Acido solfidrico nella letteratura internazionale
agosto 2013

Abstract: Flow cytometric detection of mitochondrial H2S was achieved with propargylic esters of rhodamine B which selectively react with H2S via cationic rhodamine-moiety directed thiolysis of the propargylic esters to give nonfluorescent rhodamine thio-spirolactone.

Abstract: A hydroponic experiment was carried out to examine the effect of hydrogen sulfide (H2S) in alleviating chromium (Cr) stress in barley. A 2-factorial design with 6 replications was selected, including 3 levels of NaHS (0 μM, 100 μM, and 200 μM) and 2 levels of Cr (0 μM and 100 μM) as treatments. The results showed that NaHS addition enhances plant growth and photosynthesis slightly compared with the control. Moreover, NaHS alleviated the inhibition in plant growth and photosynthesis by Cr stress. Higher levels of NaHS exhibited more pronounced effects in reducing Cr concentrations in roots, shoots, and leaves. Ultrastructural examination of plant cells supported the facts by indication of visible alleviation of cell disorders in both root and leaf with exogenous application of NaHS. An increased number of plastoglobuli, disintegration, and disappearance of thylakoid membranes and starch granules were visualized inside the chloroplast of Cr-stressed plants. Starch accumulation in the chloroplasts was also noticed in the Cr-treated cells, with the effect being much less in Cr + NaHS-treated plants. Hence, it is concluded that H2S produced from NaHS can improve plant tolerance under Cr stress. Environ Toxicol Chem 2013;32:2234-2239. (c) 2013 SETAC

Abstract: Hydrogen sulfide (H2S) and nitric oxide (NO) have been described as gasotransmitters. Anti-inflammatory activity in the central and peripheral nervous systems may be one of their functions. Previously we demonstrated that several SH(-) donors including H2S-releasing aspirin (S-ASA) exhibited anti-inflammatory and neuroprotective activity in vitro against toxins released by activated microglia and astrocytes. Here we report that NOSH-ASA, an NO- and H2S-releasing hybrid of aspirin, has a significantly greater anti-inflammatory and neuroprotective effect than S-ASA or NO-ASA. When activated by LPS/IFNγ, human microglia, human microglia and THP-1 cells release materials that are toxic to differentiated SH-SY5Y cells. These phenomena also occur with IFNγ-stimulated human astroglia and U373 cells. When the cells were treated with the S-ASA or NO-ASA, there was a significant enhancement of neuroprotection. However, NOSH-ASA had significantly more potent protection properties than NO-ASA or S-ASA. The effect was concentration-dependent, as well as incubation time-dependent. Such treatment not only reduced the release of the TNFalpha and IL-6, but also attenuated activation of P38 MAPK and NFκappaB proteins. All the compounds tested were not harmful when applied directly to SH-SY5Y cells. These data suggest that NOSH-ASA has significant anti-inflammatory properties and may be a new candidate for treating...
neurodegenerative disorders that have a prominent neuroinflammatory component such as Alzheimer disease and Parkinson disease. GLIA 2013;61:1724-1734.


Abstract: Hyperglycemia is a risk factor for the development of diabetic cardiovascular complications, which are associated with the activation of the mitogen-activated protein kinase (MAPK) signaling pathway. In this study, we demonstrate the inhibitory effects of exogenous hydrogen sulfide (H2S) on the activation of the MAPK pathway. The aim of the present study was to determine whether exogenous H2S prevents high glucose (HG)-induced injury by inhibiting the activation of the p38 MAPK and extracellular signal-regulated kinase (ERK)1/2 (members of MAPK) pathways in cardiomyoblasts (H9c2 cells). The findings of the present study demonstrated that the treatment of H9c2 cells with HG (35 mM glucose) for 24 h not only significantly induced injury, including cytotoxicity, apoptosis, overproduction of reactive oxygen species (ROS) and the loss of mitochondrial membrane potential (MMP), but also upregulated the expression levels of phosphorylated (p)-p38 MAPK and p-ERK1/2. The increased expression levels of p-p38 MAPK and p-ERK1/2 were markedly reduced by pre-treatment of the H9c2 cells with 400 microM sodium hydrogen sulfide (NaHS; a donor of H2S) prior to exposure to 35 mM glucose. Importantly, pre-treatment of the cells with 400 microM NaHS or 3 microM SB203580 (a selective inhibitor of p38 MAPK) or 15 microM U0126 (a selective inhibitor of ERK1/2) attenuated the HG-induced cardiomyocyte injury, leading to an increase in cell viability and a decrease in the number of apoptotic cells, preventing ROS generation, as well as the loss of MMP. In addition, pre-treatment of the cells with 1,000 microM N-acetyl-L-cysteine (a ROS scavenger) prior to exposure to HG ameliorated the HG-induced cytotoxicity. Taken together, the data from the present study demonstrate for the first time, to our knowledge, that exogenous H2S exerts a protective effect against HG-induced injury by inhibiting the activation of the p38 MAPK and ERK1/2 pathways and preventing oxidative stress in H9c2 cells.


Abstract: Hydrogen sulfide (H2S) is a naturally occurring gaseous transmitter, which is important in normal physiology and disease. In the present study, the involvement of H2S in the regulation of the immune response induced by burn injury was investigated in mice. Adult male C57BL/6 mice were subjected to burn injuries and treated with vehicle (0.9% sodium chloride, NaCl; 100 ml/kg body weight; subcutaneously, s.c.) or the H2S donor (sodium hydrosulfide, NaHS; 2 mg/kg body weight; s.c.). Compared with the controls, mice which received burn injuries exhibited a significant decrease in plasma H2S levels. Moreover, the levels of tumor necrosis factor (TNF)alpha, interleukin (IL)6 and IL8 significantly increased, while IL10 levels were decreased, compared with that of the controls in the plasma of mice subjected to burn injuries. Myeloperoxidase (MPO) activity in the liver tissue of injured mice was also markedly higher compared with that of the control group. However, the administration of NaHS significantly decreased the levels of TNFalpha, IL6 and IL8 but increased the levels of IL10 in the plasma of mice subjected to burn injuries. In addition, the MPO activity was decreased by NaHS. These results suggested that H2S regulates the inflammatory response induced by burn injury by modulating the levels of TNFalpha, IL6, IL8 and IL10. Thus, it was proposed that the administration of the H2S donor, NaHS, may be a useful therapy against the exaggerated immune response that is associated with burn injury.


Abstract: AIM: The aim of the study was to evaluate the effect of mouth cleaning with
hinokitiol-containing gel on oral malodor. METHODS: An open-label, randomized, controlled trial was conducted to assess oral malodor and clinical parameters related to oral malodor before and after mouth cleaning with hinokitiol-containing gel (n = 9) or with gel not including hinokitiol (n = 9). Mouth cleaning included the teeth, gingiva, and tongue and was carried out 3 times per day for 4 weeks. RESULTS: Organoleptic test (OLT) scores (P = .021), levels of hydrogen sulfide (P = .008) and methyl mercaptan (P = .020), frequency of bleeding on probing, average probing pocket depth, and plaque index significantly improved in the group using hinokitiol. In contrast, only the OLT score (P = .031) significantly improved in the control group after the treatment regimen. CONCLUSION: Mouth cleaning with hinokitiol-containing gel may be effective for reduction of oral malodor

Abstract: Transition metal oxide cluster anions M(m)(18)On(-) (M = Fe, Co, Ni, Cu, and Zn) were prepared by laser ablation and reacted with H2S in a fast flow reactor under thermal collision conditions. A time-of-flight mass spectrometer was used to detect the cluster distributions before and after the interactions with H2S. The experiments reveal a suite of oxygen/sulfur (O/S) exchange and oxygen/sulfydryl (O/SH) exchange reactions. The O/S exchange reaction to release water was evidenced for all of the MO2(-) cluster anions: MO2(-) + H2S --> MOS(-) + H2O, whereas the O/SH exchange reaction to derive MOSH(-) and OH species was only observed for reactions of NiO2(-), CuO2(-), and ZnO2(-). Density functional theory calculations were performed for reaction mechanisms of MO2(-) + H2S (M = Fe, Co, Ni, Cu, and Zn). The computational results are generally in good agreement with the experimental results. This gas-phase study provides an insight into the metal dependent reactivity in the removal of H2S over metal oxides.

Abstract: "Qi" and "blood" are two essential concepts in Chinese medicine (CM). As qi is intangible, the concept of qi is still controversial between CM and Western medicine. However, the endogenous hydrogen sulfide (H2S) and other gaseous signaling molecules provides a new approach for understanding the essence of qi in CM. Blood stasis syndrome is a common syndrome in CM. According to the CM theory, the incidence of blood stasis syndrome is closely correlated to the reckless movement of qi, as qi and blood are inseparable in regulating physiological functions. In recent years, more and more evidences suggest a close correlation between blood stasis syndrome and microcirculation dysfunction. In this paper, we discuss the relationship between endogenous H2S and blood stasis syndrome based on qi-blood theory of CM. We found that endogenous H2S maybe a material basis in concept of qi in CM, while dysfunctional microcirculation is the pathological basis of the blood stasis syndrome. As qi is closely associated with incidence and progression of blood stasis syndrome, endogenous H2S may play an important role in preventing and treating the blood stasis syndrome by improving the function of microcirculation.

Abstract: Removal of volatile sulphur compounds from livestock waste air by biological air filtration may be enhanced by application of packing materials with reactive properties. In this study, light expanded clay aggregates (Leca(R)) was tested with respect to sorption and potential chemical degradation of H2S, Methanethiol (MT) and Dimethyl sulphide (DMS). Leca was selected due to its content of minerals, including iron, and due to its high specific surface area. The performance of Leca was evaluated based on breakthrough curves and by comparing the difference between the inlet and outlet gas
concentrations. Whereas DMS did not appear to be removed by Leca, both H2S and MT were removed with variable efficiency depending on the specific conditions. Dimethyl disulphide (DMDS) and dimethyl trisulphide (DMTS) were demonstrated to be produced during the degradation process in relatively high yields. A comparison between ambient air and nitrogen gas conditions showed that the chemisorption of H2S and MT did not necessarily need oxygen to be present. X-ray analysis of Leca showed an abundance of Fe2O3. It is therefore hypothesized that Fe2O3 in Leca can remove H2S and MT by chemisorption. Both air velocity and moisture content clearly affected the capacity of Leca for removal of H2S and MT. Lower removal is seen at higher air velocities, whereas higher moisture content enhances removal. However, chemisorption of MT by Leca appears to be limited above a threshold moisture level. Potential reaction mechanisms are discussed in relation to the observed effects. The results implicate that Leca can be used as a filter material with reactive properties provided that moisture content is controlled and that an adequate air velocity is used.

Abstract: An ICT-based fluorescent turn-on probe for hydrogen sulfide with high selectivity has been designed and synthesized. It exhibits up to 62-fold switch-on response toward H2S at given concentrations and can detect H2S in living cells with high sensitivity.

Abstract: BACKGROUND: Hydrogen sulfide (H2S) is an endogenously generated gaseous transmitter known for its cytoprotective effect mediated by the PI3K-Akt signaling pathway. Human induced pluripotent stem cell (hiPSC)-derived mesenchymal stromal cells (MSCs), or hiPSC-MSCs, represent an alternative source of MSCs for autologous cell therapy. The big-conductance Ca2+-activated outward K+ currents (BKCa), known to mediate cell proliferation, have been detected in >80% of hiPSC-MSCs. The present study aimed to explore the effect of H2S on survival and proliferation of hiPSC-MSCs and investigate the mediatory role of BKCa. METHODS: Effects of H2S on proliferation and survival of hiPSC-MSCs were measured by 5-bromo-2-deoxyuridine incorporation, population doubling and cell cycle assays, and by 3-(4,5)-dimethylthiahiazo(-z-y1)-3,5-di- phenyltetrazoliumromide assay and 4'-6-diamidino-2-phenylindole staining, respectively. BKCa was recorded by means of the whole-cell patch-clamp technique. The expressions of KCa 1.1 (encoding BKCa) and apoptosis-related genes were measured by reverse transcriptase-polymerase chain reaction. The phosphorylation of Akt was assessed by Western blot analysis. RESULTS: Exogenously administered NaHS (an H2S donor, 50-300 mumol/L) significantly promoted proliferation of hiPSC-MSCs. NaHS prevented the hypoxia-induced apoptosis and suppressed BKCa currents without altering the expression levels of alpha- and beta-KCa 1.1. In addition, NaHS increased the phosphorylation of Akt and decreased the expression of Caspase 8 and Bax in hiPSC-MSCs. Paxilline (1 mumol/L), a BKCa blocker, showed similar effects on promoting cell proliferation and phosphorylation of Akt and suppression of apoptotic genes in hiPSC-MSCs. CONCLUSIONS: Our data confirmed that H2S augments the proliferation and survival of hiPSC-MSCs through activation of the PI3K-Akt pathway and that such effects could be mediated through inhibition of BKCa.

Abstract: A series of O-aryl- and alkyl-substituted phosphorodithioates were designed and synthesized as hydrogen sulfide (H2S) donors. H2S releasing capability of these donors...
compounds was evaluated using fluorescence methods. O-aryl substituted donors showed slow and sustained H2S release while O-alkylated compounds showed very weak H2S releasing capability. We also evaluated donors' protective effects against hydrogen peroxide (H2O2)-induced oxidative damage in myocytes and donors' toxicity toward B16BL6 mouse melanoma cells.


Abstract: Aim: To study the effects of hydrogen sulfide (H2S) on the left ventricular expression of MMP-8, MMP-13, and TIMP-1 in a rat model of congenital heart disease. Methods: Male SD rats underwent abdominal aorta-inferior vena cava shunt operation. H2S donor NaHS (56 mumol.kg-1.d-1, ip) was injected from the next day for 8 weeks. At 8 weeks, the hemodynamic parameters, including the left ventricular systolic pressure (LVSP), the left ventricular peak rate of contraction and relaxation (LV+/dp/dtmax) and the left ventricular end diastolic pressure (LVEDP) were measured. The left ventricular tissues were dissected out, and hydroxyproline and collagen I contents were detected with ELISA. The expression of MMP-8, MMP-13, and a tissue inhibitor of metalloproteinase-1 (TIMP-1) in the tissues was measured using real-time PCR, Western blots, and immunohistochemistry, respectively. Results: The shunt operation markedly reduced LVSP and LV+/dp/dtmax, increased LVEDP, hydroxyproline and collagen I contents, as well as the mRNA and protein levels of MMP-8, MMP-13, and TIMP-1 in the left ventricles. Chronic treatment of the shunt operation rats with NaHS effectively prevented the abnormalities in the hemodynamic parameters, hydroxyproline and collagen I contents, and the mRNA and protein levels of MMP-13 and TIMP-1 in the left ventricles. NaHS also prevented the increase of MMP-8 protein expression, but did not affect the increase of mRNA level of MMP-8 in the shunt operation rats. Conclusion: H2S suppresses protein and mRNA expression of MMP-8, MMP-13, and TIMP-1 in rats with cardiac volume overload, which may be contributed to the amelioration of ventricular structural remodeling and cardiac function.


Abstract: Paintings in ancient Egyptian tombs often suffer colour changes due to microbial growth and colonization. Streptomyces strains were isolated from mural paintings of Tell Basta and Tanis tombs (East of Nile Delta, Egypt) and were identified using biochemical and molecular methods. The 16S rDNA sequences data indicated that isolated strains were closely related to S. coelicolor, S. albidofuscus, S. ambofaciens, S. canarius, S. parvulus, S. corchorusii, S. albidofuscus and S. nigrifaciens. It could be shown that Streptomyces strains are involved on a large scale in the colour changes of paintings and stone support by producing a wide range of metabolites such as acids (oxalic, citric and sulphuric acids), biopigments of melanin, carotenoids, and hydrogen sulphide.


Abstract: Depression is a common and debilitating mental illness and is often comorbid with anxiety disorders. Altered synaptic plasticity is considered to be an important mechanism underlying antidepressant drug action. It has been reported that hydrogen sulfide (H2S), the third gaseous transmitter, facilitates the induction of hippocampal long-term potentiation and augments synaptic neurotransmission, involved in the regulation of synaptic plasticity. The aim of this study was to clarify the antidepressant-like and anxiolytic-like effects of H2S. H2S (NaHS, 1.68 or 5.6 mg/kg, intraperitoneally, for 7 days) exerts a specific antidepressant-like effect in the forced swimming test of mice and rats.
and the tail suspension test of mice, and reduces the anxiety-like behaviors of both mice and rats in the elevated plus-maze test. These results reveal a unique antagonistic action of H2S in depressive-like and anxiety-like behaviors and suggest that elevating H2S signaling in the brain may represent a novel approach for the treatment of depressive and anxiety disorders.


Abstract: Abstract Aims: Acute liver failure (ALF) is a fatal syndrome attributed to massive hepatocyte death. Hydrogen sulfide (H2S) has been reported to exert cytoprotective or cytotoxic effects. Here, we examined the role of cystathionine gamma-lyase (CSE, an enzyme produces H2S) in ALF induced by D-Galactosamine (GalN) and lipopolysaccharide (LPS). Results: Wild-type (WT) mice exhibited high mortality rate, prominent liver injury, and increased plasma alanine aminotransferase levels after GalN/LPS challenge. Congenital deficiency or chemical inhibition of CSE by DL-propargylglycine attenuated GalN/LPS-induced liver injury. CSE deficiency markedly improved survival rate and attenuated GalN/LPS-induced upregulation of inflammatory cytokines and activation of caspase 3 and poly (ADP-ribose) polymerase (PARP) in the liver. CSE deficiency protected primary hepatocytes from GalN/tumor necrosis factor-alpha (TNF-alpha)-induced cell death without affecting LPS-induced TNF-alpha production from primary peritoneal macrophages. Beneficial effects of CSE deficiency were associated with markedly elevated homocysteine and thiosulfate levels, upregulation of NF-E2 p45-related factor 2 (Nrf2) and antioxidant proteins, activation of Akt-dependent anti-apoptotic signaling, and inhibition of GalN/LPS-induced JNK phosphorylation in the liver. Finally, administration of sodium thiosulfate (STS) attenuated GalN/LPS-induced liver injury via activation of Akt- and Nrf2-dependent signaling and inhibition of GalN/LPS-induced JNK phosphorylation in WT mice. Innovation: These results suggest that inhibition of CSE or administration of STS prevents acute inflammatory liver failure by augmenting thiosulfate levels and upregulating antioxidant and anti-apoptotic defense in the liver. Conclusion: Congenital deficiency or chemical inhibition of CSE increases thiosulfate levels in the liver and prevents ALF at least in part by augmentation of antioxidant and anti-apoptotic mechanisms. Antioxid. Redox Signal. 00, 000-000


Abstract: The cysteine biosynthetic pathway is absent in humans but essential in microbial pathogens, suggesting that it provides potential targets for the development of novel antibacterial compounds. CysK1 is a pyridoxalphosphate-dependent O-acetyl sulphydrylase, which catalyzes the formation of l-cysteine from O-acetyl serine and hydrogen sulfide. Here we report nanomolar thiazolidine inhibitors of Mycobacterium tuberculosis CysK1 developed by rational inhibitor design. The thiazolidine compounds were discovered using the crystal structure of a CysK1-peptide inhibitor complex as template. Pharmacophore modeling and subsequent in vitro screening resulted in an initial hit compound 2 (IC50 of 103.8 nM), which was subsequently optimized by a combination of protein crystallography, modeling, and synthetic chemistry. Hit expansion of 2 by chemical synthesis led to improved thiazolidine inhibitors with an IC50 value of 19 nM for the best compound, a 150-fold higher potency than the natural peptide inhibitor (IC50 2.9 muM)

Abstract: We recently found that hydrogen sulfide (H2S) participates in inhibitory regulation of rhythmic respiration by acting on the parafacial respiratory group (pFRG) in medullary slices of neonatal rats. The present study investigated whether ATP-sensitive potassium (KATP) channels are expressed in neurons of the pFRG, and, if so, whether they play a role in central regulation of respiratory activity, in particular the H2S-mediated central inhibition of respiratory rhythm in medullary slices of neonatal rats. Immunohistochemical techniques revealed that KATP channels are expressed in neurons of the pFRG region. Micro-injection of the KATP channel activator, pinacidil, into the pFRG region inhibited the discharge rhythm of hypoglossal rootlets, whereas injection of the KATP channel blocker, glibenclamide (Gl), had no effect. Micro-injection of the H2S donor sodium hydrosulfide (NaHS) into the pFRG region produced identical inhibitory responses to those induced by pinacidil. However, combined micro-injection of Gl and NaHS eliminated inhibitory effects of NaHS and converted to minor excitatory effects on the respiratory rhythm. It can be concluded that KATP channels of pFRG neurons are involved in the central regulation of respiratory rhythm and H2S-mediated inhibitory actions on respiratory rhythm in medullary slices of neonatal rats.

Abstract: BACKGROUND: Early treatment of spinal cord white matter injury has been found beneficial. H2S, a neurotransmitter is neuroprotective at lower doses. PURPOSE: In the present study the effect of NaHS after clip compression injury of spinal cord white matter in vivo was studied. METHODS: The injury was induced in 8-10 weeks old Wistar rats by exposing the spinal cord at T8-T10 level by laminectomy and applying 35g clip for 1min. A dose of 50microM NaHS was given intraperitoneally after 1h of injury. 0.5mm Spinal cord tissues were collected 8h after injury from both sides including epicenter and dorsal column was microdissected and used for further study. RESULTS: NaHS treatment decreases nitric oxide (NO) by 27% and lipid peroxide (LPO) by 18% as compared to injury, which are hallmark of attenuation in oxidative stress. Western blots shows significant changes in Myeloperoxidase (MPO) level went down by 10%. GSH contents increased 44% in treated group as compared to the injury group. NaHS treatment increased Nrf-2 expression 1.8 times. We found NaHS treatment reduced the GFAP expression 8%, there was no significant changes in NF-200 after treatment and no evident morphological changes with H and E staining. CONCLUSIONS: With the above data we conclude that NaHS at 50microM dose at 1h after injury reduces the NO, LPO, GFAP and MPO level at injury site by increasing the expression of Nrf-2. We expect that a decrease in these parameters during acute phase of spinal cord injury would be helpful in neuroprotection and regeneration.


Abstract: In Eastern Boundary Upwelling Systems nutrient-rich waters are transported to the ocean surface, fuelling high photoautotrophic primary production. Subsequent heterotrophic decomposition of the produced biomass increases the oxygen-depletion at intermediate water depths, which can result in the formation of oxygen minimum zones (OMZ). OMZs can sporadically accumulate hydrogen sulfide (H2S), which is toxic to most multicellular organisms and has been implicated in massive fish kills. During a cruise to the OMZ off Peru in January 2009 we found a sulfidic plume in continental shelf waters, covering an area >5500 km(2), which contained approximately 2.2x10(4) tons of H2S. This was the first time that H2S was measured in the Peruvian OMZ and with approximately 440 km(3) the largest plume ever reported for oceanic waters. We assessed the phylogenetic and functional diversity of the inhabiting microbial community.
by high-throughput sequencing of DNA and RNA, while its metabolic activity was determined with rate measurements of carbon fixation and nitrogen transformation processes. The waters were dominated by several distinct gamma-, delta- and epsilon-proteobacterial taxa associated with either sulfur oxidation or sulfate reduction. Our results suggest that these chemolithoautotrophic bacteria utilized several oxidants (oxygen, nitrate, nitrite, nitric oxide and nitrous oxide) to detoxify the sulfidic waters well below the oxic surface. The chemolithoautotrophic activity at our sampling site led to high rates of dark carbon fixation. Assuming that these chemolithoautotrophic rates were maintained throughout the sulfidic waters, they could be representing as much as approximately 30% of the photoautotrophic carbon fixation. Postulated changes such as eutrophication and global warming, which lead to an expansion and intensification of OMZs, might also increase the frequency of sulfidic waters. We suggest that the chemolithoautotrophically fixed carbon may be involved in a negative feedback loop that could fuel further sulfate reduction and potentially stabilize the sulfidic OMZ waters.

(22) Sekiguchi F, Kawabata A. T-type Calcium Channels: Functional Regulation and Implication in Pain Signaling. J Pharmacol Sci 2013 Aug 20;122(4):244-50. Abstract: Low-voltage-activated T-type Ca(2+) channels (T-channels), especially Cav3.2 among the three isoforms (Cav3.1, Cav3.2, and Cav3.3), are now considered to play pivotal roles in processing of pain signals. Cav3.2 T-channels are functionally modulated by extracellular substances such as hydrogen sulfide and ascorbic acid, by intracellular signaling molecules including protein kinases, and by glycosylation. Cav3.2 T-channels are abundantly expressed in both peripheral and central endings of the primary afferent neurons, regulating neuronal excitability and release of excitatory neurotransmitters such as substance P and glutamate, respectively. Functional upregulation of Cav3.2 T-channels is involved in the pathophysiology of inflammatory, neuropathic, and visceral pain. Thus, Cav3.2 T-channels are considered to serve as novel targets for development of drugs for treatment of intractable pain resistant to currently available analgesics.

(23) Casalini ED, Goodwill AG, Owen MK, Moberly SP, Berwick ZC, Tune JD. Contribution of hydrogen sulfide to the control of coronary blood flow. Microcirculation 2013 Aug 20. Abstract: This study examined the mechanisms by which H2 S modulates coronary microvascular resistance and myocardial perfusion at rest and in response to cardiac ischemia. Experiments were conducted in isolated coronary arteries and in open-chest anesthetized dogs. We found that the H2 S substrate L-cysteine (1-10 mM) did not alter coronary tone of isolated arteries in vitro or coronary blood flow in vivo. In contrast, intracoronary (ic) H2 S (0.1-3 mM) increased coronary flow from 0.49 +/- 0.08 to 2.65 +/- 0.13 ml/min/g (P<0.001). This increase in flow was unaffected by inhibition of Kv channels with 4-aminopyridine (P=0.127) but was attenuated (0.23 +/- 0.02 to 1.13 +/- 0.13 ml/min/g) by the KATP channel antagonist glibenclamide (P<0.001). Inhibition of NO synthesis (L-NAME) did not attenuate coronary responses to H2 S. Immunohistochemistry revealed expression of cystathionine gamma-lyase (CSE), an endogenous H2 S enzyme, in myocardium. Inhibition of CSE with beta-cyano-L-alanine (10 muM) had no effect on baseline coronary flow or responses to a 15 sec coronary occlusion (P=0.82). These findings demonstrate that exogenous H2 S induces potent, endothelial-independent dilation of the coronary microcirculation predominantly through the activation of KATP channels, however, our data do not support a functional role for endogenous H2 S in the regulation of coronary microvascular resistance. This article is protected by copyright. All rights reserved.

(24) Monti M, Terzuoli E, Ziche M, Morbidelli L. The sulphhydryl containing ACE inhibitor Zofenoprilat protects coronary endothelium from Doxorubicin-induced apoptosis. Pharmacol Res 2013 Aug 18;76C:171-81. Abstract: Pediatric and adult cancer patients, following the use of the antitumor drug Doxorubicin develop cardiotoxicity. Pharmacological protection of microvascular endothelium might produce a double benefit: (i) reduction of myocardial toxicity (the...
primary target of Doxorubicin action) and (ii) maintenance of the vascular functionality for the adequate delivery of chemotherapeutics to tumor cells. This study was aimed to evaluate the mechanisms responsible of the protective effects of the angiotensin converting enzyme inhibitor (ACEI) Zofenoprilat against the toxic effects exerted by Doxorubicin on coronary microvascular endothelium. We found that exposure of endothelial cells to Doxorubicin (0.1-1μM range) impaired cell survival by promoting their apoptosis. ERK1/2 related p53 activation, but not reactive oxygen species, was responsible for Doxorubicin induced caspase-3 cleavage. P53 mediated-apoptosis and impairment of survival were reverted by treatment with Zofenoprilat. The previously described PI-3K/eNOS/endogenous fibroblast growth factor signaling was not involved in the protective effect, which, instead, could be ascribed to cystathionine gamma lyase dependent availability of H2S from Zofenoprilat. Furthermore, considering the tumor environment, the treatment of endothelial/tumor co-cultures with Zofenoprilat did not affect the antitumor efficacy of Doxorubicin. In conclusion the ACEI Zofenoprilat exerts a protective effect on Doxorubicin induced endothelial damage, without affecting its antitumor efficacy. Thus, sulphydryl containing ACEI may be a useful therapy for Doxorubicin-induced cardiotoxicity.

Abstract: Diphenylarsinic acid (DPAA) is a toxic phenylarsenic compound often found around sites contaminated with phenylarsenic chemical warfare agents, diphenylcyanarsine or diphenylchloroarsine, which were buried in soil after the World Wars. This research concerns the elucidation of the chemical structure of an arsenic metabolite transformed from DPAA under anaerobic sulfate-reducing soil conditions. In LC/ICP-MS analysis, the retention time of the metabolite was identical to that of a major phenylarsenic compound synthesized by chemical reaction of DPAA and hydrogen sulfide. Moreover the mass spectra for the two compounds measured using LC/TOF-MS were similar. Subsequent high resolution mass spectral analysis indicated that two major ions at m/z 261 and 279, observed on both mass spectra, were attributable to C12H10AsS and C12H12AsSO, respectively. These findings strongly suggest that the latter ion is the molecular-related ion ([M+H]+) of diphenylthioarsinic acid (DPTA; (C6H5)2AsS(OH)) and the former ion is its dehydrated fragment. Thus, our results reveal that DPAA can be transformed to DPTA, as a major metabolite, under sulfate-reducing soil conditions. Moreover, formation of diphenyldithioarsinic acid and subsequent dimerization were predicted by the chemical reaction analysis of DPAA with hydrogen sulfide. This is the first report to elucidate the occurrence of DPAA-thionation in an anaerobic soil.

Abstract: The process of ecological speciation drives the evolution of locally adapted and reproductively isolated populations in response to divergent natural selection. In Southern Mexico, several lineages of the freshwater fish species of the genus Poecilia have independently colonized toxic, hydrogen sulfide-rich springs. Even though ecological speciation processes are increasingly well understood in this system, aligning the taxonomy of these fish with evolutionary processes has lagged behind. While some sulfide spring populations are classified as ecotypes of Poecilia mexicana, others, like P. sulphuraria, have been described as highly endemic species. Our study particularly focused on elucidating the taxonomy of the long described sulfide spring endemic, Poecilia thermalis Steindachner 1863, and investigates if similar evolutionary patterns of phenotypic trait divergence and reproductive isolation are present as observed in other sulfidic species of Poecilia. We applied a geometric morphometric approach to assess body shape similarity to other sulfidic and non-sulfidic fish of the genus Poecilia. We also
conducted phylogenetic and population genetic analyses to establish the phylogenetic relationships of P. thermalis and used a population genetic approach to determine levels of gene flow among Poecilia from sulfidic and non-sulfidic sites. Our results indicate that P. thermalis' body shape has evolved in convergence with other sulfide spring populations in the genus. Phylogenetic analyses placed P. thermalis as most closely related to one population of P. sulphuraria, and population genetic analyses demonstrated that P. thermalis is genetically isolated from both P. mexicana ecotypes and P. sulphuraria. Based on these findings, we make taxonomic recommendations for P. thermalis. Overall, our study verifies the role of hydrogen sulfide as a main factor shaping convergent, phenotypic evolution and the emergence of reproductive isolation between Poecilia populations residing in adjacent sulfidic and non-sulfidic environments.


Abstract: Cardiac fibroblasts are crucial in pathophysiology of the myocardium whereby their aberrant proliferation has significant impact on cardiac function. Hydrogen sulphide (H2S) is a gaseous modulator of potassium channels on cardiomyocytes and has been reported to attenuate cardiac fibrosis. Yet, the mechanism of H2S in modulating proliferation of cardiac fibroblasts remains poorly understood. We hypothesized that H2S inhibits proliferative response of atrial fibroblasts through modulation of potassium channels. Biophysical property of potassium channels in human atrial fibroblasts was examined by whole-cell patch clamp technique and their cellular proliferation in response to H2S was assessed by BrdU assay. Large conductance Ca2+ -activated K+ current (BKCa), transient outward K+ current (Ito) and inwardly rectifying K+ current (IKir) were found in human atrial fibroblasts. Current density of BKCa (IC50 = 69.4 µM; n = 6), Ito (IC50 = 55.1 µM; n = 6) and IKir (IC50 = 78.9 µM; n = 6) was significantly decreased (P < 0.05) by acute exposure to NaHS (a H2S donor) in atrial fibroblasts. Furthermore, NaHS (100-500 µM) inhibited fibroblast proliferation induced by transforming growth factor-beta1 (TGF-beta1; 1 ng/ml), Ang II (100 nM) or 20% FBS. Pre-conditioning of fibroblasts with NaHS decreased basal expression of Kv4.3 (encode Ito), but not KCa1.1 (encode BKCa) and Kir2.1 (encode IKir). Furthermore, H2S significantly attenuated TGF-beta1-stimulated Kv4.3 and alpha-smooth muscle actin expression, which coincided with its inhibition of TGF-beta1-induced myofibroblast transformation. Our results show that H2S attenuates atrial fibroblast proliferation via suppression of K+ channel activity and moderates their differentiation towards myofibroblasts.


Abstract: Sulfate-reducing bacteria (SRB) colonize the guts of approximately 50% of humans. We used genome-wide transposon mutagenesis and insertion-site sequencing, RNA-Seq, plus mass spectrometry to characterize genetic and environmental factors that impact the niche of Desulfovibrio piger, the most common SRB in a surveyed cohort of healthy US adults. Gnotobiotic mice were colonized with an assemblage of sequenced human gut bacterial species with or without D. piger and fed diets with different levels and types of carbohydrates and sulfur sources. Diet was a major determinant of functions expressed by this artificial nine-member community and of the genes that impact D. piger fitness; the latter includes high- and low-affinity systems for using ammonia, a limiting resource for D. piger in mice consuming a polysaccharide-rich diet. Although genes involved in hydrogen consumption and sulfate reduction are necessary for its colonization, varying dietary-free sulfate levels did not significantly alter levels of D. piger, which can obtain sulfate from the host in part via cross-feeding mediated by Bacteroides-encoded sulfatases. Chondroitin sulfate, a common dietary supplement, increased D. piger and H2S levels without compromising gut barrier integrity. A chondroitin sulfate-supplemented diet together with D. piger impacted the assemblage's substrate utilization
preferences, allowing consumption of more reduced carbon sources and increasing the abundance of the H2-producing Actinobacterium, Collinsella aerofaciens. Our findings provide genetic and metabolic details of how this H2-consuming SRB shapes the responses of a microbiota to diet ingredients and a framework for examining how individuals lacking D. piger differ from those who harbor it.

Abstract: AIMS: The potential receptor for hydrogen sulfide (H2S) remains unknown. RESULTS: H2S could directly activate vascular endothelial growth factor receptor 2 (VEGFR2) and that a small interfering RNA (siRNA)-mediated knockdown of VEGFR2 inhibited H2S-induced migration of human vascular endothelial cells. H2S promoted angiogenesis in Matrigel plug assay in mice and this effect was attenuated by a VEGF receptor inhibitor. Using tandem mass spectrometry (MS), we identified a new disulfide complex located between Cys1045 and Cys1024 within VEGFR2 that was labile to H2S-mediated modification. Kinase activity of the mutant VEGFR2 (C1045A) devoid of the Cys1045-Cys1024 disulfide bond was significantly higher than wild-type VEGFR2. Transfection with vectors expressing VEGFR2 (C1045A) caused a significant increase in cell migration, while the migration-promoting effect of H2S disappeared in the cells transfected with VEGFR2 (C1045A). Therefore, the Cys1045-Cys1024 disulfide bond serves as an intrinsic inhibitory motif and functions as a molecular switch for H2S. The formation of the Cys1045-Cys1024 disulfide bond disrupted the integrity of the active conformation of VEGFR2. Breaking the Cys1045-Cys1024 disulfide bond recovered the active conformation of VEGFR2. This motif was prone to a nucleophilic attack by H2S via an interaction of their frontier molecular orbitals. siRNA-mediated knockdown of cystathionine gamma-lyase attenuated migration of vascular endothelial cells induced by VEGF or moderate hypoxia. INNOVATION AND CONCLUSION: The study provides the first piece of evidence of a molecular switch in H2S-targeting receptor protein kinase in H2S-induced angiogenesis and that may be applicable to additional kinases containing functionally important disulfide bonds in mediating various H2S actions.

Abstract: AIMS: The signaling molecule hydrogen sulfide (H2S) protects cells against oxidative stress and activates NF-E2 p45-related factor 2 (Nrf2), a transcription factor that regulates antioxidant genes. We sought to establish whether H2S requires Nrf2 to protect against oxidative stress, and whether activation of Nrf2 by H2S involves antagonism of Kelch-like ECH-associated protein-1 (Keap1), a redox-sensitive ubiquitin ligase substrate adaptor that represses Nrf2 under normal homeostatic conditions. RESULTS: H2S stabilizes Nrf2 protein and induces Nrf2-target genes via an antioxidant-/electrophile-response element. In mouse embryonic fibroblasts, the ability of H2S to protect against cell death caused by the redox-cycling agent menadione is dependent on Nrf2. Moreover, Nrf2 regulates murine genes involved in the production of H2S (Cystathionine-beta-synthase [Cbs] and Cystathionine-gamma-lyase [Cse]) and the degradation of H2S (Sulfide:quinone reductase-like [yeast] [SqrMf]). We found that H2S stabilizes Nrf2 through inhibition of Keap1, an event that requires covalent modification of amino acids C226 and C613 in the substrate adaptor. Upregulation of Nrf2 by H2S partially involves the production of H2O2, which inhibits Keap1 by stimulating the formation of an intramolecular disulfide bond between C226 and C613. The Keap1 C226 and C613 residues are also S-sulfhydrated by H2S, and this may entail reduction of the C226-C613 disulfide bridge formed by H2O2. INNOVATION: Upregulation of Nrf2 by H2S and H2O2 involves inactivation of Keap1 through modification of C226 and C613. CONCLUSION:
Inhibition of Keap1 by H2S leads to Nrf2-mediated induction of cytoprotective genes. Nrf2 controls Cbs, Cse, and Sqrdl, suggesting that a feedback loop exists between Nrf2 and H2S.

Abstract: To sort out the putative roles of endogenous hydrogen sulfide (H2S) in clinical conditions wherein systemic inflammation or hypoxia is present, it becomes crucial to develop approaches capable of affecting H2S concentration that can be safely applied in humans. We have investigated a paradigm, which could achieve such a goal, using vitamin B12 (vit.B12), at the dose recommended in cyanide poisoning, and very low levels of methemoglobin (MetHb). Hydroxocobalamin in the plasma, supernatant of kidney, and heart tissue homogenates of rats that had received vit.B12 (140 mg.kg(-1) intravenous) was found in the μM range. Exogenous H2S (100 μM) added to the plasma or supernatants of these rats decreased at a significantly higher rate than in control rats. In the latter however a spontaneous oxidation of exogenous H2S occurred. In vitro, hydroxocobalamin solution (100 μM) decreased, within <2 min, an equimolar concentration of H2S by 80%. Three to five percent MetHb prevented H2S induced hyperventilation in vivo and decreased exogenous H2S in vitro by 25-40 μM within 30 s. Our observations lead to the hypothesis that innocuous levels of MetHb and vit.B12 could be a used as an effective and safe way to test the role of endogenous H2S in vivo.


Abstract: CS2 hydrolase, a zinc-dependent enzyme that converts carbon disulfide to carbon dioxide and hydrogen sulfide, exists as a mixture of octameric ring and hexadecameric catenane forms in solution. A combination of size exclusion chromatography, multi-angle laser light scattering, and mass spectrometric analyses revealed that the unusual catenane structure is not an artefact, but a naturally occurring structure.

Abstract: The kinetics of the reaction of ozone with hydrogen sulfide was studied theoretically. High-level ab initio calculations were carried out to build the potential energy surface. The mechanism of the title reaction was found to be much more complicated than what is reported in the literature to date. According to our results, six different chemically activated intermediates are involved along the proposed mechanism on its lowest singlet potential energy surface that play an important role in the kinetics of this system. Multichannel RRKM-TST and CVT calculations have been carried out to compute the temperature dependence of the individual rate constants for different channels and also the overall rate constant for the consumption of the reactants. The major products are sulfur dioxide and water at lower temperatures, in good agreement with experimental reports, while at higher temperatures, formation of the other products like O2, H2SO, and radicals like cis/trans-HOSO, SH, HO3, and OH also become important.

Abstract: Thrombospondin-1 is a potent suppressor of T cell activation via its receptor CD47. However, the precise mechanism for this inhibition remains unclear. Because H2S is an endogenous potentiator of T cell activation and is necessary for full T cell activation, we hypothesized that thrombospondin-1 signaling through CD47 inhibits T cell activation by antagonizing H2S signaling. Primary T cells from thrombospondin-1 null mice were more sensitive to H2S-dependent activation assessed by proliferation and induction of interleukin-2 and CD69 mRNAs. Exogenous thrombospondin-1 inhibited H2S responses in wild type and thrombospondin-1 null T cells but enhanced the same responses in CD47 null T cells. Fibronectin, which shares integrin and glycosaminoglycan binding properties with thrombospondin-1 but not CD47 binding, did not inhibit H2S signaling. A CD47-binding peptide derived from thrombospondin-1 inhibited H2S-induced activation, whereas two other functional sequences from thrombospondin-1 enhanced H2S signaling. Therefore, engaging CD47 is necessary and sufficient for thrombospondin-1 to inhibit H2S-dependent T cell activation. H2S stimulated T cell activation by potentiating MEK-dependent ERK phosphorylation, and thrombospondin-1 inhibited this signaling in a CD47-dependent manner. Thrombospondin-1 also limited activation-dependent T cell expression of the H2S biosynthetic enzymes cystathionine beta-synthase and cystathionine gamma-lyase, thereby limiting the autocrine role of H2S in T cell activation. Thus, thrombospondin-1 signaling through CD47 is the first identified endogenous inhibitor of H2S signaling and constitutes a novel mechanism that negatively regulates T cell activation.

(36) Shi H, Ye T, Chan Z. Exogenous application of hydrogen sulfide donor sodium hydrosulfide enhanced multiple abiotic stress tolerance in bermudagrass (Cynodon dactylon (L). Pers.). Plant Physiol Biochem 2013 Aug 7;71C:226-34. Abstract: As a gaseous molecule, hydrogen sulfide (H2S) has been recently found to be involved in plant responses to multiple abiotic stress. In this study, salt (150 and 300 mM NaCl), osmotic (15% and 30% PEG6000) and cold (4 degrees C) stress treatments induced accumulation of endogenous H2S level, indicating that H2S might play a role in bermudagrass responses to salt, osmotic and cold stresses. Exogenous application of H2S donor (sodium hydrosulfide, NaHS) conferred improved salt, osmotic and freezing stress tolerances in bermudagrass, which were evidenced by decreased electrolyte leakage and increased survival rate under stress conditions. Additionally, NaHS treatment alleviated the reactive oxygen species (ROS) burst and cell damage induced by abiotic stress, via modulating metabolisms of several antioxidant enzymes [catalase (CAT), peroxidase (POD) and GR (glutathione reductase)] and non-enzymatic glutathione antioxidant pool and redox state. Moreover, exogenous NaHS treatment led to accumulation of osmolytes (proline, sucrose and soluble total sugars) in stressed bermudagrass plants. Taken together, all these data indicated the protective roles of H2S in bermudagrass responses to salt, osmotic and freezing stresses, via activation of the antioxidant response and osmolyte accumulation. These findings might be applicable to grass and crop engineering to improve abiotic stress tolerance.

(37) Li L, Han Y, Yan X, Liu J. HS removal and bacterial structure along a full-scale biofilter bed packed with polyurethane foam in a landfill site. Bioresour Technol 2013 Aug 6;147C:52-8. Abstract: Hydrogen sulfide accumulated under a cover film in a landfill site was treated for 7months by a full-scale biofilter packed with polyurethane foam cubes. Sampling ports were set along the biofilter bed to investigate H2S removal and microbial characteristics in the biofilter. The H2S was removed effectively by the biofilter, and over 90% removal efficiency was achieved in steady state. Average elimination capacity of H2S was 2.21gm-3h-1 in lower part (LPB) and 0.47gm-3h-1 in upper part (UPB) of the biofilter. Most H2S was eliminated in LPB. H2S concentration varied along the polyurethane foam packed bed, the structure of the bacterial communities showed spatial variation in the biofilter, and H2S removal as well as products distribution changed accordingly. The
introduction of odorants into the biofilter shifted the distribution of the existing microbial populations toward a specific culture that could metabolize the target odors.

Abstract: Sulfide is produced in sewer networks, and previous studies suggest that sulfide in sewage could alter the activity of heterotrophic denitrification and lead to N2O accumulation during biological wastewater treatment. However, the details of this phenomenon are poorly understood. In this study, the potential inhibitory effects of sulfide on nitrate, nitrite, and N2O reduction were assessed with a methanol-utilizing denitrifying culture both prior to and after its exposure and adaptation to sulfide. Hydrogen sulfide was found to be strongly inhibitory to N2O reduction, with 50% inhibition observed at H2S concentrations of 0.04 mg H2S-S/L and 0.1 mg H2S-S/L for the unadapted and adapted cultures, respectively. In comparison, both nitrate and nitrite reduction was more tolerant to H2S. A 50% inhibition of nitrite reduction was observed at approximately 2.0 mg H2S-S/L for both unadapted and adapted cultures, while no inhibition of nitrate reduction occurred at the highest H2S concentrations applied (2.0 mg H2S-S/L) to either culture. N2O accumulation was observed during nitrate and nitrite reduction by the adapted culture when H2S concentrations were above 0.5 and 0.2 mg H2S-S/L, respectively. Additionally, we reveal that hydrogen sulfide (H2S), rather than sulfide, was likely the true inhibitor of N2O reduction, and the inhibitory effect was reversible. These findings suggest that sulfide management in sewers could potentially have a significant impact on N2O emission from wastewater treatment plants.

Abstract: This research sought to understand the behavior of engineered nanoparticles in landfill leachate by examining the interactions between nanoparticles and leachate components. The primary foci of this paper are the effects of ZnO, TiO2, and Ag nanoparticles on biological landfill processes and the form of Zn, Ti, and Ag in leachate following the addition of nanoparticles. Insight into the behavior of nanoparticles in landfill leachate was gained from the observed increase in the aqueous concentrations over background for Zn, Ti, and Ag in some tested leachates attributed to leachate components interacting with the nanoparticle coatings resulting in dispersion, dissolution/dissociation, and/or agglomeration. Coated nanoparticles did not affect biological processes when added to leachate; five-day biochemical oxygen demand and biochemical methane potential results were not statistically different when exposed to nanoparticles, presumably due to the low concentration of dissolved free ionic forms of the associated metals resulting from the interaction with leachate components. Chemical speciation modeling predicted that dissolved Zn in leachate was primarily associated with dissolved organic matter, Ti with hydroxide, and Ag with hydrogen sulfide and ammonia; less than 1% of dissolved Zn and Ag was in the free ionic form, and free ionic Ti and Ag concentrations were negligible.

Abstract: Hydrogen sulfide (H2S) is produced throughout the gastrointestinal tract, and it contributes to maintenance of mucosal integrity, resolution of inflammation, and repair of damaged tissue. H2S synthesis is elevated in inflamed and damaged colonic tissue, but the enzymatic sources of that synthesis are not completely understood. In the present study, the contributions of three enzymatic pathways to colonic H2S synthesis were determined, with tissues taken from healthy rats and rats with colitis. The ability of the colonic tissue to inactivate H2S was also determined. Colonic tissue from rats with hapten-induced colitis produced significantly more H2S than tissue from healthy controls.
The largest source of the H2S synthesis was the pathway involving cysteine amino transferase and 3-mercaptopyruvate sulfurtransferase (an alpha-ketoglutarate-dependent pathway). Elevated H2S synthesis occurred specifically at sites of mucosal ulceration, and was not related to the extent of granulocyte infiltration into the tissue. Inactivation of H2S by colonic tissue occurred rapidly, and was significantly reduced at sites of mucosal ulceration. This correlated with a marked decrease in the expression of sulfide quinone reductase in these regions. Together, the increased production and decreased inactivation of H2S at sites of mucosal ulceration would result in higher H2S levels at these sites, which promotes resolution of inflammation and repair of damaged tissue.

Abstract: Research of medical gases is well established in Poland and has been marked with the foundation of several professional societies. Numerous academic centers including those dealing with hyperbaric and diving medicine conduct studies of medical gases, in vast majority supported with intramural funds. In general, Polish research of medical gases is very much clinical in nature, covering new applications and safety of medical gases in medicine; on the other hand there are several academic centers pursuing preclinical studies, and elaborating basic theories of gas physiology and mathematical modeling of gas exchange. What dominates is research dealing with oxygen and ozone as well as studies of anesthetic gases and their applications. Finally, several research directions involving noble gas, hydrogen and hydrogen sulfide for cell protection, only begin to gain recognition of basic scientists and clinicians. However, further developments require more monetary spending on research and clinical testing as well as formation of new collective bodies for coordinating efforts in this matter.

Abstract: pH variation in sewers has a significant effect on hydrogen sulfide production and emissions, and hence its accurate prediction is critical for the optimization of mitigation strategies. In this study, the nature and dynamics of pH variation in a sewer system is examined. Three sewer systems collecting domestic wastewater were monitored, with pH in all cases showing large diurnal variations. pH in fresh sewage in all three cases had a very similar trend with maximum pH in the range of 8.5-8.7. pH variation in fresh sewage followed the same pattern as the sewage flow rate, suggesting that sewage pH is influenced by household water use. Nitrogen content of the wastewater was found to be the most influential factor causing pH variation in fresh sewage, with the total ammonium concentration variation well correlated with the pH variation. A methodology for predicting pH variation in sewers is developed and calibration protocols proposed. The methodology, which is based on the concept of charge balance, was validated using titration curves and field pH data. Measurement of the total ammonium concentration in fresh sewage was found necessary and adequate for the calibration of the charge balance-based pH model.

Abstract: Hydrogen sulfide (H2S) has recently emerged as an important mediator of mammalian cardiovascular homeostasis. In nonmammalian vertebrates, little is known about the cardiac effects of H2S. This study aimed to evaluate, in the avascular heart of the frog, Rana esculenta, whether and to what extent H2S affects the cardiac performance, and what is the mechanism of action responsible for the observed effects. Results were analyzed in relation to those obtained in the rat heart, used as the mammalian model. Isolated and perfused (working and Langendorff) hearts, Western blot analysis, and modified biotin switch (S-sulfhydration) assay were used. In the frog heart, NaHS (used as H2S donor, 10(-12)/10(-7) M) dose-dependently decreased inotropism.
This effect was reduced by glibenclamide (KATP channels blocker), N(G)-monomethyl-L-arginine (NOS inhibitor), 1H-[1,2,4]oxadiazolo-[4,3-a]quinoxalin-1-one (guanylyl cyclase inhibitor), KT5823 (PKG inhibitor), and it was blocked by Akt1/2 (Akt inhibitor) and by detergent Triton X-100. In the rat, in addition to the classic negative inotropic effect, NaHS (10(-12)/10(-7) M) exhibited negative lusitropism. In both frog and rat hearts, NaHS treatment induced Akt and eNOS phosphorylation and an increased cardiac protein S-sulfhydration that, in the rat heart, includes phospholamban. Our data suggest that H2S represents a phylogenetically conserved cardioactive molecule. Results obtained on the rat heart extend the role of H2S also to cardiac relaxation. H2S effects involve KATP channels, the Akt/NOS-cGMP/PKG pathway, and S-sulfhydration of cardiac proteins.


Abstract: In this large-scale longitudinal study conducted in rural Southern India, we compared a presence/absence hydrogen sulfide (H2S) test with quantitative assays for total coliforms and Escherichia coli as measures of water quality, health risk, and water supply vulnerability to microbial contamination. None of the three indicators showed a significant association with child diarrhea. The presence of H2S in a water sample was associated with higher levels of total coliform species that may have included E. coli but that were not restricted to E. coli. In addition, we observed a strong relationship between the percent positive H2S test results and total coliform levels among water source samples (R(2) = 0.87). The consistent relationships between H2S and total coliform levels indicate that presence/absence of H2S tests provide a cost-effective option for assessing both the vulnerability of water supplies to microbial contamination and the results of water quality management and risk mitigation efforts.


Abstract: Cystathionine gamma-lyase (CSE), one of three enzymes in the trans-sulfuration pathway, is responsible for the production of endogenous hydrogen sulfide (H2S) using L-cysteine or L-homocysteine as a substrate. The regulatory mechanism of CSE by exogenous H2S remains unknown. The transcription and expression of the CSE gene regulated by exogenous H2S at approximately physiologic concentrations was investigated using luciferase assay, Western blotting, and quantitative RT-PCR. The results revealed that exogenous H2S down-regulates the transcription and expression of CSE in mammalian cells at 10-80 μM. Exogenous H2S at 120 μM increases the transcription and expression of CSE significantly. At a concentration of exogenous H2S over 160 μM, the transcription and expression of CSE are inhibited completely. These findings suggest that CSE expression has not only a feedback to the enzyme itself at lower concentrations of exogenous H2S but also can be up-regulated at higher concentrations, and H2S may become toxic at higher levels.


Abstract: Numerous protein engineering studies have focused on increasing the thermostability of fungal cellulases to improve production of fuels and chemicals from lignocellulosic feedstocks. However, the engineered enzymes still undergo thermal inactivation at temperatures well below the inactivation temperatures of hyperthermophilic cellulases. In this report, we investigated the role of free cysteines in the thermal inactivation of wild-type and engineered fungal family 6 cellobiohydrolases (Cel6A). The mechanism of thermal inactivation of Cel6A is consistent with disulfide bond degradation and thiol-disulfide exchange. Circular dichroism spectroscopy revealed that a thermostable variant lacking free cysteines refolds to a native-like structure and retains activity after heat treatment over the pH range 5-9. Whereas conserved disulfide bonds
are essential for retaining activity after heat treatment, free cysteines contribute to irreversible thermal inactivation in engineered thermostable Cel6A as well as Cel6A from Hypocrea jecorina and Humicola insolens.

(47) Ramos I, Perez R, Fdz-Polanco M. Microaerobic desulphurisation unit: a new biological system for the removal of H(2)S from biogas. Bioresour Technol 2013 Aug;142:633-40. Abstract: A new biotechnology for the removal of H2S from biogas was devised. The desulphurisation conditions present in microaerobic digesters were reproduced inside an external chamber called a microaerobic desulphurisation unit (MDU). A 10 L-unit was inoculated with 1L of digested sludge in order to treat the biogas produced in a pilot digester. During the 128 d of research under such conditions, the average removal efficiency was 94%. The MDU proved to be robust against fluctuations in biogas residence time (57-107 min), inlet H2S concentration (0.17-0.39% v/v), O2/H2S supplied ratio (17.3-1.4 v/v), and temperature (20-35 degrees C). Microbiological analysis confirmed the presence of at least three genera of sulphide-oxidising bacteria. Approximately 60% of all the H2S oxidised was recovered from the bottom of the system in the form of large solid S(0) sheets with 98% w/w of purity. Therefore, this system could become a cost-effective alternative to the conventional biotechniques for biogas desulphurisation.

(48) Liu Z, Han Y, Li L, Lu H, Meng G, Li X, et al. The hydrogen sulfide donor, GYY4137, exhibits anti-atherosclerotic activity in high fat fed apolipoprotein E(-/-) mice. Br J Pharmacol 2013 Aug;169(8):1795-809. Abstract: BACKGROUND AND PURPOSE: Atherosclerosis is associated with reduced vascular hydrogen sulfide (H2 S) biosynthesis. GYY4137 is a novel slow-releasing H2 S compound that may effectively mimic the time course of H2 S release in vivo. However, it is not known whether GYY4137 affects atherosclerosis. EXPERIMENTAL APPROACH: RAW 264.7 cells and human blood monocyte-derived macrophages were incubated with oxidized low density lipoprotein (ox-LDL) with/without GYY4137. ApoE(-/-) mice were fed a high-fat diet for 4 weeks and administered GYY4137 for 30 days. Lipid and atherosclerotic lesions were measured by oil red O staining. Endothelium-dependent relaxation was assessed in response to acetylcholine. Superoxide production was detected by dihydroethidium staining. Expression of mRNA and protein were evaluated by quantitative real-time PCR and Western blot. KEY RESULTS: GYY4137 inhibited ox-LDL-induced foam cell formation and cholesterol esterification in cultured cells. GYY4137 decreased the expression of lectin-like ox-LDL receptor-1, iNOS, phosphorylated IkappaBalpha, NF-kappaB, ICAM-1, VCAM-1 and chemokines, including CXCL2, CXC4, CXL10 and CCL17, but increased the scavenger protein CD36, in ox-LDL-treated RAW 264.7 cells. In vivo, GYY4137 decreased aortic atherosclerotic plaque formation and partially restored aortic endothelium-dependent relaxation in apoE(-/-) mice. GYY4137 decreased ICAM-1, TNF-alpha and IL-6 mRNA expression as well as superoxide (O2 (-) ) generation in aorta. In addition, GYY4137 increased aortic eNOS phosphorylation and expression of PI3K, enhanced Akt Ser(473) phosphorylation and down-regulated the expression of LOX-1. CONCLUSION AND IMPLICATIONS: GYY4137 inhibits lipid accumulation induced by ox-LDL in RAW 264.7 cells. In vivo, GYY4137 decreased vascular inflammation and oxidative stress, improved endothelial function and reduced atherosclerotic plaque formation in apoE(-/-) mice.

(49) Nicolau LA, Silva RO, Damasceno SR, Carvalho NS, Costa NR, Aragao KS, et al. The hydrogen sulfide donor, Lawesson's reagent, prevents alendronate-induced gastric damage in rats. Braz J Med Biol Res 2013 Aug;46(8):708-14. Abstract: Our objective was to investigate the protective effect of Lawesson's reagent, an H2S donor, against alendronate (ALD)-induced gastric damage in rats. Rats were pretreated with saline or Lawesson's reagent (3, 9, or 27 micromol/kg, po) once daily for 4 days. After 30 min, gastric damage was induced by ALD (30 mg/kg) administration by gavage. On the last day of treatment, the animals were killed 4 h after ALD.
administration. Gastric lesions were measured using a computer planimetry program, and gastric corpus pieces were assayed for malondialdehyde (MDA), glutathione (GSH), proinflammatory cytokines [tumor necrosis factor (TNF)-alpha and interleukin (IL)-1beta], and myeloperoxidase (MPO). Other groups were pretreated with glibenclamide (5 mg/kg, ip) or with glibenclamide (5 mg/kg, ip)+diazoxide (3 mg/kg, ip). After 1 h, 27 micromol/kg Lawesson's reagent was administered. After 30 min, 30 mg/kg ALD was administered. ALD caused gastric damage (63.35+/-9.8 mm²); increased levels of TNF-alpha, IL-1beta, and MDA (2311+/-302.3 pg/mL, 901.9+/-106.2 pg/mL, 121.1+/-4.3 nmol/g, respectively); increased MPO activity (26.1+/-3.8 U/mg); and reduced GSH levels (180.3+/-21.9 microg/g). ALD also increased cystathionine-gamma-lyase immunoreactivity in the gastric mucosa. Pretreatment with Lawesson's reagent (27 micromol/kg) attenuated ALD-mediated gastric damage (15.77+/-5.3 mm²); reduced TNF-alpha, IL-1beta, and MDA formation (1502+/-150.2 pg/mL, 632.3+/-43.4 pg/mL, 78.4+/-7.6 nmol/g, respectively); lowered MPO activity (11.7+/-2.8 U/mg); and increased the level of GSH in the gastric tissue (397.9+/-40.2 microg/g). Glibenclamide alone reversed the gastric protective effect of Lawesson's reagent. However, glibenclamide plus diazoxide did not alter the effects of Lawesson's reagent. Our results suggest that Lawesson's reagent plays a protective role against ALD-induced gastric damage through mechanisms that depend at least in part on activation of ATP-sensitive potassium (KATP) channels.

Abstract: Tumour necrosis factor-alpha (TNF-alpha) is a major contributor to the pathogenesis of insulin resistance associated with obesity and type 2 diabetes. It has been found that endogenous hydrogen sulfide (H2 S) contributes to the pathogenesis of diabetes. We have hypothesized that TNF-alpha-induced insulin resistance is involved in endogenous H2 S generation. The aim of the present study is to investigate the role of endogenous H2 S in TNF-alpha-induced insulin resistance by studying 3T3-L1 adipocytes. We found that treatment of 3T3-L1 adipocytes with TNF-alpha leads to deficiency in insulin-stimulated glucose consumption and uptake and increase in endogenous H2 S generation. We show that cystathionine gamma-lyase (CSE) is catalysed in 3T3-L1 adipocytes to generate H2 S and that CSE expression and activity are upregulated by TNF-alpha treatment. Inhibited CSE by its potent inhibitors significantly attenuates TNF-alpha-induced insulin resistance in 3T3-L1 adipocytes, whereas H2 S treatment of 3T3-L1 adipocytes impairs insulin-stimulated glucose consumption and uptake. These data indicate that endogenous CSE/H2 S system contributes to TNF-alpha-caused insulin resistance in 3T3-L1 adipocytes. Our findings suggest that modulation of CSE/H2 S system is a potential therapeutic avenue for insulin resistance.

Abstract: A chemical-biological process was performed to remove a high concentration of H2S in biogas. The high iron concentration tolerance (20gL(-1)) of Acidithiobacillus ferrooxidans CP9 provided sufficient ferric iron level for stable and efficient H2S elimination. A laboratory-scale apparatus was setup for a 45 d operation to analyze the optimal conditions. The results reveal that the H2S removal efficiency reached 98% for 1500ppm H2S. The optimal ferric iron concentration was kept between 9 and 11gL(-1) with a cell density of 10(8)CFUg(-1) granular activated carbon and a loading of 15gSm(-3)h(-1). In pilot-scale studies for biogas purification, the average inlet H2S concentration was 1645ppm with a removal efficiency of up to 97% for a 311d operation and an inlet loading 40.8gSm(-3)h(-1). When 0.1% glucose was added, the cell density increased twofold under the loading of 65.1gSm(-3)h(-1) with an H2S removal efficiency still above 96%. The analysis results of the distribution of microorganisms in the biological reactor
by DGGE show that microorganism populations of 96.7% and 62.7% were identical to the original strain at day 200 and day 311, respectively. These results clearly demonstrate that ferric iron reduction by H2S and ferrous iron oxidation by A. ferrooxidans CP9 are feasible processes for the removal of H2S from biogas.

Abstract: Chitosan (CS) films incorporating the antimicrobial compound ethyl-N(alpha)-dodecanoyl-l-arginate (LAE) were developed for food packaging applications. Cast chitosan films were made with 1, 5 or 10% LAE and 20% glycerol in the film forming solution. Optical properties, release of LAE and antimicrobial activity of developed films was determined. The minimum inhibitory concentration (MIC) and the minimum biocide concentration (MBC) of LAE were determined. CS films with LAE were transparent and uniform, without discontinuities or visible particles and no visual differences could be perceived between CS and CS-LAE films. When in contact with an aqueous food simulant, the agent was fully released following a Fickian behavior in a few hours at 4 and 28 degrees C. Antimicrobial activity of films against mesophiles, psychrophiles, Pseudomonas spp., coliforms, lactic acid bacteria, hydrogen sulfide-producing bacteria, yeast and fungi, was evaluated at two, six and eight days for its application on chicken breast fillets. Films were active against bacteria, yeasts and fungi in liquid and solid media. CS films evidenced antimicrobial activity in the range 0.47-2.96 log reductions, while CS-5%LAE film produced 1.78-5.81 log reduction. Results highlighted that LAE incorporation in a chitosan-based packaging structure may provide a relevant antimicrobial activity that could improve the stability of fresh poultry products.

Abstract: A novel hyperthermophilic, anaerobic archaean, strain Bio-pl-0405IT2(T), was isolated from a hydrothermal chimney sample collected from the East Pacific Rise at 2700 m depth in the 'Sarah Spring' area (7 degrees 25' 24'' S 107 degrees 47' 66'' W). Cells were irregular, motile cocci (0.8-1.5 microm in diameter) and divided by constriction. Growth was observed at temperatures between 60 degrees C and 95 degrees C with an optimum at 80 degrees C. The pH range for growth was between pH 4.0 and pH 8.0 with an optimum around pH 7.0. Strain Bio-pl-0405IT2(T) grew at salt concentrations of 1-5% (w/v) NaCl with an optimum at 2%. The novel isolate grew by fermentation or sulphur respiration on a variety of organic compounds. It was a chemoorganoheterotrophic archaean growing preferentially with yeast extract, peptone and tryptone as carbon and energy sources and sulphur and organic compounds as electron acceptors; it also grew on maltose and starch. Sulphur or l-cystine were required for growth and were reduced to hydrogen sulfide. The strain was resistant to rifampicin, chloramphenicol, vancomycin and kanamycin (all at 100 microg ml(-1)) but was sensitive to tetracycline. The G+C content of its genomic DNA was 53.6 mol%. Phylogenetic analysis of the almost complete 16S rRNA gene sequence (1450 bp) of strain Bio-pl-0405IT2(T) showed that the novel isolate belonged to the genus Thermococcus. DNA-DNA hybridization values with the two closest relatives Thermococcus hydrothermalis AL662(T) and Thermococcus celer JCM 8558(T) were below the threshold value of 70%. On the basis of the physiological and genotypic distinctness, we propose a novel species, Thermococcus prieurii sp. nov. The type strain is Bio-pl-0405IT2(T) (= CSUR P577(T) = JCM 16307(T)).

Abstract: First principles total energy calculations have been performed to study the
hydrogen sulfide (H2S) adsorption on silicane, an unusual one monolayer of Si(111) surface hydrogenated on both sides. The H2S adsorption may take place in dissociative or non-dissociative forms. Silicane has been considered as: (A) non-doped with a hydrogen vacancy, and doped in two main configurations; (B) with an aluminum replacing a hydrogen atom and (C-n; n = 1, 2, 3) with an aluminum replacing a silicon atom at a lattice site. In addition, three supercells; 4x4, 3x3 and 2x2 have been explored for both non-doped and doped silicane. The non-dissociative adsorption takes place in geometries (A), (C-1), (C-2) and (C-3) while the dissociative in (B). Adsorption energies of the dissociative case are larger than those corresponding to the non-dissociated cases. In the dissociative adsorption, the molecule is fragmented in a HS structure and a H atom which are bonded to the aluminum to form a H-S-Al-H structure. The presence of the doping produces some electronic changes as the periodicity varies. Calculations of the total density of states (DOS) indicate that in most cases the energy gap decreases as the periodicity changes from 4x4 to 2x2. The features of the total DOS are explained in terms of the partial DOS. The reported charge density plots explain quite well the chemisorptions and physisorptions of the molecule on silicane in agreement with adsorption energies


Abstract: PURPOSE: Because neuronal released endogenous H2S has a key role in relaxation of the bladder outflow region, we investigated the mechanisms involved in H2S dependent inhibitory neurotransmission to the pig bladder neck. MATERIALS AND METHODS: Bladder neck strips were mounted in myographs for isometric force recording and simultaneous measurement of intracellular Ca(2+) and tension. RESULTS: On phenylephrine contracted preparations electrical field stimulation and the H2S donor GYY4137 evoked frequency and concentration dependent relaxation, which was reduced by desensitizing capsaicin sensitive primary afferents with capsaicin, and the blockade of adenosine 5'-triphosphate dependent K(+) channels, cyclooxygenase and cyclooxygenase-1 with glibenclamide, indomethacin and SC560, respectively. Inhibition of vanilloid, transient receptor potential A1, transient receptor potential vanilloid 1, vasoactive intestinal peptide/pituitary adenyl cyclase-activating polypeptide and calcitonin gene-related peptide receptors with capsazepine, HC030031, AMG9810, PACAP6-38 and CGRP8-37, respectively, also decreased electrical field stimulation and GYY4137 responses. H2S relaxation was not changed by guanylyl cyclase, protein kinase A, or Ca(2+) activated or voltage gated K(+) channel inhibitors. GYY4137 inhibited the contractions induced by phenylephrine and by K(+) enriched (80 mM) physiological saline solution. To a lesser extent it decreased the phenylephrine and K(+) induced increases in intracellular Ca(2+). CONCLUSIONS: H2S produces pig bladder neck relaxation via activation of adenosine 5'-triphosphate dependent K(+) channel and by smooth muscle intracellular Ca(2+) desensitization dependent mechanisms. H2S also promotes the release of sensory neuropeptides and cyclooxygenase-1 pathway derived prostanoids from capsaicin sensitive primary afferents via transient receptor potential A1, transient receptor potential vanilloid 1 and/or related ion channel activation


Abstract: Sulfheydril groups on protein Cys residues undergo an array of oxidative reactions and modifications, giving rise to a virtual redox zip code with physiological and pathophysiological relevance for modulation of protein structure and functions. While over two decades of studies have established NO-dependent S-nitrosylation as ubiquitous and fundamental for the regulation of diverse protein activities, proteomic methods for studying H2S-dependent S-sulfhydration have only recently been described and now
suggest that this is also an abundant modification with potential for global physiological importance. Notably, protein S-sulfhydration and S-nitrosylation bear striking similarities in terms of their chemical and biological determinants, as well as reversal of these modifications via group-transfer to glutathione, followed by the removal from glutathione by enzymes that have apparently evolved to selectively catalyze denitrosylation and desulfhydration. Here we review determinants of protein and low-molecular-weight thiol S-sulfhydration/desulfhydration, similarities with S-nitrosylation/denitrosylation, and methods that are being employed to investigate and quantify these gasotransmitter-mediated cell signaling systems.


Abstract: Cystinosis is a lysosomal storage disorder caused by the accumulation of the amino acid cystine due to genetic defects in the CTNS gene, which encodes cystinosin, the lysosomal cystine transporter. Although many cellular dysfunctions have been described in cystinosis, the mechanisms leading to these defects are not well understood. Here, we show that increased lysosomal overload induced by accumulated cystine leads to cellular abnormalities, including vesicular transport defects and increased endoplasmic reticulum (ER) stress, and that correction of lysosomal transport improves cellular function in cystinosis. We found that Rab27a was expressed in proximal tubular cells (PTCs) and partially colocalized with the lysosomal marker LAMP-1. The expression of Rab27a but not other small GTPases, including Rab3 and Rab7, was downregulated in kidneys from Ctns-/- mice and in human PTCs from cystinotic patients. Using total internal reflection fluorescence microscopy, we found that lysosomal transport is impaired in Ctns-/- cells. Ctns-/- cells showed significant ER expansion and a marked increase in the unfolded protein response-induced chaperones Grp78 and Grp94. Upregulation of the Rab27a-dependent vesicular trafficking mechanisms rescued the defective lysosomal transport phenotype and reduced ER stress in cystinotic cells. Importantly, reconstitution of lysosomal transport mediated by Rab27a led to decreased lysosomal overload, manifested as reduced cystine cellular content. Our data suggest that upregulation of the Rab27a-dependent lysosomal trafficking and secretory pathways contributes to the correction of some of the cellular defects induced by lysosomal overload in cystinosis, including ER stress.


Abstract: BACKGROUND: The study was designed to explore if sulfur dioxide (SO2) preconditioning increased antioxidative capacity in rat with myocardial ischemia reperfusion (I/R) injury. METHODS: The myocardial I/R model was made by left coronary artery ligation for 30min and reperfusion for 120min in rats. Myocardial infarct size and plasma lactate dehydrogenase (LDH) and creatine kinase (CK) activities, plasma superoxide dismutase (SOD), malondialdehyde (MDA), glutathione peroxidase (GSH-Px) and glutathione (GSH) changes were detected for the rats. The contents of myocardial hydrogen sulfide (H2S) and nitric oxide (NO) were measured. Myocardial protein expressions of SOD1, SOD2, cystathionine gamma-lyase (CSE) and iNOS were tested using Western blot. RESULTS: Myocardial infarction developed and plasma CK and LDH activities were significantly increased in I/R group compared with those in control group, but SO2 preconditioning significantly reduced myocardial infarct size, and plasma CK and LDH activities. SO2 preconditioning successfully increased plasma SOD, GSH and GSH-Px levels and myocardial SOD1 protein expression, but decreased MDA level in rats of I/R group. Compared with controls, the myocardial H2S level and CSE expression were decreased after I/R, but myocardial NO level and iNOS expression were increased. With the treatment of SO2, myocardial H2S level and CSE expression were increased, but
myocardial NO level and iNOS expression were decreased compared with those in I/R group. CONCLUSIONS: SO2 preconditioning could significantly reduce I/R-induced myocardial injury in vivo in association with increased myocardial antioxidative capacity, upregulated myocardial H2S/CSE pathway but downregulated NO/iNOS pathway

Abstract: Werner syndrome (WS) protein is involved in DNA repair and its truncation causes Werner syndrome, an autosomal recessive genetic disorder with a premature aging phenotype. WRN protein mutation is currently known as the primary cause of WS. In cultured WS fibroblasts, we found an increase in cytosolic aggregates and hypothesized that the phenotype is indirectly related to an excess activation of the mTOR (mammalian target of rapamycin) pathway, leading to the formation of protein aggregates in the cytosol with increasing levels of oxidative stress. As we found that the expression levels of the two main H2S producing enzymes, cystathionine beta synthase and cystathionine gamma lyase, were lower in WS cells compared to normal, we investigated the effect of administration of H2S as NaHS (50muM). NaHS treatment blocked mTOR activity, abrogated protein aggregation and normalized the phenotype of WS cells. Similar results were obtained by treatment with the mTOR inhibitor rapamycin. This is the first report suggesting that hydrogen sulfide administered as NaHS restores proteostasis and cellular morphological phenotype of WS cells and hints to the importance of transsulfuration pathway in WS

Abstract: Nitric oxide (NO) is a second messenger with multifunction that is involved in plant growth, development and the acquisition of stress tolerance. In recent years, hydrogen sulphide (H(2)S) has been found to have similar functions, but crosstalk between NO and H(2)S in the acquisition of heat tolerance is not clear. In this study, pretreatment with the NO donor sodium nitroprusside (SNP) improved the survival percentage of maize seedlings and alleviated an increase in electrolyte leakage and a decrease in tissue vitality as well as accumulation of malondialdehyde, indicating that pretreatment with SNP improved the heat tolerance of maize seedlings. In addition, pretreatment with SNP enhanced the activity of L-cystine desulphhydrase, which, in turn, induced accumulation of endogenous H(2)S, while application of H(2)S donors, NaHS and GYY4137, increased endogenous H(2)S content, followed by mitigating increase in electrolyte leakage and enhanced survival percentage of seedlings under heat stress. Interestingly, SNP-induced heat tolerance was enhanced by application of NaHS and GYY4137, but was eliminated by inhibitors of H(2)S synthesis DL-propargylglycine, aminooxyacetic acid, potassium pyruvate and hydroxylamine, and the H(2)S scavenger hypotaurine. All of the above-mentioned results suggest that SNP pretreatment could improve heat tolerance, and H(2)S may be a downstream signal molecule in NO-induced heat tolerance of maize seedlings

Abstract: H2S may serve as an important neuroprotectant. The present experiments were performed to determine whether H2S could attenuate the injuries sustained by the medullary respiratory centers of neonatal rats that were subjected to cigarette smoke exposure (CS) in utero. Pregnant SD rats were divided into 4 exposure groups: control, CS, CS+NaHS (donor of H2S) and NaHS. Hypoxia decreased the burst frequencies of the hypoglossal rootlets of the medullary slices in CS neonatal rats, and NaHS offset the hypoxia-induced respiratory suppression. Nissl staining indicated that NaHS alleviated
the injuries that were sustained by neurons after CS in utero. NaHS also decreased the number of TUNEL-positive neurons and the expression of activated caspase-3 protein in the medulla oblongata of CS neonatal rats. Furthermore, NaHS promoted Bcl-2 protein expression and reduced Bax protein and mRNA expression in the medulla oblongata of CS neonatal rats. Therefore, the present study indicates that the anti-apoptotic effect of H2S protects rat medullary respiratory centers from injuries that would otherwise be sustained from in utero CS exposure.

Abstract: INTRODUCTION: Hydrogen sulfide (H2S) known as a gasotransmitter is increasingly recognized for its anti-adhesive, anti-inflammatory and vasoactive properties. Due to these properties, we analysed anti-thrombotic effects of H2S and the participation of the nitric oxide synthase (NOS)-pathway. MATERIALS AND METHODS: In individual venules of the ear of hairless SKH1-hr mice, thrombus formation was induced using a phototoxic light/dye-injury model and intravital fluorescence microscopy. Animals were treated intravenously with the H2S donor Na2S or NaCl as control. In a second setting, the NOS inhibitor L-NAME was applied intraperitoneally as a bolus 12h prior to Na2S treatment and thrombus induction. Blood and ear tissue were sampled after microscopy for assessment of plasma concentrations of soluble (s)P-selectin, sE-selectin, sVCAM-1 and sICAM-1 and expression of endothelial (e)NOS and inducible (i)NOS, respectively.
RESULTS: When mice were treated with Na2S, venular thrombus formation was significantly delayed versus that in animals of the NaCl-treated control group. While plasma levels of pro-thrombotic adhesion molecules were not affected by Na2S, immunohistochemistry of the vessel walls showed a significant up-regulation of eNOS and iNOS expression within the Na2S-treated group. The delay of thrombus formation in the Na2S-group was partly but significantly reverted by application of L-NAME.
CONCLUSIONS: The anti-thrombotic efficacy of H2S involves the NOS-pathway and may be of preventive and therapeutic value for clinical disorders with increased risk of thrombotic events.

Abstract: Wood ash addition to biogas plants represents an alternative to commonly used landfilling by improving the reactor performance, raising the pH and alleviating potential limits of trace elements. This study is the first on the effects of wood ash on reactor conditions and microbial communities in cattle slurry-based biogas reactors. General process parameters [temperature, pH, electrical conductivity, ammonia, volatile fatty acids, carbon/nitrogen (C/N), total solids (TS), volatile solids, and gas quantity and quality] were monitored along with molecular analyses of methanogens by polymerase chain reaction-denaturing gradient gel electrophoresis and modern microarrays (archaea and bacteria). A prompt pH rise was observed, as was an increase in C/N ratio and volatile fatty acids. Biogas production was inhibited, but recovered to even higher production rates and methane concentration after single amendment. High sulphur levels in the wood ash generated hydrogen sulphide and potentially hampered methanogenesis. Methanosarcina was the most dominant methanogen in all reactors; however, diversity was higher in ash-amended reactors. Bacterial groups like Firmicutes, Proteobacteria and Acidobacteria were favoured, which could improve the hydrolytic efficiency of the reactors. We recommend constant monitoring of the chemical composition of the used wood ash and suggest that ash amendment is adequate if added to the substrate at a rate low enough to allow adaptation of the microbiota (e.g. 0.25 g g(-1) TS). It could further help to enrich digestate with important nutrients, for example phosphorus, calcium and magnesium, but further experiments are required for the evaluation of wood ash concentrations that are tolerable for anaerobic digestion.

Abstract: Nonsteroidal anti-inflammatory drugs (NSAIDs) have long been used to treat pain, fever, and inflammation. However, mounting evidence shows that NSAIDs, such as aspirin, have very promising antineoplastic properties. The chemopreventive, antiproliferative behaviour of NSAIDs has been associated with both their inactivation of cyclooxygenases (COX) and their ability to induce apoptosis via pathways that are largely COX-independent. In this review, the various proapoptotic pathways induced by traditional and novel NSAIDs such as phospho-NSAIDs, hydrogen sulfide-releasing NSAIDs and nitric oxide-releasing NSAIDs in mammalian cell lines are discussed, as well as the proapoptotic effects of NSAIDs on budding yeast which retains the hallmarks of mammalian apoptosis. The significance of these mechanisms in terms of the role of NSAIDs in effective cancer prevention is considered.