*7 May 2009*

*This supplement has been prepared to present scientific and technical news items that may be of more interest to technical personnel at RDT&E activities and the labs, or the medics rather than the broader readership of the basic CB Daily. Due to the nature of the material, the articles, if available online, are usually only available through subscription services thus making specific links generally unavailable. Thus, usually only the bibliographic citation is available for use by an activity's technical library.*

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## Chem-Bio News – S&T Edtion

**1. DESTRUCTION OF ORGANOPHOSPHORUS COMPOUNDS IN FLAMES AND NONTHERMAL PLASMAS:** *"Practical aspects of the processed studied, including toxic waste disposal, chemical weapon elimination, and fire safety problems, are briefly overviewed."*

**2. PHOTO-TRIGGERED ON DEMAND DRUG RELEASE OF NANOPARTICLES:** *"A number of applications in nanomedicine – imaging, drug delivery or photo therapy for instance – utilize phenomena called two-photon absorption (TPA)."*

**3. SECOND STRAIN OF FLU MAY COMPLICATE PICTURE:** *"They have found a strain of the H3N2 virus that appears to have made a shift and could have complicated the flu picture in Mexico, epicenter of an outbreak of a new strain of the H1N1 swine flu virus."*

**4. N-CHLORAMIDE MODIFIED NOMEX(A(R)) AS A REGENERABLE SELF-DECONTAMINATING MATERIAL FOR PROTECTION AGAINST CHEMICAL WARFARE AGENTS:** *"Furthermore, the rate constant for the neutralization of each simulant on the reactive material was calculated from data collected by GC-MS and ATR-FTIR real-time studies."*

**5. SELF-ASSEMBLED PEPTIDE MONOLAYERS AS A TOXIN SENSING MECHANISM WITHIN ARRAYED MICROCHANNELS:** *"The modular design of this microfluidic SAM platform allows for extension to sensing other toxins that operate via enzymatic cleavage, such as the remaining BoNT [botulinum neurotoxin] serotypes B-G, anthrax, and tetanus toxin."*

**6. USE OF POLYCLONAL ANTIBODIES TO OCHRATOXIN A WITH A QUARTZ-CRYSTAL MICROBALANCE FOR DEVELOPING REAL-TIME MYCOTOXIN PIEZOELECTRIC IMMUNOSENSORS:** *"A pepsin 2 mg/mL (pH=2.1) solution was used to release antigen-antibody complexes, regenerating the biorecognition surface."*

**7. THE PRIMED EBOLAVIRUS GLYCOPROTEIN (19-KILODALTON GP(1,2)): SEQUENCE AND RESIDUES CRITICAL FOR HOST CELL BINDING:** *"Combined with those of Lee et al., our findings provide structural insight into how GP(1,2) is primed for*

*fusion and define the core of the EBOV RBR (residues 90 to 149 of GP(1)) as a highly conserved region containing a two-stranded beta-sheet, the two intra-GP(1) disulfide bonds, and four critical Lys residues."*

**8. GENERATION OF HIGH-TITER NEUTRALIZING ANTIBODIES AGAINST BOTULINUM TOXINS A, B, AND E BY DNA ELECTROTRANSFER:** *"This study demonstrates that DNA electrotransfer is an effective procedure for raising neutralizing antiserum titers to remarkably high levels."*

# CB Daily Report

## *Chem-Bio News*

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**DESTRUCTION OF ORGANOPHOSPHORUS COMPOUNDS IN FLAMES AND NONTHERMAL PLASMAS**
News of Science
May 10, 2009

"The available results of experimental and theoretical studies of the chemistry and mechanism of the destruction of organophosphorus compounds (OPCs) in a flame and corona discharge plasma are systematized. The experimental methods, instrumentation, and methodological approaches used in determining the flame structure and identifying the products of OPC destruction are described."

"The published kinetic models capable of describing the decomposition of OPCs and the mechanisms of the promoting and inhibiting action of OPCs on combustion are considered. Common and distinctive features of the mechanisms of OPC destruction in various processes are examined."

"Practical aspects of the processed studied, including toxic waste disposal, chemical weapon elimination, and fire safety problems, are briefly overviewed."

The full article can be found at: (O.P. Korobeinichev, et. al., "Destruction of Organophosphorus Compounds in Flames and Nonthermal Plasmas". Russian Journal of Physical Chemistry B, 2008;2(6):856-875). Link not available.

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**PHOTO-TRIGGERED ON DEMAND DRUG RELEASE OF NANOPARTICLES**
By Michael Berger
Nanowerk.com
April 27, 2009

"A number of applications in nanomedicine – imaging, drug delivery or photo therapy for instance – utilize phenomena called two-photon absorption (TPA). In TPA, the simultaneous

absorption of two photons excite a molecule from one state to a higher energy electronic state. TPA initially was used only as a spectroscopic tool but new applications emerged over time.

"Currently approved two-photon absorption-induced excitation is one of the most promising approaches in photo therapies as it increases light penetration," Dong-Hwang Chen tells Nanowerk."It enables the use of light in the tissue-transparent window (750–1000 nm), allowing deeper light penetration and reduced risk of laser hyperthermia. An uphill energy conversion through the use of two-photon absorbing chromophores and subsequent energy transfer is a promising scientific frontier."

Chen, a Distinguished Professor in the Department of Chemical Engineering at National Cheng Kung University in Tainan, Taiwan, continues to explain that fluorescence resonant energy transfer (FRET)-based semiconductor nanocrystal sensors and nanoformulation for photodynamic therapy have emerged over the past few years as promising nanoscales for analyte detection and light-activated treatment for cancer and other diseases.

Drug release triggered by two-photon excitation in near infrared (NIR) using the FRET technique have not yet been developed despite much progress in photo-triggered drug release."

The full article can be found at: http://www.nanowerk.com/spotlight/spotid=10275.php

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**SECOND STRAIN OF FLU MAY COMPLICATE PICTURE**
By Maggie Fox
Reuters
May 6, 2009

"They have found a strain of the H3N2 virus that appears to have made a shift and could have complicated the flu picture in Mexico, epicenter of an outbreak of a new strain of the H1N1 swine flu virus."

"Vaccines target hemagglutinin and when it changes, the vaccine must be changed, too. This year the vaccine targets strains of H3N2 influenza, an H1N1 strain different from the new swine flu strain, and an influenza B strain.

"Until mid-February 2009, amino acid sequences of the hemagglutinin gene of H3 viruses in British Columbia were virtually identical to the vaccine strain," Skowronski wrote.

"In early March 2009, however, we detected additional differences from the vaccine strain among British Columbia viruses collected from facility outbreak settings." They only found these changes in flu samples taken from patients in care facilities."

The full article can be found at: http://www.reuters.com/article/newsOne/idUSTRE54547I20090506

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**N-CHLORAMIDE MODIFIED NOMEX(A(R)) AS A REGENERABLE SELF-DECONTAMINATING MATERIAL FOR PROTECTION AGAINST CHEMICAL WARFARE AGENTS**
Science Letter
May 5, 2009

“Recent interest in the treatment of textiles for chemical and biological agent defense has led to the creation of materials that contain N-chloramide moieties. These materials have demonstrated efficacy against weaponizable bacteria, mustard, and VX, as well as possessing antimicrobial properties against nuisance organisms that cause conditions such as athlete's foot or molds.”

"Here, N-chloramides have been attached to Nomex(A (R)) intended for use as self-decontaminating regenerable military textiles. The materials were assayed for content of active oxidizing agent, and tested for efficacy against 2-chloroethyl ethyl sulfide and Demeton-S, simulants for mustard and VX, respectively. The decomposition products for each reaction were identified as well as reaction pathways to form each by-product as correlated to analogous products of mustard and VX.”

"Furthermore, the rate constant for the neutralization of each simulant on the reactive material was calculated from data collected by GC-MS and ATR-FTIR real-time studies."

The full article can be found at: (B. Salter, et. al., “N-chloramide modified Nomex(A(R)) as a regenerable self-decontaminating material for protection against chemical warfare agents”. Journal of Materials Science, 2009;44(8):2069-2078). Link not available.

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**SELF-ASSEMBLED PEPTIDE MONOLAYERS AS A TOXIN SENSING MECHANISM WITHIN ARRAYED MICROCHANNELS**
Chemical & Chemistry
May 15, 2009

"A sensor for the lethal bacterial enzyme, botulinum neurotoxin type A (BoNT/A), was developed using self-assembled monolayers (SAMs). SAMs consisting of an immobilized synthetic peptide that mimicked the toxin's in vivo SNAP-25 protein substrate were formed on Au and interfaced with arrayed microfluidic channels."

"Efforts to optimize SAM composition and assay conditions for greatest reaction efficiency and sensitivity are described in detail. Channel design provided facile fluid manipulation, sample incubation, analyte concentration, and fluorescence detection all within a single microfluidic channel, thus avoiding sample transfer and loss. Peptide SAMs were exposed to

varying concentrations of BoNT/A or its catalytic light chain (ALC), resulting in enzymatic cleavage of the peptide substrate from the surface. Fluorescence detection was achieved down to 20 pg/mL ALC and 3 pg/mL BoNT/A in 3 h. Toxin sensing was also accomplished in vegetable soup, demonstrating practicality of the method."

"The modular design of this microfluidic SAM platform allows for extension to sensing other toxins that operate via enzymatic cleavage, such as the remaining BoNT serotypes B-G, anthrax, and tetanus toxin."

The full article can be found at: (M.L. Frisk, et. al., "Self-Assembled Peptide Monolayers as a Toxin Sensing Mechanism within Arrayed Microchannels". Analytical Chemistry, 2009;81 (7):2760-2767). Link not available.

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**USE OF POLYCLONAL ANTIBODIES TO OCHRATOXIN A WITH A QUARTZ-CRYSTAL MICROBALANCE FOR DEVELOPING REAL-TIME MYCOTOXIN PIEZOELECTRIC IMMUNOSENSORS**

Drug Week
May 8, 2009

"Use of polyclonal antibodies to ochratoxin A with a quartz-crystal microbalance for developing real-time mycotoxin piezoelectric immunosensors,' are discussed in a new report. "A piezoelectric immunosensor was tested for ochratoxin A (OTA) mycotoxin detection through the immobilization of OTA-bovine serum albumin (OTA-BSA) conjugate on gold-coated quartz crystals (AT-cut/5 MHz). Immunoassays were performed in a flow-injection system through frequency decreases in a quartz-crystal microbalance (QCM) because of a mass increasing during immunoreaction with anti-OTA antibodies."

"Three immobilization procedures for OTA-BSA (direct adsorption and covalent attachment to two alkane thiol self-assembled monolayers) were characterized with QCM in real time. Covalent attachment of the OTA-BSA conjugates through gold nanoparticles was also tested for amplifying the signal. Binding of the excess of antibodies to the immobilized OTA in an indirect competitive analysis decreased linearly the resonant frequency in the range of the OTA concentration from 10 to 128 ng/mL, with a detection limit of 8 ng/mL (signal/noise ratio of 3)."

"A pepsin 2 mg/mL (pH=2.1) solution was used to release antigen-antibody complexes, regenerating the biorecognition surface."

The full article can be found at: (J.C. Vidal, et. al., "Use of polyclonal antibodies to ochratoxin A with a quartz-crystal microbalance for developing real-time mycotoxin piezoelectric immunosensors". Analytical and Bioanalytical Chemistry, 2009;394(2):575-82). Link not available.

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## THE PRIMED EBOLAVIRUS GLYCOPROTEIN (19-KILODALTON GP(1,2)): SEQUENCE AND RESIDUES CRITICAL FOR HOST CELL BINDING

Blood Weekly
May 14, 2009

"Entry of ebolavirus (EBOV) into cells is mediated by its glycoprotein (GP(1,2)), a class I fusion protein whose structure was recently determined (J.E. Lee et al., Nature 454: 177-182, 2008)."

"Here we confirmed two major predictions of the structural analysis, namely, the residues in GP(1) and GP(2) that remain after GP(1,2) is proteolytically primed by endosomal cathepsins for fusion and residues in GP(1) that are critical for binding to host cells. Mass spectroscopic analysis indicated that primed GP(1,2) contains residues 33 to 190 of GP(1) and all residues of GP(2). The location of the receptor binding site was determined by a two-pronged approach. We identified a small receptor binding region (RBR), residues 90 to 149 of GP(1), by comparing the cell binding abilities of four RBR proteins produced in high yield. We characterized the binding properties of the optimal RBR (containing GP(1) residues 57 to 149) and then conducted a mutational analysis to identify critical binding residues. Substitutions at four lysines (K95, K114, K115, and K140) decreased binding and the ability of RBR proteins to inhibit GP(1,2)-mediated infection. K114, K115, and K140 lie in a small region modeled to be located on the top surface of the chalice following proteolytic priming; K95 lies deeper in the chalice bowl."

"Combined with those of Lee et al., our findings provide structural insight into how GP(1,2) is primed for fusion and define the core of the EBOV RBR (residues 90 to 149 of GP(1)) as a highly conserved region containing a two-stranded beta-sheet, the two intra-GP(1) disulfide bonds, and four critical Lys residues."

The full article can be found at: (D. Dube, et. al., "The Primed Ebolavirus Glycoprotein (19-Kilodalton GP(1,2)): Sequence and Residues Critical for Host Cell Binding". Journal of Virology, 2009;83(7):2883-2891). Link not available.

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## GENERATION OF HIGH-TITER NEUTRALIZING ANTIBODIES AGAINST BOTULINUM TOXINS A, B, AND E BY DNA ELECTROTRANSFER

Biotech Week
May 6, 2009

"Thus, new strategies for efficient production of safe and effective anti-botulinum neurotoxin antisera have been a high priority. Here we describe the use of DNA electrotransfer into the skeletal muscle to enhance antiserum titers against botulinum toxin serotypes A, B, and E in mice. We treated animals with codon-optimized plasmid DNA encoding the nontoxic but highly immunogenic C-terminal heavy chain fragment of the toxin. By employing both codon optimization and the electrotransfer procedure, the immune response and corresponding

neutralizing antiserum titers were markedly increased. The cellular localization of the antigen and the immunization regimens were also shown to increase neutralizing titers to >100 IU/ml."

"This study demonstrates that DNA electrotransfer is an effective procedure for raising neutralizing antiserum titers to remarkably high levels."

The full article can be found at: (C. Trollet, et. al., "Generation of high-titer neutralizing antibodies against botulinum toxins A, B, and E by DNA electrotransfer". Infection and Immunity, 2009;77(5):2221-9). Link not available.

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