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Abstract: BACKGROUND: Reversible, depressed cardiac function is frequently encountered during septic shock and commonly called septic cardiomyopathy. Previous studies demonstrated reduced ejection fraction and left ventricular dilatation in both humans and animal models. However, the majority of the studies in humans excluded pre-existing cardiac disease and animal studies were performed on healthy specimen and/or without vasopressor support during sepsis. In order to more closely mimic the actual patients’ conditions on intensive care units and to assess the influence of both cardiac comorbidity and vasopressor support on septic cardiomyopathy, we evaluated the left ventricular function in a porcine model of resuscitated septic shock with pre-existing atherosclerosis. METHODS: Hypercholesterolaemic, atherosclerotic pigs due to homozygous low-density lipoprotein receptor mutation and high-fat diet were anaesthetised and surgically instrumented. Faecal peritonitis was induced by inoculation of autologous faeces into the peritoneal cavity in n = 8 animals; n = 5 pigs underwent sham procedure. Sepsis resuscitation included administration of fluids and noradrenaline. Left ventricular function was analysed via pressure-conductance catheters before, 12 and 24 h after the induction of sepsis. RESULTS: The main findings were impaired ventricular dilatation (no significant change in the left ventricular end-diastolic volume) and unchanged ejection fraction in septic pigs with pre-existing atherosclerosis. The relaxation time constant tau decreased while dp/dtmax increased. Cardiac nitrotyrosine formation increased while expression of the endogenous hydrogen sulphide (H2S)-producing enzyme cystathionine gamma-lyase (CSE) decreased.
CONCLUSIONS: The data of the present study are in conflict with previously published data from healthy animal models, most likely as a result of ongoing resuscitation including noradrenaline treatment or intrinsic pathophysiologic processes of the pre-existing atherosclerosis. Moreover, increased nitrotyrosine formation and decreased expression of CSE suggest the implication of augmented oxidative/nitrosative stress and/or reduced bioavailability of nitric oxide as well as diminished endogenous H2S release in the pathophysiology of septic cardiomyopathy

Abstract: A novel fluorescent probe for H2S was developed based on a far-red emitting indole-BODIPY, which was decorated with morpholine and 2,4-dinitrobenzenesulfonyl (DNBS) group. This probe showed rapid response (t1/2=3min), high selectivity and sensitivity for H2S with significant colorimetric and fluorescence OFF-ON signals, which was triggered by cleavage of 2,4-dinitrobenzenesulfonyl group. This probe could quantitatively detect the concentrations of H2S ranging from 0 to 60μM, and the detection of limit was found to be as low as 26nM. Cell imaging results indicated that the probe could detect and visualize H2S in the living cells

Abstract: Schizosaccharomyces was initially considered as a spoilage yeast because of the production of undesirable metabolites such as acetic acid, hydrogen sulfide, or acetaldehyde, but it currently seems to be of great value in enology. Nevertheless, Schizosaccharomyces can reduce all of the malic acid in must, leading to malolactic fermentation. Malolactic fermentation is a highly complicated process in enology and leads to a higher concentration of biogenic amines, so the use of Schizosaccharomyces pombe can be an excellent tool for assuring wine safety. Schizosaccharomyces also has much more potential than only reducing the malic acid content, such as increasing the level of pyruvic acid and thus the vinlyphenolic pyranoanthocyanin content. Until now, few commercial strains have been available and little research on the selection of appropriate yeast strains with such potential has been conducted. In this study, selected and wild Sc. pombe strains were used along with a Saccharomyces cerevisiae strain to ferment red grape must. The results showed significant differences in several parameters including non-volatile and volatile compounds, anthocyanins, biogenic amines and sensory parameters.


Abstract: A novel and low-cost colorimetric sensor for the determination of hydrogen sulphide in environmental samples has been developed. This sensor is based on the immobilization of the reagent N,N-Dimethyl-p-phenylenediamine and FeCl3 in paper support, in which the H2S is adsorbed in order to give rise to the formation of methylene blue as reaction product. The sensor has been applied to determine H2S in water and air samples. Two different sampling systems for H2S caption from the air have been assayed: active and passive sampling. The analytical properties of the different systems have been obtained and compared. The analytical signals, corresponding to the methylene blue, have been obtained measuring the absorbance by conventional reflectance diffuse or using different algorithms for quantifying color intensity. The results obtained with both measurement procedures were comparable, with a detection limit of 1.11 and 1.12mLm(-3) for air samples (active and passive), and 0.5mgL(-1) for water samples. The developed sensor provides good accuracy and precision (RSD<12%) and simplifies significantly the analytical measurements because it avoids the need of preparing derivatization reagents, sample handling and allows in situ measurements. The reaction product obtained is highly stable in this support and no provide any blank signal. Under the optimal conditions, the proposed method exhibit excellent visual sensitivity for the naked eye procedure, making the detection of H2S possible.


Abstract: Hexahydro-1,3,5-trinitro-1,3,5,-triazine (RDX) is a toxic and mobile groundwater contaminant common to military sites. This study compared in situ RDX degradation rates following bioaugmentation with Gordonia sp. strain KTR9 (henceforth KTR9) to rates under biostimulation conditions in an RDX-contaminated aquifer in Umatilla, OR. Bioaugmentation was achieved by injecting site groundwater (6000 L) amended with KTR9 cells (108 cells mL-1) and low carbon substrate concentrations (<1 mM fructose) into site wells. Biostimulation (no added cells) was performed by injecting groundwater amended with low (<1 mM fructose) or high (>15 mM fructose) carbon substrate concentrations in an effort to stimulate aerobic or anaerobic microbial activity, respectively. Single-well push-pull tests were conducted to measure RDX degradation rates for each treatment. Average rate coefficients were 1.2 day-1 for bioaugmentation and 0.7 day-1 for high carbon biostimulation; rate coefficients for low carbon biostimulation were not significantly different from zero (p values >/=0.060). Our results suggest that bioaugmentation with KTR9 is a feasible strategy for in situ biodegradation.
of RDX and, at this site, is capable of achieving RDX concentration reductions comparable to those obtained by high carbon biostimulation while requiring ~97% less fructose. Bioaugmentation has potential to minimize substrate quantities and associated costs, as well as secondary groundwater quality impacts associated with anaerobic biostimulation processes (e.g., hydrogen sulfide, methane production) during full-scale RDX remediation.

(6) Pu C, Peng X. To Battle Surface Traps on CdSe/CdS Core/Shell Nanocrystals: Shell Isolation versus Surface Treatment. J Am Chem Soc 2016 Jul 6;138(26):8134-42. Abstract: Electronic traps at the inorganic-organic interface of colloidal quantum dots (QDs) are detrimental to their luminescent properties. Several types of interface traps were identified for single-crystalline CdSe/CdS core/shell QDs, which were all found to be extrinsic to either the core/shell structure or their optical performance. The electron traps—presumably excess or unpassivated Cd surface sites—are shallow ones and could be readily isolated from the electron wave function of the excitons with more than approximately 2 monolayers of CdS shell. There were two identifiable deep hole traps within the bandgap of the QDs, i.e., the surface adsorbed H2S and unpassivated surface S sites. The surface adsorbed H2S could be removed by either degassing processes or photochemical decomposition of H2S without damaging the QDs. The unpassivated surface S sites could be removed by surface treatment with cadmium carboxylates. Understanding of the surface traps enabled establishment of new phosphine-free synthetic schemes for either single-precursor or successive-ion-layer-adsorption-and-reaction approach, which yielded CdSe/CdS core/shell QDs with near-unity photoluminescence quantum yield and monoexponential photoluminescence decay dynamics with 2-10 monolayers of CdS shell.

(7) Botos A, Biskupek J, Chamberlain TW, Rance GA, Stoppiello CT, Sloan J, et al. Carbon Nanotubes as Electrically Active Nanoreactors for Multi-Step Inorganic Synthesis: Sequential Transformations of Molecules to Nanoclusters and Nanoclusters to Nanoribbons. J Am Chem Soc 2016 Jul 6;138(26):8175-83. Abstract: In organic synthesis, the composition and structure of products are predetermined by the reaction conditions; however, the synthesis of well-defined inorganic nanostructures often presents a significant challenge yielding nonstoichiometric or polymorphic products. In this study, confinement in the nanoscale cavities of single-walled carbon nanotubes (SWNTs) provides a new approach for multistep inorganic synthesis where sequential chemical transformations take place within the same nanotube. In the first step, SWNTs donate electrons to reactant iodine molecules (I2), transforming them to iodide anions ([I-]). These then react with metal hexacarbonyls (M(CO)6, M = Mo or W) in the next step, yielding anionic nanoclusters [M6I14](2-), the size and composition of which are strictly dictated by the nanotube cavity, as demonstrated by aberration-corrected high resolution transmission electron microscopy, scanning transmission electron microscopy, and energy dispersive X-ray spectroscopy. Atoms in the nanoclusters [M6I14](2-) are arranged in a perfect octahedral geometry and can engage in further chemical reactions within the nanotube, either reacting with each other leading to a new polymeric phase of molybdenum iodide [Mo6I12]n or with hydrogen sulfide gas giving rise to nanoribbons of molybdenum/tungsten disulfide [MS2]n in the third step of the synthesis. Electron microscopy measurements demonstrate that the products of the multistep inorganic transformations are precisely controlled by the SWNT nanoreactor with complementary Raman spectroscopy revealing the remarkable property of SWNTs to act as a reservoir of electrons during the chemical transformation. The electron transfer from the host nanotube to the reacting guest molecules is essential for stabilizing the anionic metal iodide nanoclusters and for their further transformation to metal disulfide nanoribbons synthesized in the nanotubes in high yield.

persistent self-assembled polymersome capsules are shown to solubilise and stabilize a new hydrosulfide-containing (†), as well as hydroxylated (†), malachite green derivatives in their leuco-forms in aqueous buffer solution. Photoirradiation resulted in reversible hydroxide release/hydrogen sulfide generation. Notably, the efficient augmentation of H2S concentration to physiologically-relevant levels is shown

Abstract: Microbial souring in oil reservoirs produces toxic, corrosive hydrogen sulfide through microbial sulfate reduction, often accompanying (sea)water flooding during secondary oil recovery. With data from column experiments as constraints, we developed the first reactive-transport model of a new candidate inhibitor, perchlorate, and compared it with the commonly used inhibitor, nitrate. Our model provided a good fit to the data, which suggest that perchlorate is more effective than nitrate on a per mole of inhibitor basis. Critically, we used our model to gain insight into the underlying competing mechanisms controlling the action of each inhibitor. This analysis suggested that competition by heterotrophic perchlorate reducers and direct inhibition by nitrite produced from heterotrophic nitrate reduction were the most important mechanisms for the perchlorate and nitrate treatments, respectively, in the modeled column experiments. This work demonstrates modeling to be a powerful tool for increasing and testing our understanding of reservoir-souring generation, prevention, and remediation processes, allowing us to incorporate insights derived from laboratory experiments into a framework that can potentially be used to assess risk and design optimal treatment schemes

Abstract: The aim of the present study was to elucidate the roles of endothelium-derived hyperpolarizing factors (EDHFs) and nitric oxide (NO) in mediating the vasodilatation response to astragaloside IV and the effects of astragaloside IV on voltage-dependent Ca2+ channels and receptor-operated Ca2+ channels in rat thoracic aortic rings precontracted with potassium chloride (KCl; 60 mM) or phenylephrine (PHE; 1 microM). The results showed that astragaloside IV (1x10-4-3x10-1 g/l) concentration-dependently relaxed the contraction induced by KCl (10-90 mM) or PHE (1x10-9-3x10-5 microM) and inhibited concentration-contraction curves for the two vasoconstrictors in the aortic rings. Preincubation with Nomega-nitro-L-arginine methyl ester (L-NAME, 100 microM) significantly attenuated astragaloside IV-induced relaxation in the endothelium-intact and -denuded arterial rings precontracted with PHE. Astragaloside IV, following preincubation with L-NAME (100 microM) plus indomethacin (10 microM), exerted vasodilatation, which was depressed by tetraethylammonium (1 mM) and propargylglycine (100 microM), but not by carbeneoxolone (10 microM), catalase (500 U/ml) or probenecid hydrochloride (10 microM). The action mode of astragaloside IV was evident in comparison to nifedipine. Inhibition of PHE-induced contraction by astragaloside IV (100 mg/l) was more potent compared to inhibition of KCl-induced contraction, while inhibition of KCl-induced contraction by nifedipine (100 mg/l) was more potent compared to inhibition of PHE-induced contraction by nifedipine (100 mg/l). In addition, the combination of astragaloside IV and nifedipine exhibited synergistic and additive inhibitory effects on contraction evoked by KCl, which was similar to PHE. In conclusion, astragaloside IV, as a Ca2+ antagonist, relaxes the vessels through the blockade of superior receptor-operated Ca2+ and inferior voltage-dependent Ca2+ channels, which modulate NO from vascular endothelial cells and vascular smooth muscle cells, and EDHFs including K+ and hydrogen sulfide

(11) Thangaraj KR, Priyadarshini SJ, Qureshi IN, Joseph AJ, Balasubramanian KA, Ramachandran A. Plasma Citrulline, Glycans, and Hydrogen Sulfide in Patients With

Abstract: Enzymes in the sulfur network generate the signaling molecule, hydrogen sulfide (H2S), from the amino acids cysteine and homocysteine. Since it is toxic at elevated concentrations, cells are equipped to clear H2S. A canonical sulfide oxidation pathway operates in mitochondria, converting H2S to thiosulfate and sulfate. We have recently discovered the ability of ferric hemoglobin to oxidize sulfide to thiosulfate and iron-bound hydropolsulfides. In this study, we report that myoglobin exhibits a similar capacity for sulfide oxidation. We have trapped and characterized iron-bound sulfur intermediates using cryo-mass spectrometry and X-ray absorption spectroscopy. Further support for the postulated intermediates in the chemically challenging conversion of H2S to thiosulfate and iron-bound catenated sulfur products is provided by EPR and resonance Raman spectroscopy in addition to density functional theory computational results. We speculate that the unusual sensitivity of skeletal muscle cytochrome c oxidase to sulfide poisoning in ethylmalonic encephalopathy, resulting from the deficiency in a mitochondrial sulfide oxidation enzyme, might be due to the concentration of H2S by myoglobin in this tissue.

Abstract: Currently, the development of polymeric micelles combining diagnosis and targeted therapy is theoretically and practically significant in cancer treatment. In addition, it has been reported that cancer cells can produce large amounts of hydrogen sulfide (H2S) and their survival depends on the content of H2S. In this study, a series of N-(2-hydroxyethyl)-4-azide-1,8-naphthalimide ended amphiphilic diblock copolymer poly(2-hydroxyethyl methacrylate)-block-poly(methyl methacrylate) (N3-Nap-PHEMA-b-PMMA-N3) micelles were prepared. Around cancer tissues, the N3-Nap-PHEMA45-b-PMMA42-N3 micelles exhibited dual characteristics of monitoring H2S and H2S triggered charge reversal with the reduction of the azido group. The surface charge of N3-Nap-PHEMA45-b-PMMA42-N3 micelles reversed from negative to positive after monitoring H2S. With H2S triggered charge reversal, the cellular uptake of DOX-loaded N3-Nap-PHEMA45-b-PMMA42-N3 micelles was effectively enhanced through electrostatic attraction mediated targeting, and a fast doxorubicin (DOX) release rate was observed. The MTT assay demonstrated that N3-Nap-PHEMA45-b-PMMA42-N3 micelles were biocompatible to HeLa cells, and DOX-loaded N3-Nap-PHEMA45-b-PMMA42-N3 micelles showed enhanced cytotoxicity in HeLa cells in the presence of H2S. Furthermore, in vivo fluorescence imaging and biodistribution experiments revealed that DOX-loaded N3-Nap-PHEMA45-b-PMMA42-N3 micelles could provide good tumor imaging and accumulate in tumor tissue. Therefore, N3-Nap-PHEMA45-b-PMMA42-N3 micelles can be used as a promising platform for tumor diagnosis and therapy.

Abstract: Novel CuO nanoparticle-capped ZnO nanorods have been produced using a pulsed laser deposition (PLD) method. These nanorods are shown to grow by a CuO-nanoparticle-assisted vapor-solid-solid (V-S-S) mechanism. The photoluminescence (PL) accompanying ultraviolet illumination of these capped nanorod samples shows large variations upon exposure to trace quantities of H2S gas. The present data suggest that both the Cu-doped ZnO stem and the CuO capping nanoparticle contribute to optical H2S sensing with these CuO-ZnO nanorods. This study represents the first demonstration of
PL-based H2S gas sensing, at room temperature, with sub-ppm sensitivity. It also opens the way to producing CuO-ZnO nanorods by a V-S-S mechanism using gas-phase methods other than PLD.

Abstract: Leminorella is a member of Enterobacteriaceae family and was known previously as Enteric Group 57. Based upon genetic differences using DNA hybridization, it has three taxa: L. grimontii, Leminorella richardii, and Leminorella sp. strain 3. The third one is similar biochemically to the L. grimontii strains. The generic name has been derived on the name of a French microbiologist, Leon Le Minor. The biochemical properties includes being facultative anaerobes, growth on sheep blood, TSI, and MacConkey agar; hydrogen sulfide producer, l-arabinose fermenter, and tyrosine hydrolyzer; and are negative for d-mannose fermentation, urea, and lipase. They usually infect in adulthood and result in urinary tract infection, surgical site infection, bacteremia, peritonitis, respiratory tract infection, and soft tissue infection. We report the first case of L. grimontii sepsis in a very low birth weight neonate that died because of neonatal sepsis.

Abstract: In this article, the reaction mechanisms of H2S + (3)O2 formation by the HO2 + HS reaction without and with catalyst X (X = H2O, (H2O)2 and (H2O)3) have been investigated theoretically at the CCSD(T)/6-311++G(3df,2pd)//B3LYP/6-311+G(2df,2p) level of theory, coupled with rate constant calculations by using conventional transition state theory. Our results show that in the presence of catalyst X (X = H2O, (H2O)2 and (H2O)3) into the channel of H2S + (3)O2 formation, the reactions between the SH radical and HO2(H2O)n (n = 1-3) complexes are more favorable than the corresponding reactions of the HO2 radical with HS(H2O)n (n = 1-3) complexes due to the lower barrier of the former reactions and the higher concentrations of HO2(H2O)n (n = 1-3) complexes. Meanwhile, the catalytic effect of water, water dimers and water trimers is mainly taken from the contribution of a single water vapor molecule, since the total effective rate constant of HO2H2O + HS and H2OHO2 + HS reactions was, respectively, larger by 7-9 and 9-12 orders of magnitude than that of SH + HO2(H2O)2 and SH + HO2(H2O)3 reactions. Besides, the enhancement factor of water vapor is only 0.37% at 240 K, while at high temperatures, such as 425 K, the positive water vapor effect is enhanced up to 38.00%, indicating that at high temperatures the positive water effect is obvious under atmospheric conditions. Overall, these results show how water and water clusters catalyze the gas phase reactions under atmospheric conditions.

Abstract: Hydrogen polysulfide (H2Sn) has attracted increasing attention due to the fact that it is actually the key signaling molecule rather than hydrogen sulfide (H2S). Therefore, developing a sensitive and accurate assay to investigate the biosynthetic pathways of H2Sn is of physiological and pathological significance. In this work, based on the commonly used two-photon fluorophore, 1,8-naphthalimide, a new probe, NRT-HP, has been designed and synthesized that displayed both one- and two-photon ratiometric fluorescence changes toward H2Sn via H2Sn-mediated benzothioline formation. NRT-HP exhibits excellent pH stability, high selectivity and low detection limit (0.1 muM) in aqueous media. Furthermore, two-photon fluorescence microscopy experiments have demonstrated that NRT-HP could be used for the H2Sn detection in live cells as well as tissue slices.

Abstract: The characteristics of malodor released from piggery excreta samples were investigated by measuring their emission concentrations both before and after such treatments as composting or aeration from field sites. These samples were then collected from field sites and brought into the lab for analysis with the aid of the dynamic flux chamber method. The dominating compounds in the emissions were reduced sulfur compounds, phenol, and indole. The results were examined in terms of two key odor indices: odor intensity (OI) and odor activity values (OAVs), after being grouped by some criteria. When the odor contribution in the composting facility was assessed by the OAV value, methanethiol (53.1%), trimethylamine (TMA) (25.5%), and skatole (10.1%) were dominant in the pretreatment facilities, while skatole (64.7%) and p-cresol (27.9%) in the post-treatment specimens. Likewise, in the liquid treatment facility, hydrogen sulfide (47.4%), p-cresol (26.9%), and skatole (20.2%) were dominant in the pretreatment, while only p-cresol (73.6%) in the post-treatment. In comparison to the composting facility, the liquid treatment facility proved to be more efficient in the treatment of diverse hog-barn-related odorants


Abstract: Hydrogen sulfide (H2S) is a signaling molecule with protective effects in the cardiovascular system. To harness the therapeutic potential of H2S, a number of donors have been developed. The aim of the present study was to compare the cardioprotective actions of representative H2S donors from different classes and to study their mechanisms of action in myocardial injury in vitro and in vivo. Exposure of cardiomyocytes to H2O2 lead to significant cytotoxicity which was inhibited by sodium sulfide (Na2S), thiovaline (TV), GYY4137 and AP39. Inhibition of nitric oxide (NO) synthesis prevented the cytoprotective effects of Na2S and TV, but not GYY4137 and AP39, against H2O2-induced cardiomyocyte injury. Mice subjected to left anterior descending coronary ligation were protected from ischemia-reperfusion injury by the H2S donors tested. Inhibition of NOS in vivo blocked only the beneficial effect of Na2S. Moreover, Na2S, but not AP39, administration enhanced endothelial NOS and vasodilator stimulated phosphoprotein phosphorylation. Both Na2S and AP39 reduced infarct size in mice lacking cyclophilin-D (CypD), a modulator of the mitochondrial permeability transition pore (PTP). Nevertheless, only AP39 displayed a direct effect on mitochondria by increasing mitochondrial Ca2+ retention capacity, an evidence of decreased propensity to undergo permeability transition. We conclude that although all H2S donors tested limit infarct size, the pathways involved were not conserved. Na2S had no direct effects on PTP opening and its action was NO-dependent. In contrast, the cardioprotection exhibited by AP39, could result from a direct inhibitory effect on PTP, acting at a site different than CypD


Abstract: BACKGROUND: One aspect of premating isolation between diverging, locally-adapted population pairs is female mate choice for resident over alien male phenotypes. Mating preferences often show considerable individual variation, and whether or not certain individuals are more likely to contribute to population interbreeding remains to be studied. In the Poecilia mexicana-species complex different ecotypes have adapted to hydrogen sulfide (H2S)-toxic springs, and females from adjacent non-sulfidic habitats prefer resident over sulfide-adapted males. We asked if consistent individual differences in behavioral tendencies (animal personality) predict the strength and direction of the mate choice component of premating isolation in this system. RESULTS:
We characterized focal females for their personality and found behavioral measures of 'novel object exploration', 'boldness' and 'activity in an unknown area' to be highly repeatable. Furthermore, the interaction term between our measures of exploration and boldness affected focal females' strength of preference (SOP) for the resident male phenotype in dichotomous association preference tests. High exploration tendencies were coupled with stronger SOPs for resident over alien mating partners in bold, but not shy, females. Shy and/or little explorative females had an increased likelihood of preferring the non-resident phenotype and thus, are more likely to contribute to rare population hybridization. When we offered large vs. small conspecific stimulus males instead, less explorative females showed stronger preferences for large male body size. However, this effect disappeared when the size difference between the stimulus males was small. CONCLUSIONS: Our results suggest that personality affects female mate choice in a very nuanced fashion. Hence, population differences in the distribution of personality types could be facilitating or impeding reproductive isolation between diverging populations depending on the study system and the male trait(s) upon which females base their mating decisions, respectively.


Abstract: BACKGROUND: Replicate population pairs that diverge in response to similar selective regimes allow for an investigation of (a) whether phenotypic traits diverge in a similar and predictable fashion, (b) whether there is gradual variation in phenotypic divergence reflecting variation in the strength of natural selection among populations, (c) whether the extent of this divergence is correlated between multiple character suites (i.e., concerted evolution), and (d) whether gradual variation in phenotypic divergence predicts the degree of reproductive isolation, pointing towards a role for adaptation as a driver of (ecological) speciation. Here, we use poeciliid fishes of the genera Gambusia and Poecilia that have repeatedly evolved extremophile lineages able to tolerate high and sustained levels of toxic hydrogen sulfide (H2S) to answer these questions. RESULTS: We investigated evolutionary divergence in response to H2S in Gambusia spp. (and to a lesser extent Poecilia spp.) using a multivariate approach considering the interplay of life history, body shape, and population genetics (nuclear microsatellites to infer population genetic differentiation as a proxy for reproductive isolation). We uncovered both shared and unique patterns of evolution: most extremophile Gambusia predictably evolved larger heads and offspring size, matching a priori predictions for adaptation to sulfidic waters, while variation in adult life histories was idiosyncratic. When investigating patterns for both genera (Gambusia and Poecilia), we found that divergence in offspring-related life histories and body shape were positively correlated across populations, but evidence for individual-level associations between the two character suites was limited, suggesting that genetic linkage, developmental interdependencies, or pleiotropic effects do not explain patterns of concerted evolution. We further found that phenotypic divergence was positively correlated with both environmental H2S-concentration and neutral genetic differentiation (a proxy for gene flow). CONCLUSIONS: Our results suggest that higher toxicity exerts stronger selection, and that divergent selection appears to constrain gene flow, supporting a scenario of ecological speciation. Nonetheless, progress toward ecological speciation was variable, partially reflecting variation in the strength of divergent selection, highlighting the complexity of selective regimes even in natural systems that are seemingly governed by a single, strong selective agent.


Abstract: Hydrogen sulfide (H2S) has been shown to have powerful anti-oxidative and anti-inflammatory properties which can regulate multiple cardiovascular functions. However, its precise role in diabetes-accelerated atherosclerosis remains unclear. We
report here that H2S reduced aortic atherosclerotic plaque formation with reduction in superoxide (O2 -) generation and the adhesion molecules in streptozotocin (STZ)-induced LDLr/- mice but not in LDLr/-Nrf2/- mice. In vitro, H2S inhibited foam cell formation, decreased O2 - generation, as well as increased Nrf2 nuclear translocation and consequently heme oxygenase-1 (HO-1) expression up-regulation in high-glucose (HG) plus oxidized low density lipoprotein (ox-LDL)-treated primary peritoneal macrophages from wild-type but not Nrf2/- mice. H2S also decreased O2 - and adhesion molecules levels, increased Nrf2 nuclear translocation and HO-1 expression which were suppressed by Nrf2 knockdown in HG/ox-LDL-treated endothelial cells. H2S increased S-sulfhydration of Keap1, induced Nrf2 dissociation from Keap1, enhanced Nrf2 nuclear translocation and inhibited O2 - generation which were abrogated after Keap1 mutated at Cys151, but not Cys273, in endothelial cells. Collectively, H2S attenuates diabetes-accelerated atherosclerosis, which may be related to inhibition of oxidative stress via Keap1 sulfhydrylation at Cys151 to activate Nrf2 signaling. This may provide a novel therapeutic target to prevent atherosclerosis in the context of diabetes.


Abstract: Halitosis occurs in approximately 30% of the adult population and has a negative social and psychological impact on affected individuals. Mouthwashes may be used to prevent unpleasant odour, with long-duration of effect being a desirable attribute. The aim of this study was to assess the long-term efficacy of CB12 (a mixture of 0.3% zinc acetate and 0.025% chlorhexidine) for the treatment of intra-oral halitosis. Thirty-four subjects with confirmed intra-oral halitosis were randomized into a double-blind, controlled, cross-over study to one of 2 groups; (i) CB12-water-water or (ii) water-CB12-CB12. Each group comprised 3 treatments, each given evening and morning (12 h apart) on consecutive study days, with a 5 d washout between treatments. Intra-oral halitosis was assessed objectively by measuring concentrations of hydrogen sulphide, methyl mercaptan, dimethyl sulphide and total volatile sulphur compound (VSC) concentrations and subjectively using organoleptic score (OLS). These were measured at baseline, 12 h after the evening rinse (i.e. 12 h overnight assessment) and 12 h after the daytime rinse (i.e. 12 h day time assessment). CB12 significantly reduced mean hydrogen sulphide, methyl mercaptan, dimethyl sulphide and VSC concentrations, with a duration of effect lasting 12 h, whether assessed overnight (all p < 0.0003 versus water) or during the day (all p < 0.0007 versus water). CB12's effect on OLS was also evident for 12 h overnight (p = 0.0043). CB12 was well-tolerated. In conclusion, CB12 showed a clear and durable effect on intra-oral halitosis which lasted at least 12 h, both during the day and overnight, with consistent effect on both objective and subjective variables.


Abstract: Benchmark ab initio calculations are performed to investigate the stable isomers of [O,N,S,S]. These computations are carried out using coupled cluster (RCCSD(T)) and explicitly correlated coupled cluster methods (RCCSD(T)-F12). In addition to the already known cis isomer of SSNO, nine other stable forms are predicted. The most stable isomer is cis-OSNS. Nine structures are chain bent-bent with relatively large dipole moments which make them detectable, as cis-SSNO, by infrared, far-infrared, and microwave spectroscopies. We found also a C2v isomer (NS2O). Since these species are strongly suggested to play an important role as intermediates during the bioactive reaction products of the NO/H2S interaction, the rotational and vibrational spectroscopic parameters are presented to help aid the in vivo identification and assignment of these spectra. Results from this work show that [O,N,S,S] may play key roles during nitric oxide transport and deliver in biological media, as well as, provide an explanation for the weak characteristic of disulfide bridges within proteins.
(25) Mard SA, Ahmadi I, Ahangarpour A, Gharib-Naseri MK, Badavi M. Delayed gastric emptying in diabetic rats caused by decreased expression of cystathionine gamma lyase and H2S synthesis: in vitro and in vivo studies. Neurogastroenterol Motil 2016 Jun 20. Abstract: BACKGROUND: This study aimed to evaluate the role of H2S on gastric emptying rate (GER) and also to determine the effect of gastric distension on mRNA and protein expression of cystathionine beta-lyase (CBS) and cystathionine gamma-synthase (CSE) in diabetic-gastroparetic and normal rats. METHODS: Adult normal rats intraperitoneally received either propargylglycine (PAG), L-cysteine or NaHS 30 min prior to GER marker (acetaminophen) to investigate H2S involvement in GER and the same protocols were performed in diabetes-induced gastroparesis rats. The role of calcitonin gene related peptide (CGRP) neurons in the prokinetic effect of endogenous H2S on GER was determined. The level of CBS and CSE expressions in response to gastric distention were also determined. The effect of H2S on frequency and tension of spontaneous contractions of gastric smooth muscle strips was investigated. KEY RESULTS: Our results showed that: (i) H2S and L-cysteine increased GER in gastroparetic and normal rats. (ii) The increased levels of CSE expression in response to gastric distention in diabetic rats were lower than in normal rats. (iii) PAG inhibited the excitatory effect of capsaicin on GER and on tension of spontaneous contractions of strips. (iv) Hydrogen sulphide increased the frequency and tension of spontaneous contractions of gastric strip muscles in normal and diabetic rats. CONCLUSIONS & INFERENCES: The results showed that delayed GER in diabetic rats can be due to down-regulation of H2S biosynthesis enzyme, CSE and suggested that a potential prokinetic role for H2S to treat the delayed gastric emptying in diabetic patients

(26) Ivanciu T, Sbrana E, Ansar M, Bazhanov N, Szabo C, Casola A, et al. Hydrogen Sulfide: An Antiviral and Anti-inflammatory Endogenous Gasotransmitter in the Airways. Role in Respiratory Syncytial Virus Infection. Am J Respir Cell Mol Biol 2016 Jun 17. Abstract: RATIONALE: Hydrogen sulfide (H2S) is an endogenous gaseous transmitter whose role in the pathophysiology of several lung diseases has been increasingly appreciated. Our recent studies in vitro have shown for the first time that H2S has an important antiviral and anti-inflammatory activity in respiratory syncytial virus (RSV) infection, the leading cause of bronchiolitis and viral pneumonia in children. OBJECTIVES: To evaluate the therapeutic potential of GYY4137, a novel slow-releasing H2S donor, for prevention and treatment of RSV-induced lung disease, as well as to investigate the role of endogenous H2S in a mouse model of RSV infection. METHODS: 10-12 week-old BALB/c mice treated with GYY4137 or C57BL/6J mice genetically deficient in the cystathionine gamma-lyase enzyme (CSE KO), the major H2S generating enzyme in the lung, were infected with RSV and assessed for viral replication, clinical disease, airway hyperresponsiveness (AHR) and inflammatory responses. MEASUREMENTS AND MAIN RESULTS: Our results show that intranasal delivery of GYY4137 to RSV-infected mice significantly reduced viral replication and markedly improved clinical disease parameters and pulmonary dysfunction compared to vehicle treated controls. The protective effect of H2S donor was associated with significant reduction of viral-induced proinflammatory mediators and lung cellular infiltrates. Furthermore, CSE -/- mice showed significantly enhanced RSV-induced lung disease and viral replication compared to wild type animals. CONCLUSIONS: Overall our results indicate that H2S exerts a novel antiviral and anti-inflammatory activity in the context of RSV infection and represents a potential novel pharmacological approach to ameliorate viral-induced lung disease

(27) Kim NR, Nam SY, Ryu KJ, Kim HM, Jeong HJ. Effects of bamboo salt and its component, hydrogen sulfide, on enhancing immunity. Mol Med Rep 2016 Jun 17. Abstract: Korean bamboo salt (BS) is known to have therapeutic effects in the treatment of diseases, including viral disease, dental plaque, diabetes, circulatory organ disorders, cancer and inflammatory disorders. However, the effect of BS on immune functions remains to be elucidated. The present study was designed to determine the
immune-enhancing effect of BS and its component, hydrogen sulfide, using RAW264.7 macrophages and a forced swimming test (FST) animal model. BS and sodium hydrosulfide (NaSH), a hydrogen sulfide donor, significantly increased the levels of tumor necrosis factor (TNF) alpha through the activation of nuclear factor kappa B in the RAW 264.7 cells. In an in vivo experiment, BS and NaSH were administered orally once a day for 28 days. After the 28 days, the immobility times in the FST were significantly decreased in the BS and NaSH fed groups, compared with the control group. In addition, BS and NaSH induced significant increases in the levels of interferon gamma, interleukin 2 and TNF alpha, compared with the control group. Taken together, these results indicated that BS and NaSH may improve immune function.

Abstract: Sildenafil, a selective phosphodiesterase type 5 (PDE5) inhibitor, commonly used in the oral treatment for erectile dysfunction, relaxes smooth muscle of human bladder through the activation of hydrogen sulfide (H2S) signaling. H2S is an endogenous gaseous transmitter with myorelaxant properties predominantly formed from l-cysteine (l-Cys) by cystathionine-beta-synthase (CBS) and cystathionine-gamma-lyase (CSE). Sildenafil also relaxes rat and human myometrium during preterm labor but the underlying mechanism is still unclear. In the present study we investigated the possible involvement of H2S as a mediator of sildenafil-induced effect in uterine mouse contractility. We firstly demonstrated that both enzymes, CBS and CSE were expressed, and able to convert l-Cys into H2S in mouse uterus. Thereafter, sildenafil significantly increased H2S production in mouse uterus and this effect was abrogated by CBS or CSE inhibition. In parallel, l-Cys, sodium hydrogen sulfide or sildenafil but not d-Cys reduced spontaneous uterus contractility in a functional study. The blockage of CBS and CSE reduced this latter effect even if a major role for CSE than CBS was observed. This data was strongly confirmed by using CSE-/- mice. Indeed, the increase in H2S production mediated by l-Cys or by sildenafil was not found in CSE-/- mice. Besides, the effect of H2S or sildenafil on spontaneous contractility was reduced in CSE-/- mice. A decisive proof for the involvement of H2S signaling in sildenafil effect in mice uterus was given by the measurement of cGMP. Sildenafil increased cGMP level that was significantly reduced by CSE inhibition. In conclusion, l-Cys/CSE/H2S signaling modulates the mouse uterus motility and the sildenafil effect. Therefore the study may open different therapeutical approaches for the management of the uterus abnormal contractility disorders.

Abstract: In this study an alternative valorization of Municipal Solid Waste Incineration (MSWI) Bottom Ash (BA) for H2S elimination from landfill biogas was evaluated. Emphasis was given to the influence of water content in biogas on H2S removal efficiency by BA. A small-scale pilot was developed and implemented in a landfill site located in France. A new biogas analyzer was used and allowed real-time continuous measurement of CH4, CO2, O2, H2S and H2O in raw and treated biogas. The H2S removal efficiency of bottom ash was evaluated for different inlet biogas humidities: from 4 to 24 g water/m3. The biogas water content was found to greatly affect bottom ash efficiency regarding H2S removal. With humid inlet biogas the H2S removal was almost 3 times higher than with a dry inlet biogas. Best removal capacity obtained was 56 gH2S/kg dry BA. A humid inlet biogas allows to conserve the bottom ash moisture content for a maximum H2S retention.

(30) Wang XY, Yang HW. Upregulation of CBS/H2S system contributes to asymmetric dimethylarginine-triggered protection against the neurotoxicity of glutamate to PC12 cells

Abstract: Glutamate-induced neurotoxicity involves in overproduction of nitric oxide (NO) and oxidative stress. Our previous data demonstrated that asymmetric dimethylarginine (ADMA), an endogenous nitric oxide synthase (NOS) inhibitor, has a protective effect against glutamate-induced neurotoxicity. Hydrogen sulfide (H2S), the third endogenous gaseous mediator, has potential therapeutic value for oxidative stress-induced neural damage. Therefore, we hypothesized that ADMA provides protection against the neurotoxicity of glutamate by regulating endogenous H2S generation. In the present study, we found that ADMA prevented glutamate-triggered decrease in endogenous H2S generation in PC12 cells and reversed glutamate-induced suppression in the expression and activity of cystathionine-beta-synthetase (CBS), the predominant enzymatic source of H2S in PC12 cells. Furthermore, AOAA, a potent inhibitor of CBS, significantly abolished the protective action of ADMA against glutamate-induced neurotoxicity to PC12 cells. We also showed that ADMA suppressed glutamate-elicited NOS excessive activation and NO overproduction in PC12 cells. These data indicate that the protection of ADMA against glutamate-induced neurotoxicity is by promoting endogenous H2S generation, resulting from suppression in NOS excessive activation and NO overproduction. These findings provide a novel mechanism underlying the protection of ADMA against glutamate-induced neurotoxicity.


Abstract: Phenol exposure is one of the hazards in the industrial wastewater treatment basin of any refinery. It additively interacts with hydrogen sulfide emitted from the wastewater basin. Consequently, its concentration should be greatly lower than its threshold limit value. The present study aimed at controlling occupational exposure to phenol in the work environment of wastewater treatment plant in a refinery by reducing phenolic compounds in the industrial wastewater basin. This study was conducted on both laboratory and refinery scales. The first was completed by dividing each wastewater sample from the outlets of different refinery units into three portions; the first was analyzed for phenolic compounds. The second and third were for laboratory scale charcoal and bacterial treatments. The two methods were compared regarding their simplicities, design, and removal efficiencies. Accordingly, bacterial treatment by continuous flow of sewage water containing Pseudomonas Aeruginosa was used for refinery scale treatment. Laboratory scale treatment of phenolic compounds revealed higher removal efficiency of charcoal [100.0(0.0) %] than of bacteria [99.9(0.013) %]. The refinery scale bacterial treatment was [99.8(0.013) %] efficient. Consequently, level of phenol in the work environment after refinery scale treatment [0.069(0.802) mg/m3] was much lower than that before [5.700(26.050) mg/m3], with removal efficiency of [99.125(2.335) %]. From the present study, we can conclude that bacterial treatment of phenolic compounds in industrial wastewater of the wastewater treatment plant using continuous flow of sewage water containing Pseudomonas Aeruginosa reduces the workers’ exposure to phenol.


Abstract: Underlying formation pathways of dimethylmercury ((CH3)2Hg) in the ocean are unknown. Early work proposed reactions of inorganic Hg (Hg(II)) with methyl cobalamin or of dissolved monomethylmercury (CH3Hg) with hydrogen sulfide as possible bacterial mediated or abiotic pathways. A significant fraction (up to 90%) of CH3Hg in natural waters is however adsorbed to reduced sulfur groups on mineral or organic surfaces. We show that binding of CH3Hg to such reactive sites facilitates the formation of (CH3)2Hg by degradation of the adsorbed CH3Hg. We demonstrate that the reaction can be mediated by different sulfide minerals, as well as by dithiols suggesting that e.g. reduced
sulfur groups on mineral particles or on protein surfaces could mediate the reaction. The observed fraction of CH3Hg methylated on sulfide mineral surfaces exceeded previously observed methylation rates of CH3Hg to (CH3)2Hg in seawaters and we suggest the pathway demonstrated here could account for much of the (CH3)2Hg found in the ocean.

(33) Qu K, Liu YM, He XL, Zhang H, Zhang K, Peng J, et al. H2 S inhibits apo(a) expression and secretion through PKCalpha/FXR and Akt/HNF4alpha pathways in HepG2 cells. Cell Biol Int 2016 Jun 14. Abstract: Lipoprotein(a) [Lp(a)] is a strong genetic risk factor for coronary heart diseases. However, the metabolism of this protein remains poorly understood. Efficient and specific drugs that can decrease high plasma levels of Lp(a) have not been developed yet. Hydrogen sulfide (H2 S), a member of the gas transmitter family, performs important biological actions, including protection against cardiovascular diseases and maintenance of the lipid metabolism equilibrium in hepatocytes and adipocytes. In this study, we investigated the possible molecular mechanism of H2 S that influences apolipoprotein(a) [apo(a)] biosynthesis. We also determined the effects of H2 S on apo(a) expression and secretion in HepG2 cells as well as the underlying mechanisms. Results showed that H2 S significantly inhibited the expression and secretion levels of apo(a). These effects were attenuated by the PKCalpha inhibitor and FXR siRNA. H2 S also reduced HNF4alpha expression and enhanced FXR expression. The Akt inhibitor partially reversed H2 S-induced inhibition of apo(a) and HNF4alpha expression and apo(a) secretion. This study reveals that H2 S suppressed apo(a) expression and secretion via the PKCalpha-FXR and PI3K/Akt-HNF4alpha pathways.

(34) Zhang R, Liu S, Wang J, Han G, Yang L, Liu B, et al. Visualization of exhaled hydrogen sulphide on test paper with an ultrasensitive and time-gated luminescent probe. Analyst 2016 Jun 13. Abstract: Luminescent chemosensors for hydrogen sulphide (H2S) are of great interest because of the close association of H2S with our health. However, current probes for H2S detection have problems such as low sensitivity/selectivity, poor aqueous-solubility or interference from background fluorescence. This study reports an ultrasensitive and time-gated "switch on" probe for detection of H2S, and its application in test paper for visualization of exhaled H2S. The complex probe is synthesized with a luminescent Tb3+ centre and three ligands of azido (-N3) substituted pyridine-2,6-dicarboxylic acid, giving the probe high hydrophilicity and relatively fast reaction dynamics with H2S because there are three -N3 groups in each molecule. The introduced -N3 group as a strong electron-withdrawing moiety effectively changes the energy level of ligand via intramolecular charge transfer (ICT), and thus breaks the energy transferring from ligand to lanthanide ion, resulting in quenching of Tb3+ luminescence. On addition of H2S, the -N3 group can be reduced to an amine group to break the process of ICT, and the luminescence of Tb3+ is recovered at a nanomolar sensitivity level. With a long lifetime of luminescence of Tb3+ centre (1.9 ms), use of a time-gated technique effectively eliminates the background fluorescence by delaying fluorescence collection for 0.1 ms. The test paper imprinted by the complex probe ink can visualize clearly the trace H2S gas exhaled by mice.

(35) Miao L, Shen X, Whiteman M, Xin H, Shen Y, Xin X, et al. Hydrogen Sulfide Mitigates Myocardial Infarction via Promotion of Mitochondrial Biogenesis-Dependent M2 Polarization of Macrophages. Antioxid Redox Signal 2016 Jun 13. Abstract: AIMS: Macrophages are of key importance for tissue repair after myocardial infarction (MI). Hydrogen sulfide (H2S) has been shown to exert cardioprotective effects in MI. However, the mechanisms by which H2S modulates cardiac remodeling and repair post-MI remain to be clarified. RESULTS: In our current study, we showed H2S supplementation ameliorated pathological remodeling and dysfunction post-MI in WT and CSE-KO mice, resulting in decreased infarct size and mortality, accompanied by an increase in the number of M2-polarized macrophages at the early stage of MI. Strikingly,
adoptive transfer of NaHS-treated (BMMs) into WT and CSE-KO mice with depleted macrophages also ameliorated MI-induced cardiac functional deterioration. Further mechanistic studies demonstrated that NaHS-induced M2 polarization was achieved by enhanced mitochondrial biogenesis and fatty acid oxidation (FAO). INNOVATION AND CONCLUSION: Our study shows, for the first time, that H2S may have the potential as a therapeutic agent for MI via promotion of M2 macrophage polarization

Abstract: The pathogenicity of Clostridium difficile is linked to its ability to produce two toxins: TcdA and TcdB. The level of toxin synthesis is influenced by environmental signals, such as PTS sugars, biotin and amino acids, especially cysteine. To understand the molecular mechanisms of cysteine-dependent repression of toxin production, we reconstructed the sulfur metabolism pathways of C. difficile strain 630 in silico and validated some of them by testing C. difficile growth in the presence of various sulfur sources. High levels of sulfide and pyruvate were produced in the presence of 10 mM cysteine, indicating that cysteine is actively catabolized by cysteine desulfhydrases. Using a transcriptomic approach, we analyzed cysteine-dependent control of gene expression and showed that cysteine modulates the expression of genes involved in cysteine metabolism, amino-acid biosynthesis, fermentation, energy metabolism, iron acquisition and the stress response. Additionally, sigma factor (SigL) and global regulators (CcpA, CodY, Fur) were tested to elucidate their roles in the cysteine-dependent regulation of toxin production. Among these regulators, only sigL inactivation resulted in the de-repression of toxin-gene expression in the presence of cysteine. Interestingly, the sigL mutant produced less pyruvate and H2S than the wild-type strain. Unlike cysteine, the addition of 10 mM pyruvate to the medium for a short time during the growth of the wild-type and sigL mutant strains reduced expression of the toxin gene, indicating that cysteine-dependent repression of toxin production is mainly due to the accumulation of cysteine by-products during growth. Finally, we showed that the effect of pyruvate on toxin-gene expression is mediated at least in part by the two-component system CD2602-CD2601

Abstract: Intensive anchoring of leisure boats in seagrass meadows leads to mechanical damages. This anthropogenic impact creates bare mat patches that are not easily recolonized by the plant. Several tools are used to study human impacts on the structure of seagrass meadows but they are not able to assess the indirect and long term implication of mechanical destruction. We chose to investigate the possible changes in the substrate chemistry given contrasted boat impacts. Our observations show that hydrogen sulfide concentrations remain high at 15 and 20m depth (42.6µM and 18.8µM) several months after the highest period of anchoring during the summer. Moreover, our multidisciplinary study reveals that anchoring impacts of large boats at 15 and 20m depth can potentially change the seascape structure. By taking into account both structural and chemical assessments, different managing strategies must be applied for coastal areas under anthropogenic pressures

Abstract: An aerobic, coccoid to short rod, yellow-pigmented, non-sporulating and Gram staining negative bacterium, designated NH6-79T, was isolated from the surface seawater of South China Sea. The isolate was motile with a polar flagellum. Growth was observed at 4-42 masculineC (optimum 37 masculineC), pH 6.0-8.5 (optimum pH 7.0),
0.5-11% (w/v) NaCl (optimum 4.5%) and 1.5-17% (w/v) sea salt (optimum 3.5-5%). It could decompose peptone to produce H2S whereas could not hydrolyze skim milk. Phylogenetic analysis based on 16S rRNA gene sequences indicated that strain NH6-79T had the closest affinity to the genus Parvularcula, sharing the highest sequence similarity with 'P. oceanus' JLT2013T (94.1%), P. lutaonensis CC-MMS-1T (93.4%), P. dongshanensis SH25T (92.9%) and P. bermudensis HTCC2503T (92.7%), while lower sequence similarities (<90%) with all other genera. The dominant fatty acids were C18:1 omega7c and C16:0. The polar lipid profile was mainly composed of seven unidentified glycolipids. The predominant isoprenoid quinone was ubiquinone-10. The DNA G + C content was 60.7 mol%. Based on the polyphasic taxonomic characterization, strain NH6-79T is considered to represent a novel species of the genus Parvularcula, for which the name Parvularcula flava sp. nov. is proposed. The type strain is NH6-79T (= CGMCC 1.14984T = JCM 30557T = MCCC 1K00277T)

Abstract: The distribution, accumulation and circulation of oxygen and hydrogen in Earth's interior dictate the geochemical evolution of the hydrosphere, atmosphere and biosphere. The oxygen-rich atmosphere and iron-rich core represent two end-members of the oxygen-iron (O-Fe) system, overlapping with the entire pressure-temperature-composition range of the planet. The extreme pressure and temperature conditions of the deep interior alter the oxidation states, spin states and phase stabilities of iron oxides, creating new stoichiometries, such as Fe4O5 (ref. 5) and Fe5O6 (ref. 6). Such interactions between O and Fe dictate Earth's formation, the separation of the core and mantle, and the evolution of the atmosphere. Iron, in its multiple oxidation states, controls the oxygen fugacity and oxygen budget, with hydrogen having a key role in the reaction of Fe and O (causing iron to rust in humid air). Here we use first-principles calculations and experiments to identify a highly stable, pyrite-structured iron oxide (FeO2) at 76 gigapascals and 1,800 kelvin that holds an excessive amount of oxygen. We show that the mineral goethite, FeOOH, which exists ubiquitously as 'rust' and is concentrated in bog iron ore, decomposes under the deep lower-mantle conditions to form FeO2 and release H2. The reaction could cause accumulation of the heavy FeO2-bearing patches in the deep lower mantle, upward migration of hydrogen, and separation of the oxygen and hydrogen cycles. This process provides an alternative interpretation for the origin of seismic and geochemical anomalies in the deep lower mantle, as well as a sporadic O2 source for the Great Oxidation Event over two billion years ago that created the present oxygen-rich atmosphere

Abstract: Hydrogen sulfide (H2S) is known to act protectively during renal ischemia/reperfusion injury (IRI). However, the role of the endogenous H2S in acute kidney injury (AKI) is largely unclear. Here, we analyzed the role of cystathionine gamma-lyase (CTH) in acute renal IRI using CTH-deficient (Cth(-/-)) mice whose renal H2S levels were approximately 50% of control (wild-type) mice. Although levels of serum creatinine and renal expression of AKI marker proteins were equivalent between Cth(-/-) and control mice, histological analysis revealed that IRI caused less renal tubular damage in Cth(-/-) mice. Although levels of serum creatinine and renal expression of AKI marker proteins were equivalent between Cth(-/-) and control mice, histological analysis revealed that IRI caused less renal tubular damage in Cth(-/-) mice. Flow cytometric analysis revealed that renal population of infiltrated granulocytes/macrophages was equivalent in these mice. However, renal expression levels of certain inflammatory cytokines/adhesion molecules believed to play a role in IRI were found to be lower after IRI only in Cth(-/-) mice. Our results indicate that the systemic CTH loss does not deteriorate but rather ameliorates the immediate AKI outcome probably due to reduced inflammatory responses in the kidney. The renal
expression of CTH and other H2S-producing enzymes was markedly suppressed after IRI, which could be an integrated adaptive response for renal cell protection

Abstract: This study assessed bioremediation of acid rock drainage in simulated permeable reactive barriers (PRB) using algae, Chlorella sorokiniana, as the sole electron donor for sulfate-reducing bacteria. Lipid extracted algae (LEA), the residues of biodiesel production, were compared with whole cell algae (WCA) as an electron donor to promote sulfate-reducing activity. Inoculated columns containing anaerobic granular sludge were fed a synthetic medium containing H2SO4 and Cu2+. Sulfate, sulfide, Cu2+ and pH were monitored throughout the experiment of 123d. Cu recovered in the column packing at the end of the experiment was evaluated using sequential extraction. Both WCA and LEA promoted 80% of sulfate removal (12.7mg

Abstract: One gram-stain negative, aerobic, non-motile bacterial strain 7Y-4 was isolated from bark tissue of Populus x euramericana. The isolate is able to grow between 10 and 37 degrees C, with optimal growth occurring at 28-30 degrees C. The species is positive for oxidase and catalase activities. Nitrite is not reduced from nitrate. Positive reactions for the activities of beta-galactosidase, urease, beta-glucosidase and but negative reactions for the activities of gelatinase and the productions of indole, acetoin and H2S can be observed. Citrate is not utilized. The major fatty acids are iso-C15:0 (27.5 %), C16:1 omega7c/C16:1 omega6c (30.0 %) and iso-C17:0 3OH (22.8 %). The main polar lipid profiles of the novel isolate include phosphatidylethanolamine (PE), phospholipid (PL1-3) and six unknown lipids (L1-6). The predominant menaquinone of the novel isolate is MK-7. The DNA G+C content is 41.7 mol%. The 16S rRNA gene sequences analysis revealed that the novel isolate shared the greatest sequence similarities with Sphingobacterium hotanense XH4T (93.50 %). On the basis of phenotypic and genotypic characteristics, strain 7Y-4 represents a novel species within the genus Sphingobacterium, for which the name Sphingobacterium populi is proposed. The type strain is 7Y-4T (=CFCC 11742T =KCTC 42247T)

Abstract: We isolated, identified and characterized yeast strains from grapes, and their fermented musts, sampled in the small island of Linosa, where there are no wineries and therefore the possibility of territory contamination by industrial strains is minimal. By traditional culture-dependent methods, we isolated 3805 colonies, distinguished by molecular methods in 17 different species. 544 isolates were analysed for the main oenological characteristics such as fermentative vigor with and without sulphites, sugar consumption, and production of alcohol, volatile acidity, hydrogen sulphide, glycerol and beta-glucosidase. This analysis identified Kluyveromyces marxianus (seldomly used in winemaking) as the most interesting candidate yeast for the production of innovative wines. This article is protected by copyright. All rights reserved

Abstract: A novel approach has been developed for the simultaneous description of reaction kinetics to describe the formation of polysulfide and sulfate anions from the biological oxidation of hydrogen sulfide (H2S) using a quick, sulfide-dependent respiration test. Next to H2S, thiols are commonly present in sour gas streams. We
investigated the inhibition mode and the corresponding inhibition constants of six thiols and the corresponding diorgano polysulfanes on the biological oxidation of H2S. A linear relationship was found between the calculated IC50 values and the lipophilicity of the inhibitors. Moreover, a mathematical model was proposed to estimate the biomass activity in the absence and presence of sulfurous inhibitors. The biomass used in the respiration tests originated from a full-scale biodesulfurization reactor. A microbial community analysis of this biomass revealed that two groups of microorganism are abundant, viz. Ectothiorhodospiraceae and Piscirickettsiaceae

(45) Wu M, Zhang Y, Ye Y, Lin C. In situ Removal of Hydrogen Sulfide During Biogas Fermentation at Microaerobic Condition. Appl Biochem Biotechnol 2016 Jun 2. Abstract: In this paper, rice straw was used as a raw material to produce biogas by anaerobic batch fermentation at 35 degrees C (mesophilic) or 55 degrees C (thermophilic). The hydrogen sulfide in biogas can be converted to S0 or sulfate and removed in-situ under micro-oxygen environment. Trace oxygen was conducted to the anaerobic fermentation tank in amount of 0.5, 1.0, 2.0, 3.0, 4.0, 5.0, or 10.0 times stoichiometric equivalence, respectively, and the control experiment without oxygen addition was carried out. The results showed that the initial H2S concentrations of biogas are about 3235 +/- 185 mg/m3 (mesophilic) or 3394 +/- 126 mg/m3 (thermophilic), respectively. The desulfurization efficiency is 72.3 % (mesophilic) or 65.6 % (thermophilic), respectively, with oxygen addition by stoichiometric relation. When the oxygen fed in amount of 2 approximately 4 times, theoretical quantity demanded the removal efficiency of hydrogen sulfide could be over 92 %, and the oxygen residue in biogas could be maintained less than 0.5 %, which fit the requirement of biogas used as vehicle fuel or combined to the grid. Though further more oxygen addition could promote the removal efficiency of hydrogen sulfide (about 93.6 %), the oxygen residue in biogas would be higher than the application limit concentration (0.5 %). Whether mesophilic or thermophilic fermentation with the extra addition of oxygen, there were no obvious changes in the gas production and methane concentration. In conclusion, in-situ desulfurization can be achieved in the anaerobic methane fermentation system under micro-oxygen environment. In addition, air could be used as a substitute oxygen resource on the situation without strict demand for the methane content of biogas. 

(46) Jiang JM, Wang L, Gu HF, Wu K, Xiao F, Chen Y, et al. Arecoline Induces Neurotoxicity to PC12 Cells: Involvement in ER Stress and Disturbance of Endogenous H2S Generation. Neurochem Res 2016 Jun 2. Abstract: Arecoline is a major alkaloid of areca nut and has been effect on central nervous system. Although arecoline-induced neurotoxicity has been reported, the possible underlying neurotoxic mechanisms have not yet been elucidated. Increasing evidences have shown that both excessive endoplasmic reticulum (ER) stress and disturbance of hydrogen sulfide (H2S) production are involved in the pathophysiology of numerous neurodegenerative diseases. Here, the purpose of present study was to verify whether ER stress and the disturbance of endogenous H2S generation are also involved in arecoline-caused neurotoxicity. We found that treatment of PC12 cells with arecoline induced the down-regulation of cells viability and up-regulation of apoptosis and the activity of caspase-3, indicating the neurotoxic role of arecoline to PC12 cells. In addition, arecoline also increased the expression of Bax (pro-apoptotic protein) and attenuated the expression of Bcl-2 (anti-apoptotic protein) in PC12 cells. Simultaneously, arecoline caused excessive ER stress in PC12 cells, as evidenced by the up-regulations of Glucose-regulated protein 78 (GRP78), CCAAT/enhancer binding protein homologous protein (CHOP), and Cleaved caspase-12 expressions. Notably, the level of H2S in the culture supernatant and the expressions of cystathionine beta-synthase and 3-mercaptopuruvate sulfurtransferase (two major enzymes for endogenous H2S generation in PC12 cells) were also reduced by arecoline treatment. These results indicate that arecoline-caused neurotoxicity to PC12 cells is involved in ER stress and disturbance of endogenous H2S generation and suggest that the modulation of ER stress
and endogenous H2S generation may be potential therapeutic approach in treatment of arecoline-caused neurotoxicity

Abstract: Adulthood hypertension can be programmed by preeclampsia. Preeclampsia is associated with an imbalance in vasoactive factors, including nitric oxide (NO), hydrogen sulfide (H2S), and renin-angiotensin system (RAS). We examined whether maternal N-acetylcysteine (NAC) therapy prevented maternal suramin treatment-induced programmed hypertension in offspring and explored the effects of this therapy on NO, H2S, and RAS pathways in the kidneys. Pregnant Sprague-Dawley rats were intraperitoneally administered 60 mg/kg suramin alone on Gestational Days 10 and 11 and were treated with or without 1% NAC through drinking water during the entire pregnancy and lactation period. Male offspring were divided into 4 groups (n = 8-10/group): control, suramin, NAC, and suramin + NAC. All rat offspring were sacrificed at 12 wk of age. Maternal suramin treatment induced programmed hypertension in male offspring, which was prevented by maternal NAC therapy. Suramin-induced programmed hypertension was associated with increased plasma asymmetric dimethylarginine (ADMA, an NO synthase inhibitor) level, decreased plasma L-arginine-to-ADMA ratio, and decreased renal dimethylarginine dimethylaminohydrolase (an ADMA-metabolizing enzyme) activity. Protective effects of NAC against suramin-induced programmed hypertension were associated with an increase in plasma glutathione level, increase in renal 3-mercaptoppyruvate sulfurrtransferase level, and restoration of suramin-induced reduction in H2S synthesis in the kidneys. Suramin treatment exerted negligible effect on the RAS pathway in the adult male offspring kidneys. Our data suggested that interplay among suramin, ADMA-NO pathway, and H2S synthesis pathway in programmed hypertension. Furthermore, NAC administration in pregnant rats with hypertension prevented programmed hypertension in adult offspring

Abstract: Evolutionary endocrinology represents a synthesis between comparative endocrinology and evolutionary genetics. This synthesis can be viewed through the breeder's equation, a cornerstone of quantitative genetics that, in its univariate form, states that a population's evolutionary response is the product of the heritability of a trait and selection on that trait (R = h2S). Under this framework, evolutionary endocrinologists have begun to quantify the heritability of, and the strength of selection on, a variety of hormonal phenotypes. With specific reference to our work on testosterone and corticosterone in birds and lizards, we review these studies while emphasizing the challenges of applying this framework to hormonal phenotypes that are inherently plastic and mediate adaptive responses to environmental variation. Next, we consider the untapped potential of evolutionary endocrinology as a framework for exploring multivariate versions of the breeder's equation, with emphasis on the role of hormones in structuring phenotypic and genetic correlations. As an extension of the familiar concepts of phenotypic integration and hormonal pleiotropy, we illustrate how the hormonal milieu of an individual acts as a local environment for the expression of genes and phenotypes, thereby influencing the quantitative genetic architecture of multivariate phenotypes. We emphasize that hormones are more than mechanistic links in the translation of genotype to phenotype: by virtue of their pleiotropic effects on gene expression, hormones structure the underlying genetic variances and covariances that determine a population's evolutionary response to selection

Abstract: PURPOSE: Hydrogen sulfide (H2S) is an endogenous gaseous signaling molecule with significant pathophysiological importance, but its role in retinal neovascular diseases is unknown. Hydrogen sulfide is generated from L-cysteine by cystathionine-beta-synthase (CBS), cystathionine-gamma-lyase (CSE), and/or 3-mercaptopyruvate sulfurtransferase (3-MST). The aim of this study was to investigate the role of H2S in retinal neovascularization (NV) in ischemia-induced retinopathy. METHODS: Studies were performed in a murine model of oxygen-induced retinopathy (OIR). Hydrogen sulfide was detected with a fluorescent assay. Western blots and immunohistochemistry were used to assess the changes of H2S-producing enzymes. Gene deletion and pharmacologic inhibition were used to investigate the role of H2S in retinal NV. RESULTS: Hydrogen sulfide production was markedly increased in retinas from OIR mice compared with those from room air (RA) controls. Cystathionine-beta-synthase and CSE were significantly increased in OIR retinas, whereas 3-MST was not changed. Cystathionine-beta-synthase was expressed throughout the neuronal retina and upregulated in neurons and glia during OIR. Cystathionine-gamma-lyase was also localized to multiple retinal layers. Its immunoreactivity was prominently increased in neovascular tufts in OIR. Pharmacologic inhibition of CBS/CSE or genetic deletion of CSE significantly reduced retinal NV in OIR. CONCLUSIONS: Our data indicate that the H2S-generating enzymes/H2S contributes to retinal NV in ischemia-induced retinopathy and suggest that blocking this pathway may provide novel therapeutic approaches for the treatment of proliferative retinopathy

Abstract: Sulfate reducing bacteria (SRB) play significant roles in anaerobic environments in oil sands mature fine tailings (MFTs). Hydrogen sulfide (H2S) is produced during the biological sulfate reduction process. The production of toxic H2S is one of the concerns because it may hinder the landscape remediation efficiency of oil sands tailing ponds. In present study, the in situ activity and the community structure of SRB in MFT and gypsum amended MFT in two settling columns were investigated. Combined techniques of H2S microsensor and dissimilatory sulfite reductase beta-subunit (dsrB) genes-based real time quantitative polymerase chain reaction (qPCR) were applied to detect the in situ H2S and the abundance of SRB. A higher diversity of SRB and more H2S were observed in gypsum amended MFT than that in MFT, indicating a higher sulfate reduction activity in gypsum amended MFT; in addition, the activity of SRB varied as depth in both MFT and gypsum amended MFT: the deeper the more H2S produced. Long-term plans for tailings management can be assessed more wisely with the information provided in this study

Abstract: Hydrogen sulfide is the third and most recently discovered gaseous signaling molecule following nitric oxide and carbon monoxide, playing important roles both in normal physiological conditions and disease progression. The trimethylsulfonium ion (TMS) can result from successive methylation reactions of hydrogen sulfide. No report exists so far about the presence or quantities of TMS in human urine. We developed a method for determining TMS in urine using liquid chromatography-electrospray ionization-triple quadrupole mass spectrometry (LC-ESI-QQQ), and applied the method to establish the urinary levels of TMS in a group of human volunteers. The measured urinary levels of TMS were in the nanomolar range, which is commensurate with the steady-state tissue concentrations of hydrogen sulfide previously reported in the literature. The developed method can be used in future studies for the quantification of urinary TMS as a potential biomarker for hydrogen sulfide body pools

Abstract: OBJECTIVE: To investigate the effects of hydrogen sulfide (H2S) on contraction capacity of diaphragm in type 1 diabetic rats. METHODS: Thirty-two male SD rats were randomly divided into a normal group (NC), a diabetic group (DM), a NaHS treatment group (DM+NaHS) and a NaHS group (NaHS) (n=8). Intraperitoneal injection of streptozotocin was utilized to establish diabetic rat model. After the modeling, the rats in the DM+NaHS and the NaHS groups were intraperitoneally injected with 28 mumol/kg NaHS solution. 8 weeks later, the diaphragm contractility was assessed by isolated diaphragm strips perfusion. The peak twitch tension (Pt), maximum tetanic tension (Po) and maximal rates of contraction/relaxation (+/-dT/dtmax) were determined. The alterations in diaphragm ultrastructure were observed under electron microscopy. The diaphragm weight/body weight (DW/BW) was measured. The activities of succinic dehydrogenase (SDH), lactate dehydrogenase (LDH) and sarcoplasmic reticulum Ca2+ ATPase (SERCA) were analyzed by spectrophotometric method. The mRNA levels of SERCA and prospholamban (PLB) in diaphragm were detected by RT-PCR. RESULTS: Compared with the NC group, there was no significant change in all measured index in the NaHS group (P>0.05), while Pt, Po and +/-dT/dtmax were significantly decreased in the DM group (P<0.05). Transmission electron microscopy revealed obvious ultrastructural changes in the diaphragm. The DW/BW ratio and the activities of SDH, LDH and SERCA were decreased. The SERCA mRNA was decreased, while PLB mRNA was increased. Compared with the DM group, the diaphragm contractility and ultrastructure damage were improved in the DM+NaHS group. The DW/BW ratio and the activities of SDH, LDH and SERCA were increased. The SERCA mRNA was increased, while PLB mRNA was decreased (all P<0.05). CONCLUSION: H2S can enhance the contraction capacity of diaphragm in type 1 diabetic rats, which is involved in regulating the activities of biological enzymes and the gene expressions of calcium regulatory proteins

(53) Millikin R, Bianco CL, White C, Saund SS, Henriquez S, Sosa V, et al. The chemical biology of protein hydropersulfides: Studies of a possible protective function of biological hydropersulfide generation. Free Radic Biol Med 2016 May 27;97:136-47. Abstract: The recent discovery of significant hydropersulfide (RSSH) levels in mammalian tissues, fluids and cells has led to numerous questions regarding their possible physiological function. Cysteine hydropersulfides have been found in free cysteine, small molecule peptides as well as in proteins. Based on their chemical properties and likely cellular conditions associated with their biosynthesis, it has been proposed that they can serve a protective function. That is, hydropersulfide formation on critical thiols may protect them from irreversible oxidative or electrophilic inactivation. As a prelude to understanding the possible roles and functions of hydropersulfides in biological systems, this study utilizes primarily chemical experiments to delineate the possible mechanistic chemistry associated with cellular protection. Thus, the ability of hydropersulfides to protect against irreversible electrophilic and oxidative modification was examined. The results herein indicate that hydropersulfides are very reactive towards oxidants and electrophiles and are modified readily. However, reduction of these oxidized/modified species is facile generating the corresponding thiol, consistent with the idea that hydropersulfides can serve a protective function for thiol proteins

(54) Wang ZS, Jin H, Wang DM. Influence of hydrogen sulfide on zymogen activation of homocysteine-induced matrix metalloproteinase-2 in H9C2 cardiocytes. Asian Pac J Trop Med 2016 May;9(5):489-93. Abstract: OBJECTIVE: To observe the influence of different concentrations of homocysteine (Hcy) and hydrogen sulfide (H2S) on the secretion and activation of matrix metalloproteinase-2 (MMP-2) in cardiocytes so as to search for new ways to fight against myocardial tissue fibrosis. METHODS: Cardiocytes H9C2 was cultured in vitro and different concentrations of Hcy and H2S were added for 6-h and 24-h cultivation. MTT cell proliferation assay was applied to test the activation change of cardiocytes H9C2
after affecting by different concentrations of Hcy and H2S. ELISA and MTT were employed to detect the expression and enzymatic activity of MMP-2. RESULTS: The H9C2 cell inhibition of activity was more significant with 1000 mumol/L of Hcy as compared with other concentrations (P < 0.001). With 2.5-100.0 mumol/L Hcy and 0.1, 1.0 and 10.0 mmol/L H2S, the activity of H9C2 did not change significantly (P > 0.05). Hcy with concentrations of 10, 50 and 100 mumol/L could increase the quantity of MMP-2 secreted by cardiocytes H9C2, and the interaction strength was concentration-dependent (P < 0.05). After interacting with 100 mumol/L of Hcy for 6 h, the zymogen activation effect of MMP-2 was stronger than that of the 2.5-25 mumol/L group (P < 0.05). After interacting with Hcy and H2S (1.0 mmol/L) for 6 h and 24 h, the activation effect of MMP-2 was stronger than those interacted with 10, 25, 50 and 100 mumol/L of Hcy (P < 0.05). CONCLUSIONS: Hcy can increase the production of MMP-2 secreted by H9C2 cell and improve its zymogen activation. Besides, the interaction strength is concentration-dependent; while H2S can up-regulate the activation of MMP-2 and co-promote the activation of MMP-2 with Hcy as well.

(55) Fuentes-Amaya LF, Munyard S, Fernandez-Piquer J, Howieson J. Sensory, Microbiological and Chemical Changes in Vacuum-Packaged Blue Spotted Emperor (Lethrinus sp), Saddletail Snapper (Lutjanus malabaricus), Crimson Snapper (Lutjanus erythropterus), Barramundi (Lates calcarifer) and Atlantic Salmon (Salmo salar) Fillets Stored at 4 degrees C. Food Sci Nutr 2016 May;4(3):479-89. Abstract: Quality assessment of finfish fillets during storage is important to be able to predict the shelf life of the fresh product during distribution. Microbial, chemical (pH, TMA, and TVB-N), and sensory (Quality index assessment QIA, Torry scheme) changes in vacuum-packaged blue-spotted emperor (Lethrinus sp), saddletail (Lutjanus malabaricus), crimson snapper (Lutjanus erythropterus), barramundi (Lates calcarifer), and Atlantic salmon (Salmo salar) fillets stored at 4 degrees C were evaluated for 5 days. Microbiological study included evaluation of TVC (total viable counts), total psychrotrophic organisms, and H2S-producing bacteria. Numbers increased during storage time and reached an average of 8.5, 8.5, and 9.2 log10 cfu/g, respectively, for the five different fish species. These levels were above accepted microbiological limits for fish fillets. Although the sensory analyses showed a decrease in quality, none of the finfish fillets were considered unacceptable at the end of the storage trial. Chemically, there was a slight pH increase, but trimethylamine (TMA) levels remained low. However, total volatile basic nitrogen (TVB-N) levels increased over time, reaching levels above 35 mg/100 g for blue spotted emperor, saddletail snapper, and crimson snapper by the end of the storage period. Results show that the deterioration of finfish fillet quality is a complex event of biochemical, sensory, and microbial factors, and multiple analyses may be required to define acceptability.

(56) Chao C, Zatarain JR, Ding Y, Coletta C, Mrazek AA, Druzhyna N, et al. Cystathionine-beta-synthase inhibition for colon cancer: Enhancement of the efficacy of aminooxyacetic acid via the prodrug approach. Mol Med 2016 Apr 21;22. Abstract: Colon cancer cells contain high levels of cystathionine-beta-synthase (CBS). Its product, hydrogen sulfide (H2S) promotes the growth and proliferation of colorectal tumor cells. In order to improve the antitumor efficacy of the prototypical CBS inhibitor aminooxyacetic acid (AOAA), we designed and synthesized YD0171, a methyl ester derivative of AOAA. The antiproliferative effect of YD0171 exceeded the antiproliferative potency of AOAA in HCT116 human colon cancer cells. The esterase inhibitor paraoxon prevented the cellular inhibition of CBS activity by YD0171. YD0171 suppressed mitochondrial respiration and glycolytic function and induced G0/G1 arrest, but did not induce tumor cell apoptosis or necrosis. The efficacy of YD0171 as an inhibitor of tumor growth was also tested in nude mice bearing subcutaneous HCT116 cancer cell xenografts. Animals were treated via injection of vehicle, AOAA or YD0171 for 3 weeks. Tumor growth was significantly reduced by 9 mg/kg/day AOAA, but not at lower doses. With YD0171, tumor volume was significantly inhibited at 0.5 and 1 mg/kg/day. Thus, the
in vivo efficacy of YD0171 is 9-times higher than that of AOAA. YD0171 attenuated tumor growth and metastasis formation in the intracecal HCT116 tumor model. YD0171 also reduced tumor growth in patient-derived tumor xenograft (PDTX) bearing athymic mice. YD0171 induced the regression of established HCT116 tumors in vivo. A 5-day safety study in mice demonstrated that YD0171 at 20 mg/kg/day does not increase plasma markers of organ injury, nor does it induce histological alterations in the liver or kidney. In conclusion, the prodrug approach improves the pharmacological profile of AOAA; YD0171 represents a prototype for CBS inhibitory anticancer prodrugs. By targeting colorectal cancer bioenergetics, this approach may offer direct translational opportunities.

Abstract: INTRODUCTION: Multiple sclerosis (MS) is generally known as a manageable but not yet curable autoimmune disease affecting central nervous system. A potential therapeutic approach should possess several properties: Prevent immune system from damaging the brain and spinal cord, promote differentiation of oligodendrocyte progenitor cells (OPCs) into mature oligodendrocytes to produce myelin, prevent the formation of fibronectin aggregates by astrocytes to inhibit scar formation, and enhance function of healthy endothelial cells (ECs). METHODS: To determine if an increase in sulfur contents through H2S, a potent antioxidant known to induce protective autophagy in cells, could provide the above desired outcomes, peripheral blood mononuclear cells (PBMCs), OPCs, astrocytes, and ECs were treated with NaHS (50 μM) in vitro. RESULTS: Transmigration assay using EC monolayer showed that serotonin increased migration of PBMC while pretreatment of EC with NaHS inhibited the migration induced by serotonin treatment. NaHS upregulated proteins involved in immune system response and downregulated PBMCs- and EC-related adhesion molecules (LFA-1 and VCAM-1). Furthermore, it had a cell expansion inducing effect, altering EC morphology. The effects of NaHS on OPCs and astrocytes were studied compared to mTOR inhibitor rapamycin. In NaHS treated astrocytes the induced fibronectin production was partially inhibited while rapamycin almost fully inhibited fibronectin production. NaHS slowed but did not inhibit the differentiation of OPCs or the production of myelin compared to rapamycin. CONCLUSION: The in vitro results point to the potential therapeutic application of hydrogen sulfide releasing molecules or health-promoting sulfur compounds in MS.

Abstract: BACKGROUND: One of Europe's most well-developed industrial regions is found in the Republic of Bulgaria. The industrialization of the region has a big impact on air pollution. Thermal power plant "Maritza East" (the largest of its kind in southeastern Europe), the army training range, machine manufacturers, household heating and high volume of automobile traffic are all major sources of pollution in the region. METHODS: A five year study (2009-2013) followed yearly concentrations of principal atmospheric pollutants such as sulfur dioxide, dust, nitrogen dioxide, lead aerosols and hydrogen sulfide, and the way in which those levels had an effect on morbidity (outpatient and inpatient medical care) in the area. Statistical processing of data has been completed to represent and analyze the collected data in nonparametric and alternative format. RESULTS: Atmospheric pollution affects human health directly through pathological changes in the human organism. The registered outpatient care provided for the period 2009-2013 is highest for diseases of the cardiovascular system (11.85%), the respiratory system (17.34%) and the genitourinary system (9.76%). The registered rate of hospitalization for the same period is for diseases of the digestive system (11.90%), the cardiovascular system (11.85%), respiratory system (10.86%) and the genitourinary system (8.88%). CONCLUSION: The observed period shows a decrease in average yearly concentrations of the principal atmospheric pollutants in the industrial region (Bulgaria) and reflects a decrease in morbidity based on outpatient care and an increase
in morbidity by inpatient care (hospitalization). Our findings should be corroborated in future longitudinal studies.

Abstract: OBJECTIVE: To investigate the effect of hydrogen sulfide (H2S) on cardiac myosin light chain kinase (MLCK) expression in diabetic rats. METHODS: A total of 32 male SD rats were randomly divided into a normal control group (NC group), a diabetic control group (DM), a NaHS treatment group (DM+NaHS) and a NaHS group (NaHS) (n=8 in each group). Intraperitoneal injection of streptozotocin was utilized to establish Type 1 diabetic rat model. The diabetic rats in the DM+NaHS and NaHS groups were intraperitoneally injected with 28 mumol/kg NaHS solution. Eight weeks later, the ventricular hemodynamic parameters, the ratio of heart weight/body weight (HW/BW ratio), the levels of lactate dehydrogenase (LDH) and creatine kinase MB isozyme (CK-MB) in serum were determined. The ultrastructures of myocardium were observed under electron microscopy. The expressions of MLCK mRNA and protein level in myocardium were detected by RT-PCR and Western blot, respectively. RESULTS: Compared with the NC group, there was no significant difference in the various indexes in the NaHS group (all P>0.05). The function of left ventricular contract and relaxation were decreased obviously in diabetic rats, while the HW/BW ratio was increased (all P<0.01). The levels of LDH and CK-MB were decreased (both P<0.01) in serum, while the levels of MLCK mRNA and protein were decreased significantly (both P<0.01) in myocardial tissues. Compared with the DM group, the left ventricular hemodynamic parameters and myocardial ultrastructure damage were improved in the DM+NaHS group, while the HW/BW ratio was decreased (all P<0.05). The levels of LDH and CK-MB were decreased (both P<0.01), while the levels of MLCK mRNA and protein were increased significantly (both P<0.01). CONCLUSION: H2S can protect myocardium in diabetic rats, which may be associated with upregulation of cardiac MLCK.

Abstract: INTRODUCTION: In cases of transport by rescue helicopter or ambulance of patients having ingested hazardous substances, medical personnel may be at a certain risk of inhaling the substances. However, few reports have addressed such risk of causing secondary casualties. PURPOSE: This simulation study aimed to assess the risk of inhalation of hydrogen sulfide and chloropicrin in the cabin of a helicopter or an ambulance transporting a patient who has ingested calcium polysulfide or chloropicrin, which were previously reported to cause secondary casualties. METHOD: Concentrations of hydrogen sulfide and chloropicrin were assessed on the following assumptions: The patient ingested 100 mL of the causative or original chemical. All chemical substances reacted with the gastric juice or were thoroughly vomited and evaporated uniformly within the cabin space of the helicopter or ambulance. Environmental conditions were 20 *degrees at 1 atmosphere of pressure in a 5 m3 cabin volume in the helicopter and a 13.5 m3 cabin volume in the ambulance. RESULTS: In the case of calcium polysulfide ingestion which produced hydrogen sulfide, its concentration reached 774 ppm in the helicopter and 287 ppm in the ambulance. For chloropicrin ingestion, the concentrations were 4,824 ppm and 1,787 ppm, respectively. DISCUSSION: The simulated concentration of hydrogen sulfide was more than 500 ppm in the helicopter, which may lead to respiratory paralysis and death. The simulated concentration of chloropicrin was more than 300 ppm, which has a risk of death within 10 minutes. Currently, as far as Japanese laws are concerned, there are no restrictions requiring pretransport assessment or setting criteria for transporting patients who might have ingested hazardous substances that could cause secondary casualties when vomited. CONCLUSION: When patients who might have ingested hazardous chemicals...
are transported, it is important to recognize the risk of causing secondary casualties by vomiting the chemicals

(61) Yang G, Shi L, Zhang J, Tan X, Wang G, Lv X, et al. [Roles of CYP2E1 in liver damage induced by 1,2-dichloroethane]. Wei Sheng Yan Jiu 2016 Mar;45(2):179-83, 188. Abstract: OBJECTIVE: To explore the expression of CYP2E1 in the liver of mice and its effects on liver injury induced by 1,2-dichloroethane (1, 2-DCE). METHODS: (1) Thirty-two female mice were randomly divided into four groups, which were control group, low dose group, medium dose group and high dose group. Mice were exposed to 1,2-DCE through respiratory for 4 h per day for 10 days. At the end of exposure, the mice were sacrificed, their blood and liver were collected rapidly. Pathological analysis was examined. Activity of ALT and AST in serum and activity of CYP2E1 in liver were randomly divided into six groups, ie simple control group, corn oil control group, inhibitor control group, simple poisonous group, low and high dose diallyl sulfide (DAS) intervention groups. Mice were treated orally with DAS in corn oil 4 hours before 1, 2-DCE exposure. The examination indicators were as aforementioned. RESULTS: (1) Compared to control group, activity of ALT in serum of mice in the high dose group and expression of CYP2E1 in the liver of mice in medium and high dose group increased significantly. In addition, the histological observation suggested obvious liver damage in medium and high dose group. (2) CYP2E1 protein expression and activity in liver and ALT in serum decreased significantly in DAS-intervention groups compared to simple poisonous group. Along with the changes of CYP2E1 and ALT, pathological changes of liver damage was better. CONCLUSION: Our results suggested that expression of CYP2E1 and oxidative damage in the liver could be induced by 1,2-DCE exposure, and CYP2E1 inhibitors can reduce the hepatic tissue damage caused by DCE

(62) Tran TA, Krishnamoorthy K, Cho SK, Kim SJ. Inhibitory Effect of Zinc Sulfide Nanoparticles Towards Breast Cancer Stem Cell Migration and Invasion. J Biomed Nanotechnol 2016 Feb;12(2):329-36. Abstract: Cancer stem cells are demonstrated to be a highly malignant cancer with an extremely high migratory ability and conventional therapies have little effect on preventing cancer migration and invasion. In this study, we investigated the inhibitory effect of zinc sulfide (ZnS) nanoparticles towards the migration and invasion of breast cancer stem cells MCF-7-SC. The cytotoxicity studies and the Hoechst staining experiments suggested that there is no obvious toxicity of ZnS has been observed upto a concentration of 400 microg/mL. ZnS nanoparticles significantly inhibited the wound healing in the MCF-7-SC cells. The cell invasion assay and western blot analysis results suggested that ZnS nanoparticles inhibited the metastasis of MCF-7-SCs in dose-dependent manner by suppressing epithelial-mesenchymal transition process. Overall, our experimental analysis suggested that nano ZnS has the ability to inhibit cancer stem cell migration and invasion, which can open up new insights in the cancer therapy

(63) Yan B, Zhang M, Li W, Xiao C, Li Q, Cheng J. Substitution Reactions of the Aluminum Chlorogermyleloid H2GeClAlCl2 with HF, H2O, NH3, HCl, H2S, and PH3. Acta Chim Slov 2016;63(2):271-8. Abstract: Quantum chemical calculations have been performed for the substitution reactions of the aluminum chlorogermyleloid H2GeClAlCl2 with HF, H2O, NH3, HCl, H2S, and PH3 to get more insights into the reactivity of H2GeClAlCl2. The theoretical calculated results indicated that the substitution reactions of H2GeClAlCl2 with HF, H2O, NH3, HCl, H2S, and PH3 proceeded in a concerted manner. There were one transition state and one intermediate which connected the reactants and the products along the potential energy surface. The six substitution reactions of H2GeClAlCl2 with HF, H2O, NH3, HCl, H2S, and PH3 are compared with the addition reactions of H2Ge with these hydrides. And based on the calculated results we concluded that the substitution reactions of H2GeClAlCl2 with these hydrides involve two steps, one is dissociation onto
H2Ge with AlCl3, and the other is the addition reactions of H2Ge with HF, H2O, NH3, HCl, H2S, and PH3


Abstract: AIM: Vascular smooth muscle cell (VSMC) proliferation in response to hyperglycemia is an important process in the development of arterial vessel hyperplasia. The shape change of mitochondria is dynamic and closely related to fission and fusion. Hydrogen sulfide (H2S) was confirmed to have anti-oxidative, anti-inflammatory and anti-proliferative effects. However, little it is known about its effects on mitochondrial morphology induced by hyperglycemia. The aim of the study is to demonstrate that H2S inhibits VSMC proliferation through regulating mitochondrial fission. METHODS AND RESULTS: We observe lower H2S levels as well as higher proliferative protein expression levels for proliferative cell nuclear antigen (PCNA) and cyclin D1 and higher mitochondrial fusion-fission protein expression levels for dynamin-related protein 1 (Drp 1) in human kidney arteries and in db/db mouse aorta. Exogenous H2S (100 μM NaHS) inhibits vascular smooth muscle cells of human pulmonary aorta (HPASMC) proliferation and migration in response to high glucose using the BrdU and scratch wound repair assays, decreases proliferative protein (PCNA and cyclin D1) expression, and reduces ROS production in the cytoplasm and mitochondria. When HPASMCs proliferate with a high glucose treatment, the mitochondria become small spheres with a short rod-shaped structure, whereas NaHS, a mitochondrial division inhibitor and siDrp prevent VSMC proliferation and maintain mitochondria as stationary and randomly dispersed with fixed structures. CONCLUSION: Exogenous H2S aids in inhibiting mitochondrial fragmentation and affects proliferation in db/db mice and HPASMCs by decreasing Drp 1 expression


Abstract: Twelve samples of Aglianico grapes, collected in different locations of the Taurasi DOCG (Appellation of Controlled and Guaranteed Origin) production area were naturally fermented in sterile containers at room temperature. A total of 70 yeast cultures were isolated from countable WL agar plates: 52 in the middle of the fermentation and 18 at the end. On the basis of ITS-RFLP analysis and ITS sequencing, all cultures collected at the end of fermentations were identified as Saccharomyces (S.) cerevisiae; while, the 52 isolates, collected after 1 week, could be referred to the following species: Metschnikowia (M.) pulcherrima; Starmerella (Star.) bacillaris; Fichia (P.) kudriavzevii; Lachancea (L.) thermotolerans; Hanseniaspora (H.) uvarum; Pseudozyma (Pseud.) aphidis; S. cerevisiae. By means of Interdelta analysis, 18 different biotypes of S. cerevisiae were retrieved. All strains were characterized for ethanol production, SO2 resistance, H2S development, beta-glucosidasic, esterasic and antagonistic activities. Fermentation abilities of selected strains were evaluated in micro-fermentations on Aglianico must. Within non-Saccharomycyces species, some cultures showed features of technological interest. Antagonistic activity was expressed by some strains of M. pulcherrima, L. thermotolerans, P. kudriavzevii, and S. cerevisiae. Strains of M. pulcherrima showed the highest beta-glucosidase activity and proved to be able to produce high concentrations of succinic acid. L. thermotolerans produced both succinic and lactic acids. The lowest amount of acetic acid was produced by M. pulcherrima and L. thermotolerans; while the highest content was recorded for H. uvarum. The strain of Star. bacillaris produced the highest amount of glycerol and was able to metabolize all fructose and malic acid. Strains of M. pulcherrima and H. uvarum showed a low fermentation power (about 4%), while, L. thermotolerans, Star. Bacillaris, and P. kudriavzevii of about 10%. Significant differences were even detected for S. cerevisiae biotypes with respect to H2S production, antagonistic activity and beta-glucosidase activity as well as for the production of acetic acid, glycerol and ethanol in micro-vinification experiments

Abstract: On-farm manure storage pits contain both toxic and asphyxiating gases such as hydrogen sulfide, carbon dioxide, methane, and ammonia. Farmers and service personnel occasionally need to enter these pits to conduct repair and maintenance tasks. One intervention to reduce the toxic and asphyxiating gas exposure risk to farm workers when entering manure pits is manure pit ventilation. This article describes an online computational fluid dynamics-based design aid for evaluating the effectiveness of manure pit ventilation systems to reduce the concentrations of toxic and asphyxiating gases in the manure pits. This design aid, developed by a team of agricultural engineering and agricultural safety specialists at Pennsylvania State University, represents the culmination of more than a decade of research and technology development effort. The article includes a summary of the research efforts leading to the online design aid development and describes protocols for using the online design aid, including procedures for data input and for accessing design aid results. Design aid results include gas concentration decay and oxygen replenishment curves inside the manure pit and inside the barns above the manure pits, as well as animated motion pictures of individual gas concentration decay and oxygen replenishment in selected horizontal and vertical cut plots in the manure pits and barns. These results allow the user to assess (1) how long one needs to ventilate the pits to remove toxic and asphyxiating gases from the pit and barn, (2) from which portions of the barn and pit these gases are most and least readily evacuated, and (3) whether or not animals and personnel need to be removed from portions of the barn above the manure pit being ventilated.


Abstract: BACKGROUND: Dietary manipulation is a common practice to mitigate gaseous emission from livestock production facilities, and the variation of fat level in the diet has shown great influence on ruminal volatile fatty acids (VFA) and enteric methane generation. The changes in dietary fat levels influence rumen chemistry that could modify manure nutrient composition along with odor and gaseous emissions from manure management facilities. METHODS: A field experiment was carried out on beef cattle feedlots to investigate the effect of four levels of dietary fat concentrations (3 to 5.5 %) on the manure composition and gaseous emissions (methane-CH4, nitrous oxide-N2O, carbon dioxide-CO2 and hydrogen sulfide-H2S) from the feedlot pen surface. The experiment was carried out over a 5-month period from June to October during North Dakota's summer-fall climatic condition. Air and manure sampling was conducted five times at a 20-30 day intervals. RESULTS: Overall, this research indicated that fat levels in diet have no or little effect on the nutrient composition of manure and gaseous emission from the pens with cattle fed with different diet. Though significant variation of gaseous emission and manure composition were observed between different sampling periods, no effect of high fat diet was observed on manure composition and gaseous emission. CONCLUSIONS: It can be concluded that addition of fat to animal diet may not have any impact on gaseous emission and manure compositions.


Abstract: Accumulating evidence demonstrated that hydrogen sulfide (H2S) is highly involved in inflammation, oxidative stress, and apoptosis and contributes to the pathogenesis of kidney diseases. However, the role of H2S in cisplatin nephrotoxicity is still debatable. Here we investigated the effect of GYY4137, a novel slow-releasing H2S donor, on cisplatin nephrotoxicity in mice. Male C57BL/6 mice were pretreated with GYY4137 for 72 h prior to cisplatin injection. After cisplatin treatment for 72 h, mice developed obvious renal dysfunction and kidney injury as evidenced by elevated blood urea nitrogen (BUN) and histological damage. Consistently, these mice also showed...
increased proinflammatory cytokines such as TNF-alpha, IL-6, and IL-1beta in circulation and/or kidney tissues. Meanwhile, circulating thiobarbituric acid-reactive substances (TBARS) and renal apoptotic indices including caspase-3, Bak, and Bax were all elevated. However, application of GYY4137 further aggravated renal dysfunction and kidney structural injury in line with promoted inflammation, oxidative stress, and apoptotic response following cisplatin treatment. Taken together, our results suggested that GYY4137 exacerbated cisplatin-induced nephrotoxicity in mice possibly through promoting inflammation, oxidative stress, and apoptotic response.

(69) Li W, Ma F, Zhang L, Huang Y, Li X, Zhang A, et al. S-Propargyl-cysteine Exerts a Novel Protective Effect on Methionine and Choline Deficient Diet-Induced Fatty Liver via Akt/Nrf2/HO-1 Pathway. Oxid Med Cell Longev 2016;2016:4690857. Abstract: This study investigated the antioxidative effect of S-propargyl-cysteine (SPRC) on nonalcoholic fatty liver (NAFLD) by treating mice fed a methionine and choline deficient (MCD) diet with SPRC for four weeks. We found that SPRC significantly reduced hepatic reactive oxygen species (ROS) and methane dicarboxylic aldehyde (MDA) levels. Moreover, SPRC also increased the superoxide dismutase (SOD) activity. By Western blot, we found that this protective effect of SPRC was importantly attributed to the regulated hepatic antioxidant-related proteins, including protein kinase B (Akt), heme oxygenase-1 (HO-1), nuclear factor erythroid 2-related factor 2 (Nrf2), and cystathionine gamma-lyase (CSE, an enzyme that synthesizes hydrogen sulfide). Next, we examined the detailed molecular mechanism of the SPRC protective effect using oleic acid- (OA-) induced HepG2 cells. The results showed that SPRC significantly decreased intracellular ROS and MDA levels in OA-induced HepG2 cells by upregulating the phosphorylation of Akt, the expression of HO-1 and CSE, and the translocation of Nrf2. SPRC-induced HO-1 expression and Nrf2 translocation were abolished by the phosphoinositide 3-kinase (PI3K) inhibitor LY294002. Moreover, the antioxidative effect of SPRC was abolished by CSE inhibitor DL-propargylglycine (PAG) and HO-1 siRNA. Therefore, these results proved that SPRC produced an antioxidative effect on NAFLD through the PI3K/Akt/Nrf2/HO-1 signaling pathway.

(70) Karunakaran E, Vernon D, Biggs CA, Saul A, Crawford D, Jensen H. Enumeration of sulphate-reducing bacteria for assessing potential for hydrogen sulphide production in urban drainage systems. Water Sci Technol 2016;73(12):3087-94. Abstract: Urban drainage structures have increasing demands which can lead to increasing hydrogen sulphide related problems forming in places where they have not previously been prevalent. This puts pressure on the methods currently used to monitor and diagnose these problems and more sophisticated methods may be needed for identifying the origin of the problems. Molecular microbiological techniques, such as quantitative polymerase chain reaction, offer a potential alternative for identifying and quantifying bacteria likely to be causing the production of hydrogen sulphide, information that, when combined with an appropriate sampling programme, can then be used to identify the potentially most effective remediation technique. The application of these methods in urban drainage systems is, however, not always simple, but good results can be achieved. In this study bacteria producing hydrogen sulphide were quantified in three small combined sewer overflow storage tanks. Bacterial counts were compared between wastewater, biofilms and sediments. Similar numbers were found in the wastewater and biofilms, with the numbers in the sediments being lower. If remediation methods for hydrogen sulphide are deemed necessary in the tanks, methods that target both the wastewater and the biofilms should therefore be considered.

(DCM). METHODS: Thirty male SD rats were randomly divided into control group, diabetes group and treatment group (n = 10). Intraperitoneal injection of streptozotocin was utilized to establish a rat model of DCM. The rats with DCM in treatment group were intraperitoneally injected with NaHS solution. After treated for 12 weeks, the hearts isolated from rats were perfused on a langendorff apparatus. The ventricular hemodynamic parameters were measured. The ultrastructures of myocardium were observed using electron microscopy. The content of malondialdehyde (MDA), the activities of superoxide dismutase (SOD) and glutathione peroxidase (GSH-Px) in myocardial tissue were determined by spectrophotometry. The expressions of C/EBP homologous protein (CHOP), glucose-regulated protein 78 (GRP78) and Caspase 12 at mRNA level in myocardium were detected using RT-PCR. RESULTS: Compared with control group, the cardiac function and myocardial ultrastructure were damaged obviously in diabetic rats. In myocardial tissue, the content of MDA was increased, while the activities of SOD and GSH-Px were decreased. CHOP, GRP78 and Caspase 12 mRNA expressions were increased significantly. Compared with diabetes group, cardiac function and myocardial ultrastructure damage were improved in treatment group. The content of MDA was decreased, while the activities of SOD and GSH-Px were increased significantly. The mRNA levels of CHOP, GRP78 and Caspase 12 were increased. CONCLUSION: H2S can protect myocardium in diabetic rats, maybe it is related to reduce oxidative stress damage and inhibition of the ERS-induced apoptosis pathway.

(72) Emmez H, Borcek AO, Gonul II, Bolay BH, Solaroglu I, Baykaner MK. The Effect of Hydrogen Sulphide on Experimental Cerebral Vasospasm. Turk Neurosurg 2015 Nov 13. Abstract: AIM: Cerebral vasospasm is the primary cause of morbidity and mortality after subarachnoid hemorrhage (SAH). Hydrogen Sulfide (H2S), a gaseous neurotransmitter, is produced in many tissues including the central nervous system. The vasodilatatory effect of H2S has been shown in the CNS; however, its role in cerebral vasospasm has not been investigated before. MATERIAL AND METHODS: The rats were divided into 8 groups: control, SAH, sodium hydrosulphide (NaHS), propargylglycine (PPG), aminooxyacetic acid (AOAA), SAH+NaHS, SAH+PPG, and SAH+AOAA. After establishing experimental SAH, the basilar artery and brainstem were harvested at 24 hours. The diameter and wall thickness of basilar artery were measured. Production of H2S was assessed by showing the activity of cystathionine beta-synthase (CBS) and cystathionine gamma-lyase enzymes (CSE). RESULTS: NaHS treatment significantly reduced vasospasm at 24 hours following SAH. This vasodilatatory effect was correlated with the CSE expression in basilar artery. CSE and CBS enzyme expressions were significantly lower in brain stem and basilar artery in PPG and AOAA-treated goups. PPG and AOAA treatments exerted vasoconstrictive effect in basilar artery. There were statistically significant differences between NaHS, PPG and AOAA groups, in terms of basilar artery lumen diameter. CONCLUSION: Results show that H2S may have a therapeutic potential in the treatment of vasospasm with its vasodilator activity.