

3 June 2010

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 Edition

1. DESORPTION ELECTROSPRAY IONIZATION MASS SPECTROMETRIC ANALYSIS OF ORGANOPHOSPHORUS CHEMICAL WARFARE AGENTS USING ION MOBILITY AND TANDEM MASS SPECTROMETRY:

"Background interference was minimal and the spiked CWA were readily identified within one minute on the basis of the acquired ion mobility and mass spectrometric data."

2. EFFECTIVE, BROAD SPECTRUM CONTROL OF VIRULENT BACTERIAL INFECTIONS USING CATIONIC DNA LIPOSOME COMPLEXES COMBINED WITH BACTERIAL ANTIGENS:

*"Here we describe the development and mechanism of a novel pan-anti-bacterial prophylaxis. Using cationic liposome non-coding DNA complexes (CLDC) mixed with crude *F. tularensis* membrane protein fractions (MPF), we demonstrate control of virulent *F. tularensis* infection in vitro and in vivo. CLDC+MPF inhibited bacterial replication in primary human and murine macrophages in vitro."*

3. GRASS SHOWS PROMISE FOR REMOVING ANTIBIOTICS FROM WATER:

"Working with Rupali Datta, an associate professor of biological sciences, Smith designed an experiment using sterile vetiver grass to address the issue. Vetiver is a native of India often grown in artificial wetlands to cleanse wastewater. It is both vigorous and noninvasive, posing little risk to indigenous plants. It's also been used to clean up some tough customers, including TNT."

4. LIQUID MARBLES DETECT GASES: *"Now, Wei Shen and colleagues at Monash University in Clayton have discovered a new use for them. By exploiting the fact that the liquid marble shell will allow gas but not liquid to diffuse through, they have produced ammonia and hydrochloric acid gas sensors. 'The liquid marble shell is a natural gas-liquid separator which has important application implications,' explains Shen. 'The liquid marbles can be used to sense, absorb, or emit gas.'"*

5. TMT POSTS AMENDMENT TO BROAD AGENCY ANNOUNCEMENT (BAA): *"Visit FedBizOpps.gov for details about TMT™s new Amendment to the Broad Agency Announcement (BAA), HDTRA1-09-CHEM-BIO-BAA. The new Amendment features a revised submission milestones schedule and a list of new proposal topics. Announcement of Apparent Successful Offerors will be made on or about 1 December 2010."*

6. EFFICIENT HETEROGENEOUS AND ENVIRONMENTALLY FRIENDLY

DEGRADATION OF NERVE AGENTS ON A TUNGSTEN-BASED POM: *"Although oxidation did not take place, sarin (GB) and VX were smoothly decontaminated to*

non-toxic products within 1 and 10 days, respectively. Degradation was carried out directly on the powder, eliminating the need for solvents. Mustard gas (HD), whose degradation is highly dependent on oxidation, was not decontaminated by this POM [polyoxometalates]."

7. PROTECTION OF NONHUMAN PRIMATES AGAINST TWO SPECIES OF EBOLA

VIRUS INFECTION WITH A SINGLE COMPLEX ADENOVIRUS VECTOR: *"Significantly, protection against SEBOV given as an aerosol challenge, which has not previously been shown, could be achieved with a boosting vaccination."*

CB Daily Report

Chem-Bio News

DESORPTION ELECTROSPRAY IONIZATION MASS SPECTROMETRIC ANALYSIS OF ORGANOPHOSPHORUS CHEMICAL WARFARE AGENTS USING ION MOBILITY AND TANDEM MASS SPECTROMETRY

Chemical & Chemistry

June 11, 2010

"Desorption electrospray ionization mass spectrometry (DESI-MS) has been applied to the direct analysis of sample media for target chemicals, including chemical warfare agents (CWA), without the need for additional sample handling. During the present study, solid-phase microextraction (SPME) fibers were used to sample the headspace above five organophosphorus CWA, O-isopropyl methylphosphonofluoridate (sarin, GB), O-pinacolyl methylphosphonofluoridate (soman, GD), O-ethyl N,N-dimethyl phosphoramidocyanidate (tabun, GA), O-cyclohexyl methylphosphonofluoridate (cyclohexyl sarin, GF) and O-ethyl S-2-diisopropylaminoethyl methyl phosphonothiolate (VX) spiked into glass headspace sampling vials."

"Following sampling, the SPME fibers were introduced directly into a modified ESI source, enabling rapid and safe DESI of the toxic compounds. A SYNAPT HDMS instrument was used to acquire time-aligned parallel (TAP) fragmentation data, which provided both ion mobility and MS(n) (n=2 or 3) data useful for the confirmation of CWA. Unique ion mobility profiles were acquired for each compound and characteristic product ions of the ion mobility separated ions were produced in the Triwave transfer collision region. Up to six full scanning MS(n) spectra, containing the [M + H](+) ion and up to seven diagnostic product ions, were acquired for each CWA during SPME fiber analysis. A rapid screening approach, based on the developed methodology, was applied to several typical forensic media, including Dacron sampling swabs spiked with 5 microg of CWA."

"Background interference was minimal and the spiked CWA were readily identified within one minute on the basis of the acquired ion mobility and mass spectrometric data."

The full article can be found at: (P.A. D'Agostino, et. al., "Desorption electrospray ionization mass spectrometric analysis of organophosphorus chemical warfare agents using ion mobility and tandem mass spectrometry". *Rapid Communications In Mass Spectrometry*, 2010;24(11):1617-24). Link not available.

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EFFECTIVE, BROAD SPECTRUM CONTROL OF VIRULENT BACTERIAL INFECTIONS USING CATIONIC DNA LIPOSOME COMPLEXES COMBINED WITH BACTERIAL ANTIGENS

By Robin Ireland, Norma Olivares-Zavaleta, Jonathan M. Warawa, Frank C. Gherardini, Clayton Jarrett, B. Joseph Hinnebusch, John T. Belisle, Jeffery Fairman, Catharine M. Bosio
PLoS Pathogens
May 27, 2010

"Abstract

Protection against virulent pathogens that cause acute, fatal disease is often hampered by development of microbial resistance to traditional chemotherapeutics. Further, most successful pathogens possess an array of immune evasion strategies to avoid detection and elimination by the host. Development of novel, immunomodulatory prophylaxes that target the host immune system, rather than the invading microbe, could serve as effective alternatives to traditional chemotherapies. Here we describe the development and mechanism of a novel pan-anti-bacterial prophylaxis. Using cationic liposome non-coding DNA complexes (CLDC) mixed with crude *F. tularensis* membrane protein fractions (MPF), we demonstrate control of virulent *F. tularensis* infection in vitro and in vivo. CLDC+MPF inhibited bacterial replication in primary human and murine macrophages in vitro. Control of infection in macrophages was mediated by both reactive nitrogen species (RNS) and reactive oxygen species (ROS) in mouse cells, and ROS in human cells. Importantly, mice treated with CLDC+MPF 3 days prior to challenge survived lethal intranasal infection with virulent *F. tularensis*. Similarly to in vitro observations, in vivo protection was dependent on the presence of RNS and ROS. Lastly, CLDC+MPF was also effective at controlling infections with *Yersinia pestis*, *Burkholderia pseudomallei* and *Brucella abortus*. Thus, CLDC+MPF represents a novel prophylaxis to protect against multiple, highly virulent pathogens."

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"Author Summary

Conventional treatment of bacterial infections typically includes administration of antibiotics. However, many pathogens have developed spontaneous resistance to commonly used antibiotics. Development of new compounds that stimulate the host immune system to directly kill bacteria by mechanisms different from those utilized by antibiotics may serve as effective alternatives to antibiotic therapy. In this report, we describe a novel compound capable of controlling infections mediated by different, unrelated bacteria via the induction

of host derived reactive oxygen and reactive nitrogen species. This compound is comprised of cationic liposome DNA complexes (CLDC) and crude membrane preparations (MPF) obtained from attenuated *Francisella tularensis* Live Vaccine Strain (LVS). Pretreatment of primary mouse or human cells limited replication of virulent *F. tularensis*, *Burkholderia pseudomallei*, *Yersinia pestis* and *Brucella abortus* in vitro. CLDC+MPF was also effective for controlling lethal pulmonary infections with virulent *F. tularensis*. Thus, CLDC+MPF represents a novel antimicrobial for treatment of lethal, acute, bacterial infections."

The full article can be found at: <http://www.plospathogens.org/article/info%3Adoi%2F10.1371%2Fjournal.ppat.1000921;jsessionid=FOF8D4AC7BE0411F5C0E0D0803EC5C11>

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GRASS SHOWS PROMISE FOR REMOVING ANTIBIOTICS FROM WATER

By Marcia Goodrich

Infection Control Today Magazine

June 01, 2010

"Antibiotics, like many pharmaceuticals, pass through the digestive tract largely unchanged. The resulting drug-laden waste from farms and feedlots (or for that matter, apartments and subdivisions) may be treated, but conventional methods don't break down excreted antibiotics."

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"Working with Rupali Datta, an associate professor of biological sciences, Smith designed an experiment using sterile vetiver grass to address the issue. Vetiver is a native of India often grown in artificial wetlands to cleanse wastewater. It is both vigorous and noninvasive, posing little risk to indigenous plants. It's also been used to clean up some tough customers, including TNT.

Smith grew vetiver hydroponically in a greenhouse, exposing the plants to various concentrations of tetracycline and monensin, two antibiotics commonly used to treat dairy cattle. "We wanted to see if the vetiver would uptake them, because if you give these antibiotics to cows, 70 percent is excreted in active form," Smith says. "We worry about them leaching into the groundwater, getting into drinking water and compounding the problem of antibiotic resistance."

At the end of the 12-week study, all of the tetracycline and 95.5 percent of the monensin had disappeared from the hydroponic solution. Tests showed that the vetiver had taken and metabolized both drugs up into the plant tissue. The results are preliminary, says Smith, but they show that vetiver holds promise for remediating antibiotics in wastewater.

Smith also recorded a peculiar side effect. "The plants in the tetracycline solution grew faster, much faster than the controls," she says. "The plants in monensin grew somewhat faster, but not as much."

The full article can be found at: <http://www.infectioncontrolday.com/hotnews/removing-antibiotics-from-water.html>

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LIQUID MARBLES DETECT GASES

By Leanne Marl

Highlights in Chemical Science

June 01, 2010

"Liquid marbles are formed by encapsulating a liquid drop with hydrophobic particles, making a spherical shell that stops the liquid core from coming into contact with other surfaces. Most research focuses on liquid transport applications, but problems have arisen owing to the porous nature of the liquid marble allowing the liquid core to evaporate.

Now, Wei Shen and colleagues at Monash University in Clayton have discovered a new use for them. By exploiting the fact that the liquid marble shell will allow gas but not liquid to diffuse through, they have produced ammonia and hydrochloric acid gas sensors. 'The liquid marble shell is a natural gas-liquid separator which has important application implications,' explains Shen. 'The liquid marbles can be used to sense, absorb, or emit gas.'

Shen used the concept to produce colorimetric liquid marble ammonia sensors using phenolphthalein, CoCl_2 , and CuCl_2 solutions as liquid cores encapsulated with Teflon powder, which successfully changed colour on exposure to the gas. And 8-hydroxypyrene-1,3,6-trisulfonic acid trisodium salt (HPTS) indicator was used as the liquid core to create fluorescent sensors for hydrochloric acid vapour."

The full article can be found at: http://www.rsc.org/Publishing/ChemScience/Volume/2010/07/liquid_marbles.asp

The original article can be found at: <http://www.rsc.org/Publishing/Journals/CC/article.asp?doi=c001317j>

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TMT POSTS AMENDMENT TO BROAD AGENCY ANNOUNCEMENT (BAA)

CBIAC E-mail

June 02, 2010

"Visit FedBizOpps.gov for details about TMT's [Transformational Medical Technologies] new Amendment to the Broad Agency Announcement (BAA), HDTRA1-09-CHEM-BIO-BAA. The new Amendment features a revised submission milestones schedule and a list of new proposal topics. Announcement of Apparent Successful Offerors will be made on or about 1 December 2010.

All proposal materials must be received by 2:00 p.m. EDT 28 June 2010."

Link not available.

The amended BAA can be found at: https://www.fbo.gov/download/17d/17de6cae6d72b9b095a0580da2c263e0/TMTI_Amendment_to_FY10-11_BAA_-_FY11_Supplemental_Topics_-_28_May_10.doc.pdf

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EFFICIENT HETEROGENEOUS AND ENVIRONMENTALLY FRIENDLY DEGRADATION OF NERVE AGENTS ON A TUNGSTEN-BASED POM

Bioterrorism Week

May 31, 2010

"Common (chemical warfare agent) CWA decontaminants exhibit harsh and corrosive characteristics, and are harmful to the environment. In the course of our quest for active sorbents as efficient decontaminants, Keggin-type polyoxometalate (POM) (NH₄)₃PW₁₂O₄₀ was tested for oxidative degradation of CWAs."

"Although oxidation did not take place, sarin (GB) and VX were smoothly decontaminated to non-toxic products within 1 and 10 days, respectively. Degradation was carried out directly on the powder, eliminating the need for solvents. Mustard gas (HD), whose degradation is highly dependent on oxidation, was not decontaminated by this POM."

"Solid state MAS NMR (³¹P and ¹³C) was utilized both for POM characterization and for decontamination studies monitoring."

The full article can be found at: (D.M. Mizrahi, et. al., "Efficient heterogeneous and environmentally friendly degradation of nerve agents on a tungsten-based POM". Journal of Hazardous Materials, 2010; 179(1-3): 495-9). Link not available.

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PROTECTION OF NONHUMAN PRIMATES AGAINST TWO SPECIES OF EBOLA VIRUS INFECTION WITH A SINGLE COMPLEX ADENOVIRUS VECTOR

Vaccine Weekly

June 2, 2010

"To meet the need for a vaccine against the several types of Ebola viruses that cause human diseases, we developed a multivalent vaccine candidate (EBO7) that expresses the glycoproteins of Zaire ebolavirus (ZEBOV) and Sudan ebolavirus (SEBOV) in a single complex adenovirus-based vector (CAAdVax)."

"We evaluated our vaccine in nonhuman primates against the parenteral and aerosol routes

of lethal challenge. EBO7 vaccine provided protection against both Ebola viruses by either route of infection. Significantly, protection against SEBOV given as an aerosol challenge, which has not previously been shown, could be achieved with a boosting vaccination."

"These results demonstrate the feasibility of creating a robust, multivalent Ebola virus vaccine that would be effective in the event of a natural virus outbreak or biological threat."

The full article can be found at: (W.D. Pratt, et. al., "Protection of Nonhuman Primates against Two Species of Ebola Virus Infection with a Single Complex Adenovirus Vector". *Clinical and Vaccine Immunology*, 2010; 17(4): 572-581). Link not available.

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Steve Tesko: Steve.Tesko@anser.org

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