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CONTENTS

SYNTHESIS AND CHARACTERIZATION OF AMIDE-INTERCONNECTED SINGLE-WALL CARBON NANOTUBES
Craig M. Whitaker†, Jay R. Heckert,* and Ian C. Uber* 149

INFLUENCE OF SIZE AND COMPOSITION OF THE LOOP BRIDGING THE PYRIMIDINE STRANDS HAS ON INTRAMOLECULAR RNA TRIPLEX STABILITY
Eric Hector Cantú,* Jackie Miriti* and Jason Allen Holland† 153

INVESTIGATING ENERGY TRANSFER FROM GADOLINIUM TO CHROMIUM IN CHROMIUM DOPED GADOLINIUM GARNETS
Stacey K. Vargas† and Daniel T. Dunn* 158

THE EFFECTS OF PH AND TETRAMETHYLAMMONIUM CHLORIDE ON THE HPLC SEPARATION OF BENZOIC ACID, 4-HYDROXYBENZOIC ACID, AND ETHYL PARABEN
Martina Ayad*, Isabelle Kusters*, Danielle Schwartzenburg*, and John A. Palasota† 161

REDOX REACTIONS OF HEMOGLOBIN TRAPPED IN POLYETHYLENE GLYCOL POLYMER NETWORKS.
Hoang Khoa*, and Amos Mugwer† 164

USE OF DENTAL IMPLANTATIONS BY MATRIX-ASSISTED LASER DESORPTION / IONIZATION TIME-OF-FLIGHT (MALDI-TOF) MASS SPECTROMETRY
Monica Zamora* , Mario Serrano* and Sajid Bashir† 169

COORDINATION CHEMISTRY OF POLYCYCLIC THIOSEMICARBAZONES. I. REACTIONS OF THE THIOSEMICARBAZONE FROM 9-ANTHRALDEHYDE
Amon Holt* and Floyd Beckford† 173

OPTIMIZED GEOMETRIES, VIBRATIONAL FREQUENCIES, AND THERMOCHEMICAL PROPERTIES OF MIXED BORON- AND CARBON-CONTAINING THREE-MEMBERED RINGS
Jon Hillegass, Jr.*, and David W. Ball† 178

NOVEL INHIBITORS FOR FUNGAL GLYCOSIDASES BASED ON CYCLOHEXANE-1,2-DICARBOXYLIC ACIDS
Nikmala S. Tan,* Barbora Brazdova, Nataliya M. Samoshina,† and Vyacheslav V. Samoshin† 186

CHEMICAL MODIFICATION OF ACYLTRANSFERASES
Jasmine Ohi* and Timothy L. Born† , ... 193

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SYNTHESIS AND CHARACTERIZATION OF AMIDE-INTERCONNECTED SINGLE-WALL CARBON NANOTUBES

A covalent, amide-interconnection between functionalized single-wall carbon nanotubes (SWNTs) is reported. SWNTs covalently connected via an amide bond were prepared by coupling the carboxylic acid group from one SWNT with the amine group on a second SWNT using DMAP and DCC reagents. The SWNT intermediates and product were characterized by ATR FT-IR, Ramen Spectroscopy and Thermogravimetric Analysis (TGA). The amide functionalized SWNTs have the potential to make polymeric-like materials and be incorporated in high strength nanocomposites.

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INFLUENCE OF SIZE AND COMPOSITION OF THE LOOP BRIDGING THE PYRIMIDINE STRANDS HAS ON INTRAMOLECULAR RNA TRIPLEX STABILITY

The ability of RNA to form triplexes has been known for forty years, although the influence of loop size and composition on triplex stability is not well characterized. To study this influence, the stability of two sets of intramolecular RNA triplexes with loops varying in closing nucleotide sequence and in length from four to ten nucleotides was monitored using UV-spectroscopy. Intramolecular RNA triplexes formed in 100mM and 1M NaCl solutions at pH 7.0. Triplexes were more stable at the higher salt concentration. Increasing the loop size decreases the stability of the triplex with a greater effect observed at 100mM NaCl. Loops containing **G** and **C** at the first and last positions result in slightly more stable triplexes than **C** and **G** at these positions.

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INVESTIGATING ENERGY TRANSFER FROM GADOLINIUM TO CHROMIUM IN CHROMIUM DOPED GADOLINIUM GARNETS

An excitation experiment was performed in the near ultraviolet on Cr^{3+}:$Gd_3Ga_2O_{12}$ (GGG) and Cr^{3+}:$Gd_3Sc_2Ga_3O_{12}$ (GSGG). The intent of the experiment was to investigate the possible energy transfer between Gd^{3+} and Cr^{3+} and to determine the necessary wavelengths to excite the gadolinium in the garnets. The experiment was designed to excite the gadolinium and monitor the Cr^{3+} fluorescence. The resulting excitation spectra obtained in the experiment displayed the Cr^{3+} fluorescence intensity as a function of gadolinium excitation wavelength. The peaks in the Cr^{3+} fluorescence correspond directly to the excitation wavelengths of the Gd^{3+} from the ground state to higher energy states. The excitation spectra revealed energy transfer from Gd^{3+} to Cr^{3+} in both garnets. By comparing the peaks in the excitation spectra to the energy levels of gadolinium, the wavelengths needed to excite the gadolinium from the ground state to the ^6P state and the ^6I state were determined.

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THE EFFECTS OF PH AND TETRAMETHYL-AMMONIUM CHLORIDE ON THE HPLC SEPARATION OF BENZOIC ACID, 4-HYDROXY-BENZOIC ACID, AND ETHYL PARABEN

A reversed-phase HPLC method is described that allows the separation and simultaneous determination of benzoic acid, 4-hydroxybenzoic acid, and ethyl paraben. Mobile phase pH and concentration of tetramethylammonium chloride (positive ion-interaction reagent) in the mobile phase appear to effect the separation individually, with changes in pH having a greater affect on the separation. This is supported by statistical modeling of the chromatographic data. Future work will examine the effect of pH and negative ion-interaction reagent on the separation.

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REDOX REACTIONS OF HEMOGLOBIN TRAPPED IN POLYETHYLENE GLYCOL POLYMER NETWORKS.-

Hemoglobin (Hb) was immobilized on glassy carbon electrode (GCE) surface by trapping it inside poly-ethylene glycol diacrylate (PEG-DA) macromolecular networks through photo polymerization. The enzyme entrapped in this hydrogel was found to undergo fast direct transfer-electron reactions in aqueous solvents. The formal potential (E^0 ~0.334 V) indicates the redox of HbFe(III)/(II) couple. The E^0 was found to be linearly dependent on buffer pH indicating the electron transfer of HbFe(III)/(II) redox couple accompanied with the transfer of a proton. The PEG-DA hydro gel acted to link enzyme with the electrode and at the same time provide an ideal three-dimensional, aqueous in vivo-like surrounding for maximum activity of the enzyme. A major advantage of this new way to entrap the molecule is that it only takes seconds as compared to other techniques that take overnight for the film to cure. The catalytic activity

of this enzyme in this medium was evaluated in acetate buffer pH 5.5 by its ability to reduce hydrogen peroxide. Photopolymerization initiated by mid UV radiation was found not to affect the electro activity of the enzyme.

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USE OF DENTAL IMPLANTATIONS BY MATRIX-ASSISTED LASER DESORPTION / IONIZATION TIME-OF-FLIGHT (MALDI-TOF) MASS SPECTROMETRY

Dental implants are widely used today leading to diversity in terms of composition and design. The cost of all dental implants has increased sufficiently over the past years to necessitate the use of new composite materials that are more durable and less expensive. The ideal metal for construction of dental implants was assessed by co-incubation of different metals with bacteria grown from oral swabs. The extent (percentage of growth on metal surface) of bacterial growth at 37ºC and the number of colonies on copper, aluminum, and gold was quantified. Colony counts were conducted on the three metals on a daily basis over a two week period. Cooper was more effective than gold on retardation of bacterial growth suggesting that copper may serve as a cheaper alternate than titanium for construction of dental implants.

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COORDINATION CHEMISTRY OF POLYCYCLIC THIOSEMICARBAZONES. I. REACTIONS OF THE THIOSEMICARBAZONE FROM 9-ANTHR-ALDEHYDE

The thiosemicarbazone of 9-anthraldehyde, (9-ATSC) and its group 12 metal complexes have been synthesized. The four compounds have been characterized by IR, electronic and NMR spectrometries, molar conductivity, melting points and elemental analysis. In all the complexes, the 9-ATSC coordinates through the sulfur and the azomethinic nitrogen. The zinc (II) complex shows a 1:2 metal to ligand stoichiometry while the mercury(II) and cadmium(II) complexes exhibit 1:1 metal-ligand composition. The compounds show moderate inhibitory activity against *Bacillus cereus*, *Proteus vulgaris*, *Enterococcus faecalis*, and *Salmonella typhimurium*. It was seen that the complexes were generally more active than the free ligand.

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OPTIMIZED GEOMETRIES, VIBRATIONAL FREQUENCIES, AND THERMOCHEMICAL PROPERTIES OF MIXED BORON- AND CARBON-CONTAINING THREE-MEMBERED RINGS

As a follow-up to our paper on mixed boron- and nitrogen-containing three-membered rings, we present here the predicted structures, vibrational frequencies, and thermochemical properties of two mixed boron- and carbon-containing rings. G2, G3, and two CBS methods were employed.

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NOVEL INHIBITORS FOR FUNGAL GLYCOSIDASES BASED ON CYCLOHEXANE-1,2-DICARBOXYLIC ACIDS

Novel carbasugars derived from cyclohexane-1,2-dicarboxylic acid were synthesized and tested for inhibitory activity towards fungal glycosidases from *Aspergillus oryzae* and *Penicillium canescens*. Significant inhibition was observed, which magnitude depended on configuration of substituents.

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CHEMICAL MODIFICATION OF ACYLTRANSFERASES

The enzyme homoserine transsuccinylase from *Streptococcus pneumoniae* can be inactivated by both iodoacetamide and diethypyrocarbonate, suggesting the presence of cysteine and histidine residues at the active site. Substrate protection experiments indicated that acetyl-CoA binds to the active site and is the probable natural substrate for the enzyme. In addition, malonyl-CoA, succinyl-CoA, and butyryl-CoA are also able to protect the enzyme from inactivation while propionyl-CoA has no effect. The ionization state of the active-site cysteine residue was examined by the pH-dependence of iodoacetamide inactivation and a p*K* value of 7.1 was determined.

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