

27 May 2010

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Chem-Bio News – S&T Edition

- 1. EFFECTS OF PH-SENSITIVE NANOPARTICLES PREPARED WITH DIFFERENT POLYMERS ON THE DISTRIBUTION, ADHESION AND TRANSITION OF RHODAMINE 6G IN THE GUT OF RATS:** *“Most nanoparticle formulations decreased the distribution and adhesion of Rho in the stomach but increased these values in the intestine. The nanocarriers also control the drug release sites and release rate in the GI tract.”*
- 2. ENCAPSULATION OF LIQUID CORES BY LAYER-BY-LAYER ADSORPTION OF POLYELECTROLYTES:** *“The aim of this work was to develop the method of preparation of loaded, submicron nanocapsules based on the liquid core encapsulation by polyelectrolyte (PE) multilayer adsorption.”*
- 3. DETECTION OF RESIDUAL TOXIN IN TISSUES OF RICIN-POISONED MICE BY SANDWICH ENZYME-LINKED IMMUNOSORBENT ASSAY AND IMMUNOPRECIPITATION:** *“Although the same tissue samples of intoxicated mice were analyzed by immunoprecipitation, positive bands were found. This indicated that some components in the kidney, lung, and intestine could bind with ricin and interfere in its binding activity with the coated antibody.”*
- 4. IMPEDANCE BASED DETECTION OF CHEMICAL WARFARE AGENT MIMICS USING FERROCENE-LYSINE MODIFIED CARBON NANOTUBES:** *“These changes allowed the detection of nerve agent analogues at the micromolar level, and a limited sensitivity was observed toward a sulfur mustard mimic.”*
- 5. ION CHEMISTRY OF VX SURROGATES AND ION ENERGETICS PROPERTIES OF VX: NEW SUGGESTIONS FOR VX CHEMICAL IONIZATION MASS SPECTROMETRY DETECTION:** *“Limits of detection for commercial and research grade CIMS instruments are estimated at 80 pptv and 5 ppqv, respectively.”*
- 6. DETECTION AND DIFFERENTIATION OF CLOSTRIDIUM BOTULINUM TYPE A STRAINS USING A FOCUSED DNA MICROARRAY:** *“The focused microarray format provides a rapid approach for neurotoxin gene detection and preliminary determination of the relatedness of strains isolated from different sources.”*

7. DEMONSTRATION OF CROSS-PROTECTIVE VACCINE IMMUNITY AGAINST AN EMERGING PATHOGENIC EBOLAVIRUS SPECIES:

"This report provides the first demonstration of vaccine-induced protective immunity against challenge with a heterologous EBOV species, and shows that Ebola vaccines capable of eliciting potent cellular immunity may provide the best strategy for eliciting cross-protection against newly emerging heterologous EBOV species."

8. DECIPHERING DISEASES AND BIOLOGICAL TARGETS FOR ENVIRONMENTAL CHEMICALS USING TOXICOGENOMICS NETWORKS:

"We present a high confidence human protein-protein association network built upon the integration of chemical toxicology and systems biology. This computational systems chemical biology model reveals uncharacterized connections between compounds and diseases, thus predicting which compounds may be risk factors for human health. Additionally, the network can be used to identify unexpected potential associations between chemicals and proteins."

9. ANTIBACTERIAL SILVER NANOPARTICLES ARE A BLAST:

"Writing in the International Journal of Nanoparticles, Rani Pattabi and colleagues at Mangalore University, explain how blasting silver nitrate solution with an electron beam can generate nanoparticles that are more effective at killing all kinds of bacteria, including gram-negative species that are not harmed by conventional antibacterial agents."

10. RAMAN FINGERPRINT FOR INSECTICIDE DETECTION:

"Chinese scientists can detect trace concentrations of a hazardous insecticide using gold nanoparticles to boost its spectroscopic fingerprint."

CB Daily Report

Chem-Bio News

EFFECTS OF PH-SENSITIVE NANOPARTICLES PREPARED WITH DIFFERENT POLYMERS ON THE DISTRIBUTION, ADHESION AND TRANSITION OF RHODAMINE 6G IN THE GUT OF RATS

Health & Medicine Week

May 10, 2010

"The different patterns of pH-dependent release profiles were observed, although some polymers have the same dissolving pH. The distribution, adhesion and transition of different nanoparticles in rat gut showed significant difference, closely related to the release characteristics of nanoparticles, and their release behaviour are dependent on the dissolving pH and the structure of the polymers, as well as the drug property. Most nanoparticle formulations decreased the distribution and adhesion of Rho in the stomach but increased these values in the intestine. The nanocarriers also control the drug release sites and release rate in the GI tract."

The full article can be found at: (C.S. Wu, et. al., "Effects of pH-sensitive nanoparticles prepared with different polymers on the distribution, adhesion and transition of Rhodamine 6G in the gut of rats". Journal of Microencapsulation, 2010;27(3):205-17). Link not available.

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ENCAPSULATION OF LIQUID CORES BY LAYER-BY-LAYER ADSORPTION OF POLYELECTROLYTES

Health & Medicine Week
May 10, 2010

"The aim of this work was to develop the method of preparation of loaded, submicron nanocapsules based on the liquid core encapsulation by polyelectrolyte (PE) multilayer adsorption. The procedure of PE adsorption on the emulsion droplets requires a specific selection of surfactants, which have good properties as emulsifiers and provide a stable surface charge for sequential adsorption of PE without losing stability of emulsion."

"Using AOT as emulsifier this study obtained droplets, stabilized by AOT/PDADMAC surface complexes. These positively charged liquid cores were then modified by sequential adsorption of polyelectrolytes to obtain nanocapsules with the average size of 200 nm, with various combinations of polyelectrolytes (PDADMAC, CHIT, PAH, PSS, ALG). This study demonstrated the formation of consecutive layers of PE shells by measuring zeta potential of capsules after adsorption of each layer."

"It visualized the cores by dissolving fluorescent dye Coumarine6 in oil phase and multilayer shells by using FITC labelled polycation."

The full article can be found at: (K. Szczepanowicz, et. al., "Encapsulation of liquid cores by layer-by-layer adsorption of polyelectrolytes". Journal of Microencapsulation, 2010;27(3):198-204). Link not available.

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DETECTION OF RESIDUAL TOXIN IN TISSUES OF RICIN-POISONED MICE BY SANDWICH ENZYME-LINKED IMMUNOSORBENT ASSAY AND IMMUNOPRECIPITATION

Life Science Weekly
May 11, 2010

"This work aimed to evaluate a method to detect the residual ricin in animal tissues. Immunoprecipitation and sandwich enzyme-linked immunosorbent assay (ELISA) were used to detect ricin in the tissues of intoxicated mice."

"The monoclonal antibodies (Mabs) 4C13 and 3D74 were used to assay the whole ricin

molecules via sandwich ELISA. Mab 4C13 was conjugated with Sepharose 4B to capture ricin or ricin A chain by immunoprecipitation. Mice injected intravenously with ricin at the dosage of 5 microg/mouse were killed at different time points after intoxication. The serum, liver, kidney, lung, and intestine were harvested. High levels of ricin were found in serum and liver samples at each poisoning time point by sandwich ELISA, suggesting the possibility of determining ricin intoxication by detecting residual ricin in the serum. However, this method turned out to be ineffective for examining ricin in the kidney, lung, and intestine of poisoned mice. Although the same tissue samples of intoxicated mice were analyzed by immunoprecipitation, positive bands were found. This indicated that some components in the kidney, lung, and intestine could bind with ricin and interfere in its binding activity with the coated antibody."

The full article can be found at: (J. Men, et. al., "Detection of residual toxin in tissues of ricin-poisoned mice by sandwich enzyme-linked immunosorbent assay and immunoprecipitation". Analytical Biochemistry, 2010; 401(2):211-6). Link not available.

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IMPEDANCE BASED DETECTION OF CHEMICAL WARFARE AGENT MIMICS USING FERROCENE-LYSINE MODIFIED CARBON NANOTUBES

Life Science Weekly
May 18, 2010

"A recognition layer formed by multiwalled carbon nanotubes (MWCNTs) covalently modified with a ferrocene-lysine conjugate deposited on the indium tin oxide (ITO) was investigated as a sensor for chemical warfare agent (CWA) mimics. Electrochemical impedance spectroscopy measurements showed that upon addition of CWA mimic dramatic changes occurred in the electrical properties of the recognition layer."

"These changes allowed the detection of nerve agent analogues at the micromolar level, and a limited sensitivity was observed toward a sulfur mustard mimic. Experimental parameters were optimized so as to allow the detection of CWAs at single frequency, thereby significantly reducing acquisition time and simplifying data treatment."

"A proposed method of detection represents a significant step toward the design of an affordable and "fieldable" electrochemical CWA sensor."

The full article can be found at: (P.M. Diakowski, et. al. "Impedance Based Detection of Chemical Warfare Agent Mimics Using Ferrocene-Lysine Modified Carbon Nanotubes". Analytical Chemistry, 2010; 82(8): 3191-3197). Link not available.

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ION CHEMISTRY OF VX SURROGATES AND ION ENERGETICS PROPERTIES OF VX: NEW SUGGESTIONS FOR VX CHEMICAL IONIZATION MASS SPECTROMETRY

DETECTION

Bioterrorism Week

May 17, 2010

"Room temperature rate constants and product ion branching ratios have been measured for the reactions of numerous positive and negative ions with VX chemical warfare agent surrogates representing the amine (triethylamine) and organophosphonate (diethyl methythiomethylphosphonate (DEMTMP)) portions of VX. The measurements have been supplemented by theoretical calculations of the proton affinity, fluoride affinity, and ionization potential of VX and the stimulants."

"The results show that many proton transfer reactions are rapid and that the proton affinity of VX is near the top of the scale. Many proton transfer agents should detect VX selectively and sensitively in chemical ionization mass spectrometers. Charge transfer with NO(+) should also be sensitive and selective since the ionization potential of VX is small. The surrogate studies confirm these trends."

"Limits of detection for commercial and research grade CIMS instruments are estimated at 80 pptv and 5 ppqv, respectively."

The full article can be found at: (A.J. Midey, et. al., "Ion chemistry of VX surrogates and ion energetics properties of VX: new suggestions for VX chemical ionization mass spectrometry detection". Analytical Chemistry, 2010;82(9): 3764-71). Link not available.

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DETECTION AND DIFFERENTIATION OF CLOSTRIDIUM BOTULINUM TYPE A STRAINS USING A FOCUSED DNA MICROARRAY

Life Science Weekly

May 18, 2010

"A focused oligonucleotide microarray featuring 62 probes targeting strain variable regions of the Clostridium botulinum strain ATCC 3502 genome sequence was developed to differentiate C. botulinum type A strains. The strain variable regions were selected from deletions identified among a panel of 10 type A strains compared to the strain ATCC 3502 genome sequence using high density comparative genomic hybridization microarrays."

"The focused microarray also featured specific probes for the detection of the neurotoxin genes of various serotypes (A-G), toxin gene cluster components (ha70 and orfX1), and fldB as a marker for proteolytic clostridia (Group I). Eight pairs of strains selected from separate type A botulism outbreaks were included in the 27 subtype A1-A4 strains examined in this study. Each outbreak related strain pair consisted of strains isolated from different sources (stool and food). Of the eight outbreak related strain pairs, six groups of strains with indistinguishable hybridization patterns were identified. Outbreak related strains were shown to have identical hybridization patterns. Strain pairs from three separate outbreaks involving strains harboring both the type A neurotoxin gene (bont/A) and an unexpressed type B neurotoxin gene (bont/B) shared the same probe hybridization profile."

"The focused microarray format provides a rapid approach for neurotoxin gene detection and preliminary determination of the relatedness of strains isolated from different sources."

The full article can be found at: (B.H. Raphael, et. al., "Detection and differentiation of Clostridium botulinum type A strains using a focused DNA microarray". Molecular and Cellular Probes, 2010;24(3):146-53). Link not available.

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DEMONSTRATION OF CROSS-PROTECTIVE VACCINE IMMUNITY AGAINST AN EMERGING PATHOGENIC EBOLAVIRUS SPECIES

By Lisa E. Hensley, Sabue Mulangu, Clement Asiedu, Joshua Johnson, Anna N. Honko, Daphne Stanley, Giulia Fabozzi, Stuart T. Nichol, Thomas G. Ksiazek, Pierre E. Rollin³, Victoria Wahl-Jensen¹, Michael Bailey, Peter B. Jahrling, Mario Roederer, Richard A. Koup, Nancy J. Sullivan

PloS Pathogens

May 20, 2010

"Abstract

.....This report provides the first demonstration of vaccine-induced protective immunity against challenge with a heterologous EBOV species, and shows that Ebola vaccines capable of eliciting potent cellular immunity may provide the best strategy for eliciting cross-protection against newly emerging heterologous EBOV species."

.....

"The data presented here demonstrate that a vaccination strategy targeting structural proteins from ZEBOV and SEBOV was able to provide cross-protective immunity against infectious challenge with a heterologous EBOV species. This may have been due in part to the ability of DNA/rAd prime-boost vaccination to generate more robust immune responses than single-shot vaccines. The time to death for the BEBOV controls (12–14 days) was somewhat longer than what we have observed for ZEBOV (6–12 days) [5] suggesting it may also be possible that BEBOV is less pathogenic than other EBOV species and therefore inherently more sensitive to host immunity."

.....

"The findings reported herein demonstrate a mechanistic basis for vaccine-induced immune protection against EBOV infection and will therefore inform the design of next-generation vaccines. Furthermore, this study shows that it is possible to protect against EBOV species whose antigens are not present in the vaccine formulation. This suggests that current vaccines capable of eliciting robust T-cell immunity will have the greatest potential to protect against other newly emerging pathogenic EBOV species."

The full article can be found at: [http://www.plospathogens.org/article/info%3Adoi%](http://www.plospathogens.org/article/info%3Adoi%3A10.1371/journal.ppat.1000400)

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DECIPHERING DISEASES AND BIOLOGICAL TARGETS FOR ENVIRONMENTAL CHEMICALS USING TOXICOGENOMICS NETWORKS

By Karine Audouze, Agnieszka Sierakowska Juncker, Francisco J.S.S.A. Roque, Konrad Krysiak-Baltyn, Nils Weinhold, Olivier Taboureau, Thomas Skøt Jensen, Søren Brunak
PLoS Computational Biology
May 28, 2010

“Exposure to environmental chemicals and drugs may have a negative effect on human health. A better understanding of the molecular mechanism of such compounds is needed to determine the risk. We present a high confidence human protein-protein association network built upon the integration of chemical toxicology and systems biology. This computational systems chemical biology model reveals uncharacterized connections between compounds and diseases, thus predicting which compounds may be risk factors for human health. Additionally, the network can be used to identify unexpected potential associations between chemicals and proteins. Examples are shown for chemicals associated with breast cancer, lung cancer and necrosis, and potential protein targets for di-ethylhexyl-phthalate, 2,3,7,8-tetrachlorodibenzo-p-dioxin, pirinixic acid and permethrine. The chemical-protein associations are supported through recent published studies, which illustrate the power of our approach that integrates toxicogenomics data with other data types.”

.....

“An essential step towards deciphering the effect of chemicals on human health is to identify all possible molecular targets of a given chemical. Various network-oriented chemical pharmacology approaches have been published recently to identify novel protein candidates for drugs, using structural chemical similarity [7]–[10]. For example Keiser et al. [8] applied network analysis to drugs and their targets. The authors identified unexpected molecular targets such as muscarinic acetylcholine receptor M3, alpha-2 adrenergic receptor and neurokinin NK2 receptor for methadone, emetine and loperamide, respectively. Additionally, recent studies have demonstrated that chemicals could be classified based upon their effect on mRNA expression detected by microarrays [11]–[12]. Lamb et al. showed that genomic signatures could be used to recognize drugs with common mechanism of action allowing discovery of unknown modes of action.....”

.....

“The major limitation of our integrative systems biology approach is that the molecular target predictions are limited to the 3,528 proteins present in our P-PAN, which represent only 15% of the estimated human proteome [55]. Hence, the current lack of high quality data is the limiting factor in approaches such as the one described here. Today high throughput methodologies result in available large scale data in both chemical biology and systems biology, but these data are discipline specific [56]. There is an evident need for the

development of databases [57] to integrate disparate datasets such as toxicogenomics data in order progress in systems biology research. In addition, the results of the disease-compound association analysis will improve in the future as newer, more complete and curated data will become available."

The full article can be found at: <http://www.ploscompbiol.org/article/info%3Adoi%2F10.1371%2Fjournal.pcbi.1000788;jsessionid=5E54F634FB1367C00C13D322071F47A7>

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ANTIBACTERIAL SILVER NANOPARTICLES ARE A BLAST

Physorg.com

May 24, 2010

"Writing in the International Journal of Nanoparticles, Rani Pattabi and colleagues at Mangalore University, explain how blasting silver nitrate solution with an electron beam can generate nanoparticles that are more effective at killing all kinds of bacteria, including gram-negative species that are not harmed by conventional antibacterial agents."

.....

"Researchers have been experimenting with radiation to split silver compounds, releasing silver ions that then clump together to form nanoparticles. The incentive lies in the fact that such an approach avoids the need for costly and hazardous reducing agents and can be fine-tuned to produce nanoparticles of a controlled size, which is important for controlling their properties. Pattabi and colleagues have used electron beam technology to irradiate silver nitrate solutions in a biocompatible polymer, polyvinyl alcohol, to form their silver nanoparticles.

Preliminary tests show that silver nanoparticles produced by this straightforward, non-toxic method are highly active against *S. aureus*, *E. coli*, and *P. aeruginosa*.

More information: "Antibacterial potential of silver nanoparticles synthesised by electron beam irradiation", in *Int. J. Nanoparticles*, 2010, 3, 53-64"

The full article can be found at: <http://www.physorg.com/news193912917.html>

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RAMAN FINGERPRINT FOR INSECTICIDE DETECTION

By Erica Wise

Highlights in Chemical Technology

May 24, 2010

"Chinese scientists can detect trace concentrations of a hazardous insecticide using gold

nanoparticles to boost its spectroscopic fingerprint.”

.....

“Jin Wang and colleagues at the Chinese Academy of Sciences, Anhui, have demonstrated a fast, sensitive and practical approach for detecting methyl parathion. They synthesised gold nanoparticles and modified the surface with mono-6-thio-beta-cyclodextrin using the strong interaction between gold and sulphur. The cyclodextrin is well suited to bind the insecticide molecules and hold them in close proximity to the gold surface.

Wang's detection method applies a well known form of vibrational spectroscopy called surface enhanced Raman scattering (SERS). A SERS experiment detects the light scattered off a molecule near to a nanoscale noble metal surface. The gold nanoparticles act like lightning rods, amplifying the incoming and outgoing photons, which boosts the intensity of the insecticide's vibrational signals.

'Different molecules have inherent vibrational bands with different positions, intensities and envelopes, which can act as fingerprint peaks,' explains Wang. This means the insecticide can be easily identified in trace amounts. Methyl parathion binds to Wang's modified nanoparticles significantly better than to unmodified ones, producing a SERS signal thousands of times stronger.”

The full article can be found at: http://www.rsc.org/Publishing/ChemTech/Volume/2010/06/raman_fingerprint.asp

The original article can be found at: <http://www.rsc.org/Publishing/Journals/JM/article.asp?doi=c0jm00040j>

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