MS signal assignment was verified by comparison to a photo-acoustic analyzer (NH3) and to thermal desorption GC/MS (VOC). Due to initial rapid changes in odorant emissions and low concentrations of odorants, PTR-MS is assessed to be a very useful method for assessing odor following field application of slurry. The effects of treatments on odorant emissions are discussed

Abstract: OBJECTIVE: The discovery of carbon monoxide (CO) and hydrogen sulfide (H2S) as pathogenic signaling molecules in airway-related diseases has led to significant insights into the pathophysiologic mechanisms underlying the development of allergic rhinitis (AR). The potential crosstalk between CO and H2S signaling pathways in AR has not been adequately investigated. This study was performed to elucidate the mechanistic relationship between CO and H2S in AR. STUDY DESIGN: Experimental prospective animal study. SETTING: Animal laboratory of Tongji Hospital, Tongji University, Shanghai, China. SUBJECTS AND METHODS: A well-established model of AR was used whereby guinea pigs (N = 24) were randomly divided into 4 treatment groups (n = 6 for each group): The first group received ovalbumin only; the second group was administered exogenous hemin, a CO-binding metalloporphyrin; the third group received zinc protoporphyrin, an inhibitor of heme oxygenase-1. A control group was challenged using only saline. Symptoms of AR were recorded, and quantitation of plasma CO and H2S levels was performed. Expression of heme oxygenase-1 and H2S-generating enzyme cystathionine-(c)-lyase (CSE) were measured from nasal mucosa. RESULTS: Plasma CO and heme oxygenase-1 expression levels of nasal mucosa were significantly increased in the AR group compared to controls, whereas H2S concentrations were significantly decreased. Exogenous administration of CO exacerbated allergic symptoms, resulting in higher levels of both CO and heme oxygenase-1 expression, and a further reduction in H2S levels and CSE expression. Zinc protoporphyrin decreased CO concentrations and increased levels of both H2S and CSE expression. CONCLUSIONS: Results indicated an inverse relationship between H2S levels and CO in the pathogenesis of AR.


Abstract: We and others previously reported experimental evidence suggesting an important role for hydrogen sulfide (H2S) in oxygen sensing in murine carotid body chemoreceptors. More recent data implicated abnormal H2S-mediated chemoreceptor signaling in pathological conditions such as chronic heart failure and hypertension. However, the idea of H2S as a mediator of oxygen-sensing in chemoreceptors has been challenged. In particular, it was shown that exogenous H2S inhibited the release of neurotransmitters (ACh and ATP) from the cat carotid body, raising the possibility that there exists significant species difference in H2S-mediated signaling in chemoreceptors. This study was designed specifically to determine the effect of H2S on chemoreceptors in different species. We conducted multiunit extracellular recordings of the sinus nerve in the ex vivo carotid body preparation taken from the rat, the cat and the rabbit. As observed in the mouse carotid body, H2S donors (NaHS or Na2S) evoked qualitatively similar excitatory responses of the afferent sinus nerves of the species studied here. The excitatory effects of the H2S donors were concentration-dependent and reversible. The sinus nerve responses to H2S donors were prevented by blockade of the transmission between type I cells and the afferent terminals, as was the response to hypoxia. These results demonstrate that exogenous H2S exerts qualitatively similar excitatory effects on chemoreceptor afferents of different species. The role of endogenous H2S-mediated signaling in carotid body function in different species awaits further investigation.


Abstract: Conspectus The field of nanoscience is delivering increasingly intricate yet elegant geometric structures incorporating an ever-expanding palette of materials. Atomic layer deposition (ALD) is a powerful driver of this field, providing exceptionally conformal coatings spanning the periodic table and atomic-scale precision independent of substrate geometry. This versatility is intrinsic to ALD and results from sequential and self-limiting
surface reactions. This characteristic facilitates digital synthesis, in which the film grows linearly with the number of reaction cycles. While the majority of ALD processes identified to date produce metal oxides, novel applications in areas such as energy storage, catalysis, and nanophotonics are motivating interest in sulfide materials. Recent progress in ALD of sulfides has expanded the diversity of accessible materials as well as a more complete understanding of the unique chalcogenide surface chemistry. ALD of sulfide materials typically uses metalorganic precursors and hydrogen sulfide (H2S). As in oxide ALD, the precursor chemistry is critical to controlling both the film growth and properties including roughness, crystallinity, and impurity levels. By modification of the precursor sequence, multicomponent sulfides have been deposited, although challenges remain because of the higher propensity for cation exchange reactions, greater diffusion rates, and unintentional annealing of this more labile class of materials. A deeper understanding of these surface chemical reactions has been achieved through a combination of in situ studies and quantum-chemical calculations. As this understanding matures, so does our ability to deterministically tailor film properties to new applications and more sophisticated devices. This Account highlights the attributes of ALD chemistry that are unique to metal sulfides and surveys recent applications of these materials in photovoltaics, energy storage, and photonics. Within each application space, the benefits and challenges of novel ALD processes are emphasized and common trends are summarized. We conclude with a perspective on potential future directions for metal chalcogenide ALD as well as untapped opportunities. Finally, we consider challenges that must be addressed prior to implementing ALD metal sulfides into future device architectures.


Abstract: We conducted a detailed kinetic study of the reaction of the vitamin B12 analog diaquacobinamide ((H2O)2Cbi(III)) with hydrogen sulfide in water from pH 3 to 11. The reaction proceeds in three steps: (i) formation of three different complexes between cobinamide and hydrogen sulfide, viz. (HO-)(HS-)Cbi(III), (H2O)(HS-)Cbi(III), and (HS-)2Cbi(III); (ii) inner-sphere electron transfer (ISET) in the two complexes with one coordinated HS- to form the reduced cobinamide complex [(H)S]Cbi(II); and (iii) addition of a second molecule of hydrogen sulfide to the reduced cobinamide. ISET does not proceed in the (HS-)2Cbi(III) complex. The final products of the reaction between cobinamide and hydrogen sulfide were found to be independent of pH, with the main product being a complex of cobinamide(II) with the anion-radical SSH2-


Abstract: Before the Earth's complete oxygenation (0.58-0.55 Ga ago), the photic zone of the Proterozoic oceans was probably redox stratified and characterized by an upper slightly aerobic nutrient-limited layer above a light-limited layer that tended towards euxinia. In such oceans, cyanobacteria capable of both oxygenic and sulfide-driven anoxygenic photosynthesis played a fundamental role in the global carbon, oxygen and sulfur cycle. We isolated a cyanobacterium, Pseudanabaena FS39, in which this versatility is still conserved, and show that the transition between the two photosynthetic modes follows a surprisingly simple kinetic regulation controlled by its affinity to H2S. Specifically, oxygenic photosynthesis is only performed additionally to anoxygenic photosynthesis when H2S becomes limiting and decreases below a threshold, which increases predictably with the available ambient light. The carbon-based growth rates during oxygenic and anoxygenic photosynthesis were similar. However, Pseudanabaena FS39 additionally assimilated

Abstract: Diabetic cardiomyopathy is a significant contributor to the morbidity and mortality associated with diabetes and metabolic syndrome. However, the underlying molecular mechanisms that lead to its development have not been fully elucidated. Hydrogen sulfide (H2S) is an endogenously produced signaling molecule that is critical for the regulation of cardiovascular homeostasis. Recently, therapeutic strategies aimed at increasing its levels have proven cardioprotective in models of acute myocardial ischemia-reperfusion injury and heart failure. The precise role of H2S in the pathogenesis of diabetic cardiomyopathy has not yet been established. Therefore, the goal of the present study was to evaluate circulating and cardiac H2S levels in a murine model of high fat diet (HFD)-induced cardiomyopathy. Diabetic cardiomyopathy was produced by feeding mice HFD (60% fat) chow for 24 weeks. HFD feeding reduced both circulating and cardiac H2S and induced hallmark features of type-2 diabetes. We also observed marked cardiac dysfunction, evidence of cardiac enlargement, cardiac hypertrophy, and fibrosis. H2S therapy (SG-1002, an orally active H2S donor) restored sulfide levels, improved some of the metabolic perturbations stemming from HFD feeding, and attenuated HFD-induced cardiac dysfunction. Additional analysis revealed that H2S therapy restored adiponectin levels and suppressed cardiac ER stress stemming from HFD feeding. These results suggest that diminished circulating and cardiac H2S levels play a role in the pathophysiology of HFD-induced cardiomyopathy. Additionally, these results suggest that H2S therapy may be of clinical importance in the treatment of cardiovascular complications stemming from diabetes.


Abstract: Hydrogen sulfide (H2S) has been drawing increasing attention because it plays an important role in the nervous system and has been deemed as a third endogenous gas signal molecule besides nitric oxide (NO) and carbon monoxide (CO). In this study, using a ruthenium complex, [Ru(bpy)2(bpy-DPA)Cu](4+) (where bpy = 2,2'-bipyridine and bpy-DPA = 4-methyl-4'-[N,N-bis(2-picolyl)aminomethylene]-2,2'-bipyridine) as recognition unit, we report a new reaction-based turn-on electrochemiluminescent (ECL) sensor to selectively detect extracellular H2S in rat brain, coupled with in vivo microdialysis for dialysate sampling. To prepare the sensor for sensing endogenous H2S, [Ru(bpy)2(bpy-DPA)](2+) is first designed and synthesized, showing high ECL efficiency with tri-n-propylamine (TPA) as a coreactant and quenching after reaction with Cu(2+). Then a Nafion membrane is coated on the surface of glassy carbon (GC) electrode and [Ru(bpy)2(bpy-DPA)Cu](4+) is confined onto the Nafion membrane through ion exchange. The resulting [Ru(bpy)2(bpy-DPA)Cu](4+)/Nafion/GC sensor exhibits a low ECL signal. The [Ru(bpy)2(bpy-DPA)Cu](4+)/Nafion/GC sensor demonstrates enhanced ECL signal after reacting with volatile H2S due to the high-affinity binding between sulfur and Cu(2+), returning to [Ru(bpy)2(bpy-DPA)](2+)/Nafion/GC. The changes of ECL signal at the sensor depend linearly on the concentration of Na2S in the range from 0.5 to 10 μM, with a detection limit of 0.25 μM. Moreover, the sensor demonstrates high selectivity, free from interference especially by other nonvolatile thiol-containing species, such as cysteine and glutathione. The basal dialysate level of H2S in the microdialysate from the cortex of adult male Sprague-Dawley rats is determined to be 2.3 +/- 0.9 μM (n = 4). This method is reliable and is envisaged to help understand the regulation of H2S in physiological and pathological events.


Abstract: Giardia duodenalis is the most common cause of parasitic diarrhea worldwide and a well established risk factor for post-infectious Irritable Bowel Syndrome. We hypothesized that Giardia-induced disruptions in host-microbiota interactions may play a role in the
pathogenesis of giardiasis, and in post-giardiasis disease. Functional changes induced by Giardia in commensal bacteria and the resulting effects on C. elegans were determined. While Giardia or bacteria alone did not affect worm viability, combining commensal E. coli bacteria with Giardia became lethal to C. elegans. Giardia also induced killing of C. elegans with attenuated Citrobacter rodentium espF-/- and map-/- strains, human microbiota from a healthy donor, and microbiota from inflamed colonic sites of ulcerative colitis (UC) patient. In contrast, combinations of Giardia with microbiota from non-inflamed sites of the same patient allowed for worm survival. The synergistic lethal effects of Giardia and E. coli required the presence of live bacteria, and were associated with the facilitation of bacterial colonization in the C. elegans intestine. Exposure to C. elegans and/or Giardia altered the expression of 172 genes in E. coli. The genes affected by Giardia included hydrogen sulfide biosynthesis (HSB) genes, and deletion of a positive regulator of HSB genes, cysB, was sufficient to kill C. elegans even in the absence of Giardia. Our findings indicate that Giardia induces functional changes in commensal bacteria, possibly making them opportunistic pathogens, and alters host-microbe homeostatic interactions. This report describes the use of a novel in vivo model to assess the toxicity of human microbiota


Abstract: Hydrogen sulfide (H2S) has recently been identified as an endogenous gaseous signaling molecule. In the vascular system, the formation of H2S is catalyzed by cystathionine gammalyase (CSE). Previous studies have demonstrated the protective effects of H2S on ischemic injury in various types of tissue. However, little is known about the role of H2S in diabetes-associated vascular diseases. Thus, the aim of the present study was to examine the possible role of H2S in high glucose-induced vascular dysfunction, and to explore the underlying mechanisms. Human umbilical vein endothelial cells (HUVECs) were isolated from human umbilical veins. The levels of H2S following treatment with various levels of glucose were determined and the secretion of endothelin-1 (ET-1) was measured by ELISA. The mRNA and protein expression of CSE in the HUVECs was determined by real-time RT-PCR and western blot analysis, respectively. Treatment with high glucose (25 mmol/l) for 48 h significantly increased the secretion of ET-1 by HUVECs, with the concomitant suppression of H2S production and CSE protein expression. The increase in exogenous H2S levels through the administration of sodium hydrosulfide (NaHS) attenuated the high glucose-induced downregulation of CSE protein expression, and significantly inhibited the secretion of ET-1. These results suggest that the downregulation of CSE protein expression and the subsequent decrease in H2S production play a role in high glucose-induced vascular dysfunction possibly by increasing the secretion of ET-1 by endothelial cells.


Abstract: Triple stage and single stage biotrickling filters (T-BTF and S-BTF) were operated with oxygenated liquid recirculation to enhance bio-desulfurization of biogas. Empty bed retention time (EBRT 100-180s) and liquid recirculation velocity (q 2.4-7.1m/h) were applied. H2S removal and sulfuric acid recovery increased with higher EBRT and q. But the highest q at 7.1m/h induced large amount of liquid through the media, causing a reduction in bed porosity in S-BTF and H2S removal. Equivalent performance of S-BTF and T-BTF was obtained under the lowest loading of 165gH2S/m(3)/h. In the subsequent continuous operation test, it was found that T-BTF could maintain higher H2S elimination capacity and removal efficiency at 175.6+/-41.6gH2S/m(3)/h and 89.0+/-6.8% versus S-BTF at 159.9+/-42.8gH2S/m(3)/h and 80.1+/-10.2%, respectively. Finally, the relationship between outlet concentration and bed height was modeled. Step feeding of oxygenated liquid recirculation in multiple stages clearly demonstrated an advantage for sulfide oxidation.

Abstract: Hydrogen Sulfide (H2S) prevents and treats a variety of disorders via its cytoprotective effects. However, the effects of H2S on rats with cisplatin (CP) nephrotoxicity are unclear. The aim was to study the effects of H2S on rats with CP nephrotoxicity. Thirty male Sprague-Dawley rats were divided into three groups: control group, nephrotoxic group received single dose of CP (6 mg kg(-1)) and nephrotoxic groups that received single dose 100 micromol kg(-1) NaHS. On fifth day after injection, urine of each rat was collected over a 24-hr period. Animals were sacrificed 6 days after CP (or vehicle) treatment, and blood, urine, and kidneys were obtained, prepared for light microscopy evaluation, lipid peroxidation content and laboratory analysis. The results showed that plasma urea (226%), creatinine (271%), renal lipid peroxidation content (151%), Na and K fractional excretion, urine protein, volume and kidney weight in CP nephrotoxic rats were significantly higher and urine osmolarity and creatinine clearance lower than in controls. Increases of the proximal tubular cells apoptosis and mesangial matrix in CP nephrotoxicity group rats were observed. Hydrogen sulfide reversed the CP-induced changes in the experimental rats H2S prevented the progression of CP nephrotoxicity in rats possibly through its cytoprotective effects such as antioxidant properties.


Abstract: Inhibitory neurotransmitters, chiefly nitric oxide and vasoactive intestinal peptide, increase cyclic nucleotide levels and inhibit muscle contraction via inhibition of MLC kinase and activation of MLC phosphatase. H2S produced as an endogenous signalling molecule synthesized mainly from L-cysteine via cystathionine-gamma-lyase (CSE) and cystathionine-beta-synthase (CBS) regulate muscle contraction. The aim of this study was to analyse the expression of CSE and H2S function in the regulation of MLCP activity, MLC20 phosphorylation and contraction in isolated gastric smooth muscle cells. Both mRNA and protein expression of CSE, but not CBS was detected in smooth muscle cells of rabbit, human and mouse stomach. L-cysteine, an activator of CSE, and NaHS, a donor of H2S, inhibited carbachol-induced Rho kinase and PKC activity, Rho kinase-sensitive phosphorylation of MYPT1 and PKC-sensitive phosphorylation of CPI-17, MLC20 phosphorylation and sustained muscle contraction. Inhibitory effects of L-cysteine, but not NaHS were blocked upon suppression of CSE expression by siRNA or inhibition of its activity by DL-propargylglycine (PPG) suggesting that the effect of L-cysteine is mediated via activation of CSE. Glibenclamide, an inhibitor of KATP channels and a known target of H2S, had no effect on the inhibition of contraction by H2S. Both L-cysteine and NaHS had no effect on basal cAMP and cGMP levels, but augmented forskolin-induced cAMP and SNP-induced cGMP formation. We conclude that both endogenous and exogenous H2S inhibit muscle contraction, and the mechanism involves inhibition of Rho kinase and PKC activities and stimulation of MLC phosphatase activity leading to MLC20 dephosphorylation and inhibition of muscle contraction.


Abstract: The disposal of enormous amount of stormwater sediments becomes an emerging worldwide problem. Stormwater sediments are contaminated by heavy metals, phosphorus, trace organic and hydrocarbons and cannot be disposed without treatment. Thermal plasma decontamination technology offers high decomposition rate in a wide range of toxic organic and immobilization of heavy metal. In this study, we compared the treatment results between two different modes of thermal plasma: (1) a non-transferred Direct Current (DC) mode and (2) a partial Direct Current (DC)-transferred mode. The reductions of TOC were, respectively, 25 and 80% for non-transferred and partial...
transferred plasma. Most of the toxic organic compounds were converted majorly to CxHy. In the gaseous emission, the accumulated CxHy, CO, NO and H2S were significantly higher in partial transferred mode than that of non-transferred mode. The solid analysis demonstrated that the concentration of Ca and Fe enriched by 500 and 40%, respectively. New chemical compositions such as KAlSi3O8, Fe3O4, NaCl and CaSO4 were formed after treatment in partial DC-transferred mode. The power inputs were 1 and 10 kW, respectively, for non-transferred Direct Current (DC) mode and a partial Direct Current (DC)-transferred mode. With a lower energy input, non-transferred plasma treatment can be used for decontamination of sediments with low TOC and metal concentration. Meanwhile, partial transferred thermal plasma with higher energy input is suitable for treating sediments with high TOC percentage and volatile metal concentration. The organic compounds are converted into valuable gaseous products which can be recycled as energy source.

Supplementary material

Abstract: On the model of focal ischemia-reperfusion of the brain investigated the induction of nitrosative stress in mitochondria of rats hearts and possible mechanisms of protective action of ecdysterone. It is shown that focal ischemia-reperfusion of the brain induced in myocardial mitochondria the activation of constitutive and inducible de novo synthesis of NO by oxidation of L-arginine and not oxidative synthesis of NO through the recovery of oxidized stable metabolites of NO. Strong evidence of induction of nitrosative stress in heart mitochondria by focal ischemia-reperfusion of the brain, was a significant increase in mitochondrial pool of nitrate- and nitrite-anions and pools of nitrosothiols, that is proof of the formation and decay of peroxynitrite--a key marker of nitrosative stress. Also was observed increase in heart mitochondria by focal ischemia-reperfusion of the brain, content key regulator of de novo synthesis of NO-hydrogen sulfide and activity of inducible arginase II and, as a result, the pool of carbamide, which is also a regulator of the synthesis of NO. Previous introduction for animals herbal extract Serratsula coronata, enriched ecdysterone, reduces induction nitrosative stress in mitochondria of rats hearts under conditions of focal ischemia-reperfusion of the brain

Abstract: Brassica juncea seedlings contained a twofold higher glucosinolate content than B. rapa and these secondary sulfur compounds accounted for up to 30% of the organic sulfur fraction. The glucosinolate content was not affected by H2S and SO2 exposure, demonstrating that these sulfur compounds did not form a sink for excessive atmospheric supplied sulfur. Upon sulfate deprivation, the foliarly absorbed H2S and SO2 replaced sulfate as the sulfur source for growth of B. juncea and B. rapa seedlings. The glucosinolate content was decreased in sulfate-deprived plants, though its proportion of organic sulfur fraction was higher than that of sulfate-sufficient plants, both in absence and presence of H2S and SO2. The significance of myrosinase in the in situ turnover in these secondary sulfur compounds needs to be questioned, since there was no direct co-regulation between the content of glucosinolates and the transcript level and activity of myrosinase. Evidently, glucosinolates cannot be considered as sulfur storage compounds upon exposure to excessive atmospheric sulfur and are unlikely to be involved in the re-distribution of sulfur in B. juncea and B. rapa seedlings upon sulfate deprivation

Abstract: An on-line and continuous approach was demonstrated for in vivo measurement of bisulfide in rat's brain. A modified droplet-based microfluidic system was constructed, which allowed on-line qualification of the fluorescence responses of the gold
A nanoparticle-glutathione-fluorescein isothiocyanate probe to the variation of bisulfide in the presence of the cerebral microdialysate background. The on-line method achieved a dynamic working range from 5.0 \( \mu \)M to 40 \( \mu \)M and a detection limit of 2.5 \( \mu \)M. The in vivo bisulfide concentration in the hippocampus of rat's brain was measured under different physiological conditions. The on-line method may facilitate the study of H2S biology by providing a previously unattainable continuous record of H2S variation in living animals. It also provides a practical platform for in vivo and continuous monitoring of other important species in cerebral systems.

Abstract: Hyperbaric oxygen therapy is one of the most widely used clinical interventions to counteract insufficient pulmonary oxygen delivery in patients with severe lung injury. However, prolonged exposure to hyperoxia leads to inflammation and acute lung injury. This study aimed to investigate the protective effect of hydrogen sulfide on hyperbaric hyperoxia-induced lung injury. Rats were intraperitoneally treated with sodium hydrosulphide (NaHS) at 28 \( \mu \)mol/kg immediately before hyperoxia exposure and then exposed to pure oxygen at 2.5 atmospheres absolute (atm abs) with continuous ventilation for six hours. Immediately after hyperoxia exposure, rats were sacrificed via anesthesia. The bronchoalveolar lavage fluid (BALF) was harvested for the detection of protein concentration and IL-1 content, and the lungs were collected for HE staining, TUNEL staining and detection of wet/dry weight ratio. Our results showed hyperbaric hyperoxia exposure could significantly damage the lung (HE staining), increase the protein and IL-13 in the BALF, elevate the wet/dry Weight ratio and raise the TUNEL positive cells. However, pre-treatment with hydrogen sulfide improved the lung morphology, reduced the TUNEL positive cells and attenuated the lung inflammation (reduction in IL-13 of BALF and HE staining). Taken together, our findings indicate that hydrogen sulfide pretreatment may exert protective effects on hyperbaric hyperoxia-induced lung injury.

Abstract: BACKGROUND: Sulfurous mineral water and its main active ingredient sodium hydrosulfide (NaHS) are major sources of H2S. The present study aimed to explore their protective effect on one of the serious long-term complications of diabetes; diabetic nephropathy. METHODS: Sulfurous mineral water (as drinking water), NaHS (14\( \mu \)mol/kg/day; ip), and gliclazide (10mg/kg; po) were administered daily for 6 weeks to streptozotocin (STZ)-diabetic rats. RESULTS: STZ-induced diabetes was associated with body weight reduction, hyperglycemia, overproduction of glycated hemoglobin, as well as decline in serum insulin, C-peptide, and insulin like growth factor-I. Besides, diabetes impaired kidney functions and imposed oxidative and nitrosative stress as manifested by elevated contents of renal thiobarbituric acid reactive substances and nitric oxide, parallel to reduced glutathione content. These deleterious effects were antagonized by sulfurous water and to a better extent by NaHS. Activities of myeloperoxidase and sorbitol dehydrogenase were not altered by STZ or any of the treatments. However, STZ-induced diabetes was accompanied by an increment of aldose reductase which was only mitigated by gliclazide and NaHS. Histopathological examination of kidney sections corroborated the biochemical findings. CONCLUSION: This study suggests a novel therapeutic approach for diabetic nephropathy using H2S donors.

Abstract: Flexible transparent electrodes fabricated with random networks of silver nanowires (AgNWs) have been widely studied in recent years. This approach appears to be a promising alternative to replace ITO (indium tin oxide) in many optoelectronic...
applications. Many successful integrations in functional devices have already evidenced the high potential of this technology, but unfortunately only very few studies have been dedicated so far to the stability of this material. We present here a study dealing with the alteration of the electrical properties of AgNW meshes when subjected to different stresses. We demonstrate that AgNW electrodes are very stable when stored under ambient atmosphere up to, at least, two and a half years. Accelerated ageing processes also reveal that concentrated H2S or exposure to light does not cause any significant sheet resistance modification. However, the combination of high relative humidity and high temperature seems to be more critical. In addition, long lasting contact (two years) with PEDOT:PSS can induce deterioration of the electrical properties. Similarly, AgNW/PEDOT:PSS hybrid materials exhibit weaker stability under electrical stress when compared to pristine AgNW networks.

Abstract: To date, the precise role of the human microbiome in health and disease states remains largely undefined. Complex and selective crosstalk systems between the microbiome and mammalian cells are also not yet reported. Research up till now mainly focused on bacterial synthesis of virulence factors, reactive oxygen/nitrogen species (ROS/RNS) and hydrogen sulphide, as well as on the activation of exogenous mutagen precursors by intestinal bacteria. We discovered that certain quorum sensing peptides, produced by bacteria, interact with mammalian cells, in casu cancer cells: Phr0662 (Bacillus sp.), EntF-metabolite (Enterococcus faecium) and EDF-derived (Escherichia coli) peptides initiate HCT-8/E11 colon cancer cell invasion, with Phr0662 also promoting angiogenesis. Our findings thus indicate that the human microbiome, through their quorum sensing peptides, may be one of the factors responsible for cancer metastasis.

Abstract: INTRODUCTION: The present study investigates the effect of oral consumption of hydrogen sulfide-containing Harkany thermal spring water, as well as sodium hydrogen sulfide (NaHS) solution on experimental colitis. METHODS: Colitis was induced by 2 % dextran sulfate sodium (DSS) in the drinking water of C57BL/6 mice for 7 days. Some animal groups drank Harkany thermal spring water or water supplemented with 21.68 mg/L NaHS. General signs of colitis, myeloperoxidase (MPO) enzyme activity of colon samples, histological features of colitis and function of the enteric nervous system were assessed. RESULTS: Oral administration of Harkany thermal spring water significantly attenuated general signs of colitis, MPO enzyme activity of colon samples and detrimental effect of colitis on the function of the enteric nervous system, but not histological signs of colitis. These findings could be reproduced using NaHS solution with additional significantly diminished histological damage. CONCLUSIONS: We conclude that oral treatment with Harkany thermal spring water relieves various aspects of DSS-evoked colitis in mice. This effect is most likely to be mediated by hydrogen sulfide content of the Harkany water. Our data might promote complementary utilization of sulfurous thermal spring water in the therapy of inflammatory bowel disease.

Abstract: Hydrogen sulfide and peroxynitrite are endogenously generated molecules that participate in biologically relevant pathways. A revision of the kinetic features of the reaction between peroxynitrite and hydrogen sulfide revealed a complex process. The rate constant of peroxynitrite decay, (6.65 +/- 0.08) x 103M-1s-1 in 0.05M sodium phosphate buffer (pH 7.4, 37 degrees C), was affected by the concentration of buffer. Theoretical
modeling suggested that, as in the case of thiols, the reaction is initiated by the nucleophilic attack of HS⁻ on the peroxide group of ONOO⁻ by a typical bimolecular nucleophilic substitution, yielding HSOH and NO₂⁻. In contrast to thiols, the reaction then proceeds to the formation of distinct products that absorb near 408nm. Experiments in the presence of scavengers and carbon dioxide showed that free radicals are unlikely to be involved in the formation of these products. The results are consistent with product formation involving the reactive intermediate HSSH and its fast reaction with a second peroxynitrite molecule. Mass spectrometry and UV-Vis absorption spectra predictions suggest that at least one of the products is HSNO₂ or its isomer HSONO.

Abstract: H2S donor molecules have the potential to be viable therapeutic agents. The aim of this current study was (i) to investigate the effects of a novel triphenylphosphonium derivatised dithiolethione (AP39), in the presence and absence of reduced nitric oxide bioavailability and (ii) to determine the effects of AP39 on myocardial membrane channels; CaV3, RyR2 and Cl-. Normotensive, L-


Abstract: The importance of hydrogen sulfide (H2S) in physiology and disease is being increasingly recognized in recent years. Unlike nitric oxide (NO) that signals mainly through soluble guanyl cyclase (sGC)/cGMP, H2S is more promiscuous, affecting multiple pathways. It interacts with ion channels, enzymes, transcription factors and receptors. It was originally reported that H2S does not alter the levels of cyclic nucleotides. More recent publications, however, have shown increases in intracellular cGMP following exposure of cells or tissues to exogenously administered or endogenously produced H2S. Herein, we discuss the evidence for the participation of cGMP in H2S signaling and reconcile the seemingly divergent results presented in the literature on the role of this cyclic nucleotide in the biological actions of H2S.

Abstract: Hydrogen sulfide (H2S), is an endogenous gaseous mediator affecting many physiological and pathophysiological conditions. Enhanced expression of H2S and reactive nitrogen/oxygen (RNS/ROS) species during inflammation alter cellular excitability via modulation of ion channel function. Sulfhydration of cysteine residues and tyrosine nitration are the post-translational modifications induced by H2S and RNS, respectively. The objective of this study was to define the interaction between tyrosine nitration and cysteine sulfhydration within the KATP channel complex, a significant target in experimental colitis. A modified biotin switch assay was performed to determine sulfhydration of the KATP channel subunits, Kir6.1 and SUR2B and nitrotyrosine measured by immunoblot. NaHS (a donor of H2S) significantly enhanced sulfhydration of SUR2B but not Kir6.1 subunit. SIN-1 (a donor of peroxynitrite) induced nitration of Kir6.1 subunit but not SUR2B. Pretreatment with NaHS reduced the nitration of Kir6.1 by SIN-1 in CHO cells co-transfected with the two subunits as well as in enteric glia. Two specific mutations within SUR2B, C24S and C1455S, prevented sulfhydration by NaHS and these mutations prevented NaHS- induced reduction in tyrosine nitration of Kir6.1. NaHS also reversed peroxynitrite-induced inhibition of smooth muscle contraction. These studies suggest that post-translational modifications of the two subunits of the ATP-sensitive K+ channel interact to alter channel function. The studies described herein demonstrate a unique mechanism by which sulfhydration of one
subunit modifies tyrosine nitration of another subunit within the same channel complex. This interaction provides a mechanistic insight on the protective effects of H2S in inflammation.


Abstract: BACKGROUND: Acute lung injury (ALI) is a serious disease with high incidence in ICU, and impaired mitochondria function plays a significant role in ALI. In this study, we examined the possible roles of exogenous hydrogen sulfide (H2S) in lung mitochondria regulation in ALI rats. METHODS: The rat ALI model was induced by an intra-tongue vein Lipopolysaccharide (LPS) injection. We used sodium hydrosulphide (NaHS) as the H2S donor. We randomly divided 40 Sprague-Dawley rats into five groups: control, LPS injury, LPS + low-dose NaHS (0.78 mg * kg(-1)), LPS + middle-dose NaHS (1.56 mg * kg(-1)), and LPS + high-dose NaHS (3.12 mg * kg(-1)). Rats were killed 3 h after NaHS administration. We calculated a semi-quantitative histological index of lung injury assessments and measured the lung wet-to-dry weight ratio. We further analyzed serum for interleukin-1beta levels using enzyme-linked immunosorbent assays. We observed lung mitochondria ultrastructures with an electron microscope. We examined oxidative stress markers in lung mitochondria and the mitochondrial swelling and activity. We analyzed lung mitochondria and cytosol Cyt-c protein expression using Western blotting. RESULTS: Compared to the control group, the quantitative assessment score index, wet-to-dry weight ratios, and interleukin-1beta content in the LPS injury group were significantly increased and the mitochondrial ultrastructure damaged. Furthermore, mitochondrial activity, adenosine triphosphatase, superoxide dismutase, glutathione peroxidase, and mitochondrial Cyt-c protein expression were significantly decreased, and malondialdehyde content, mitochondrial swelling, and cytosol Cyt-c protein expression were significantly increased in the LPS injury group compared to the control group. These effects were lessened by NaHS.

CONCLUSION: Exogenous H2S provided a protective effect against ALI by decreasing the mitochondrial lipid peroxidation level and protecting the cell structure in the LPS-induced rat models. Its regulatory effect on lung mitochondria is positively correlated with the dosage.


Abstract: During a course of colitis, production of the gaseous mediator hydrogen sulfide (H2S) is markedly up-regulated at sites of mucosal damage and contributes significantly to healing and resolution of inflammation. The signaling mechanisms through which H2S promotes resolution of colitis are unknown. We hypothesized that the beneficial effects of H2S in experimental colitis are mediated via stabilization of hypoxia-inducible factor (HIF)-1alpha. The hapten dinitrobenzene sulfonic acid was used to induce colitis in rats and mice. This resulted in an elevated expression of the H2S-producing enzyme, cystathionine gamma-lyase (CSE), and HIF-1alpha at sites of mucosal ulceration, and the expression of these 2 enzymes followed a similar pattern throughout the course of colitis. This represented a functionally important relationship because the loss of CSE-derived H2S production led to decreased HIF-1alpha stabilization and exacerbation of colitis. Furthermore, application of an H2S-releasing molecule, diallyl disulfide (DADS), stabilized colonic HIF-1alpha expression, up-regulated hypoxia-responsive genes, and reduced the severity of disease during peak inflammation. Importantly, the ability of DADS to promote the resolution of colitis was abolished when coadministered with an inhibitor of HIF-1alpha in vivo (PX-478). DADS was also able to maintain HIF-1alpha expression at a later point in colitis, when HIF-1alpha levels would have normally returned to control levels, and to enhance resolution. Finally, we found that HIF-1alpha stabilization inhibited colonic H2S production and may represent a negative feedback mechanism to prevent prolonged HIF-1alpha stabilization. Our findings demonstrate an important link between H2S and HIF-1alpha in the resolution of inflammation and injury during colitis and provide...

(63) Yuan S, Patel RP, Kevil CG. Working with Nitric Oxide and Hydrogen Sulfide in Biological Systems. Am J Physiol Lung Cell Mol Physiol 2014 Dec 30;ajplung. Abstract: Nitric oxide (NO) and hydrogen sulfide (H2S) are gasotransmitter molecules important in numerous physiological and pathological processes. While these molecules were first known as environmental toxicants, it is now evident that that they are intricately involved in diverse cellular functions with impact on numerous physiologic and pathogenic processes. NO and H2S share some common characteristics, but also have unique chemical properties which suggest potential complementary interactions between the two in affecting cellular biochemistry and metabolism. Central amongst these is the interactions between NO, H2S and thiols that constitute new ways to regulate protein function, signaling and cellular responses. In this review, we discuss fundamental biochemical principals, molecular functions, measurement methods, and the pathophysiological relevance of NO and H2S