

23 April 2009

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Chem-Bio News – S&T Edition

1. BACILLUS ANTHRACIS IN CHINA AND ITS RELATIONSHIP TO WORLDWIDE

LINEAGES: *"These results suggest a genetic discontinuity between the younger Ames sub-lineage in Texas and the large Western North American sub-lineage spread across central Canada and the Dakotas."*

2. NEW EBOLAVIRUS VACCINE PROTECTS AGAINST LETHAL INFECTION IN

ANIMAL MODELS: *"In a previous study the researchers developed a replication-deficient, biologically contained EBOV, Ebola δ VP30, vaccine candidate which lacks the essential VP30 gene. In this study they demonstrated its safety in STAT-1 knockout-mice and evaluated its protective efficacy in mice and guinea pigs."*

3. MOLDS AND MYCOTOXINS IN DUST FROM WATER-DAMAGED HOMES IN NEW

ORLEANS AFTER HURRICANE KATRINA: *"The results may highlight the potential health threats posed by mold aerosols in post-disaster inhabited areas."*

4. EFFICACY OF A VACCINE BASED ON PROTECTIVE ANTIGEN AND KILLED SPORES

AGAINST EXPERIMENTAL INHALATIONAL ANTHRAX: *"These results demonstrate that the association of PA and spores is very much more effective than PA alone against experimental inhalational anthrax."*

5. MOLECULAR-DYNAMICS STUDIES OF COMPETITIVE REPLACEMENT IN PEPTIDE-

NANOTUBE ASSEMBLY FOR CONTROL OF DRUG RELEASE: *"For example, one type of peptide can be used to replace/release another type of peptide, depending on the difference in their affinity for the nanotube."*

6. A STUDY OF THE DEGRADATION OF ORGANOPHOSPHORUS PESTICIDES IN

RIVER WATERS AND THE IDENTIFICATION OF THEIR DEGRADATION PRODUCTS BY CHROMATOGRAPHY COUPLED WITH MASS SPECTROMETRY: *"Based on the identified transformation products, a rational degradation pathway in river water for both OPs is proposed."*

7. DEVELOPMENT AND CHARACTERIZATION OF AN AIRCRAFT AEROSOL TIME-OF-FLIGHT MASS SPECTROMETER:

"Initial results from ICE-L represent the first reported

aircraft-based single-particle dual-polarity mass spectrometry measurements and provide an increased understanding of particle mixing state as a function of altitude."

CB Daily Report

Chem-Bio News

BACILLUS ANTHRACIS IN CHINA AND ITS RELATIONSHIP TO WORLDWIDE LINEAGES

By Tatum S Simonson, Richard T Okinaka, Bingxiang Wang, W RYAN Easterday, Lynn Huynh, Jana M U'Ren, Meghan Dukerich, Shaylan R Zanecki, Leo J Kenefic, Jodi Beaudry, James M Schupp, Talima Pearson, David M Wagner, Alex Hoffmaster, Jacques Ravel and Paul Keim

BMC Microbiology

April 15, 2009

"Background

The global pattern of distribution of 1033 *B. anthracis* isolates has previously been defined by a set of 12 conserved canonical single nucleotide polymorphisms (canSNP). These studies reinforced the presence of three major lineages and 12 sub-lineages and sub-groups of this anthrax-causing pathogen. Isolates that form the A lineage (unlike the B and C lineages) have become widely dispersed throughout the world and form the basis for the geographical disposition of "modern" anthrax. An archival collection of 191 different *B. anthracis* isolates from China provides a glimpse into the possible role of Chinese trade and commerce in the spread of certain sub-lineages of this pathogen. Canonical single nucleotide polymorphism (canSNP) and multiple locus VNTR analysis (MLVA) typing has been used to examine this archival collection of isolates.

Results

The canSNP study indicates that there are 5 different sub-lineages/sub-groups in China out of 12 previously described world-wide canSNP genotypes. Three of these canSNP genotypes were only found in the western-most province of China, Xinjiang. These genotypes were A.Br.008/009, a sub-group that is spread across most of Europe and Asia; A.Br.Aust 94, a sub-lineage that is present in Europe and India, and A.Br.Vollum, a lineage that is also present in Europe. The remaining two canSNP genotypes are spread across the whole of China and belong to sub-group A.Br.001/002 and the A.Br.Ames sub-lineage, two closely related genotypes. MLVA typing adds resolution to the isolates in each canSNP genotype and diversity indices for the A.Br.008/009 and A.Br.001/002 sub-groups suggest that these represent older and established clades in China.

Conclusions

B. anthracis isolates were recovered from three canSNP sub-groups (A.Br.008/009, A.Br. Aust94, and A.Br.Vollum) in the western most portion of the large Chinese province of Xinjiang. The city of Kashi in this province appears to have served as a crossroads for not only trade but the movement of diseases such as anthrax along the ancient "silk road". Phylogenetic inference also suggests that the A.Br.Ames sub-lineage, first identified in the

original Ames strain isolated from Jim Hogg County, TX, is descended from the A.Br.001/002 sub-group that has a major presence in most of China. These results suggest a genetic discontinuity between the younger Ames sub-lineage in Texas and the large Western North American sub-lineage spread across central Canada and the Dakotas."

The full article can be found at: <http://www.biomedcentral.com/content/pdf/1471-2180-9-71.pdf>

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NEW EBOLAVIRUS VACCINE PROTECTS AGAINST LETHAL INFECTION IN ANIMAL MODELS

Infection Control Today Magazine

April 21, 2009

"In a previous study the researchers developed a replication-deficient, biologically contained EBOV, Ebola δ VP30, vaccine candidate which lacks the essential VP30 gene. In this study they demonstrated its safety in STAT-1 knockout-mice and evaluated its protective efficacy in mice and guinea pigs. Results showed that mice receiving two inoculations with Ebola δ VP30 were protected against lethal infection with a mouse-adapted EBOV and viral levels in the blood of vaccinated mice were noticeably lower than those in nonvaccinated mice. Additionally, guinea pigs immunized twice with Ebola δ VP30 were also protected against lethal infection with a guinea pig adapted EBOV."

The full article can be found at: <http://www.infectioncontrolday.com/hotnews/new-ebolavirus-vaccine-infection.html>

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MOLDS AND MYCOTOXINS IN DUST FROM WATER-DAMAGED HOMES IN NEW ORLEANS AFTER HURRICANE KATRINA

Medical Devices & Surgical Technology Week

April 26, 2009

"Dust collected in New Orleans homes mold-contaminated because of the flooding after hurricane Katrina was analyzed for molds and mycotoxins. The mycoflora was studied by cultivation and quantitative PCR for selected molds."

"The most commonly found mold taxa were *Aspergillus*, *Cladosporium*, and *Penicillium*. Verrucarol, a hydrolysis product of macrocyclic trichothecenes predominately produced by *Stachybotrys* spp. was identified in three dust samples by gas chromatography-tandem mass spectrometry, and sterigmatocystin (produced by various *Aspergillus* spp.) was found in two samples by high pressure liquid chromatography-tandem mass spectrometry. This is the first demonstration of mycotoxins in Katrina-associated dust samples. The analytical methods used represent valuable tools in further studies on bioaerosol exposure and health

risks. PRACTICAL IMPLICATIONS: In the aftermath of natural disasters like hurricane Katrina water-damages on infrastructure and public and private property are often associated with health risks for remediation workers and returning residents. In the case of New Orleans evaluations of health hazards, health studies, and assessments of bioaerosol have been conducted previously. However, until now mycotoxins have not been addressed. Our study shows, for the first time, the presence of mycotoxins in dust collected in houses in New Orleans mold-contaminated because of the hurricane Katrina."

"The results may highlight the potential health threats posed by mold aerosols in post-disaster inhabited areas."

The full article can be found at: (E. Bloom, et. al., "Molds and mycotoxins in dust from water-damaged homes in New Orleans after hurricane Katrina". *Indoor Air*, 2009; 19(2):153-8). Link not available.

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EFFICACY OF A VACCINE BASED ON PROTECTIVE ANTIGEN AND KILLED SPORES AGAINST EXPERIMENTAL INHALATIONAL ANTHRAX

Medical Letter on the CDC & FDA

April 26, 2009

"Protective antigen (PA)-based anthrax vaccines acting on toxins are less effective than live attenuated vaccines, suggesting that additional antigens may contribute to protective immunity. Several reports indicate that capsule or spore-associated antigens may enhance the protection afforded by PA."

"Addition of formaldehyde-inactivated spores (FIS) to PA (PA-FIS) elicits total protection against cutaneous anthrax. Nevertheless, vaccines that are effective against cutaneous anthrax may not be so against inhalational anthrax. The aim of this work was to optimize immunization with PA-FIS and to assess vaccine efficacy against inhalational anthrax. We assessed the immune response to recombinant anthrax PA from *Bacillus anthracis* (rPA)-FIS administered by various immunization protocols and the protection provided to mice and guinea pigs infected through the respiratory route with spores of a virulent strain of *B. anthracis*. Combined subcutaneous plus intranasal immunization of mice yielded a mucosal immunoglobulin G response to rPA that was more than 20 times higher than that in lung mucosal secretions after subcutaneous vaccination. The titers of toxin-neutralizing antibody and antispore antibody were also significantly higher: nine and eight times higher, respectively. The optimized immunization elicited total protection of mice intranasally infected with the virulent *B. anthracis* strain 17JB. Guinea pigs were fully protected, both against an intranasal challenge with 100 50% lethal doses (LD50) and against an aerosol with 75 LD50 of spores of the highly virulent strain 9602. Conversely, immunization with PA alone did not elicit protection."

"These results demonstrate that the association of PA and spores is very much more effective than PA alone against experimental inhalational anthrax."

The full article can be found at: (Y.P. Gauthier, et. al., "Efficacy of a Vaccine Based on Protective Antigen and Killed Spores against Experimental Inhalational Anthrax". *Infection and Immunity*, 2009;77(3):1197-1207). Link not available.

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MOLECULAR-DYNAMICS STUDIES OF COMPETITIVE REPLACEMENT IN PEPTIDE-NANOTUBE ASSEMBLY FOR CONTROL OF DRUG RELEASE

Journal of Technology & Science

May 3, 2009

"We report molecular-dynamics simulation of carbon-nanotube-based drug delivery and release systems. We show that a peptide encapsulated inside or attached to the outer surface of a carbon nanotube can be released by another nanotube through a competitive replacement process."

"Energy analysis reveals that the van der Waals interaction plays the key role in this process, and the potential well between two nanotubes drives the competitive replacement. We further show that competitive replacement is a basic principle which may be generally explored for drug release. For example, one type of peptide can be used to replace/release another type of peptide, depending on the difference in their affinity for the nanotube."

"The effects of the peptide sequence and the nanotube size on the drug release process are also studied in this paper."

The full article can be found at: (Y. Cheng, et. al., "Molecular-dynamics studies of competitive replacement in peptide-nanotube assembly for control of drug release". *Nanotechnology*, 2009;20(14):45101). Link not available.

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A STUDY OF THE DEGRADATION OF ORGANOPHOSPHORUS PESTICIDES IN RIVER WATERS AND THE IDENTIFICATION OF THEIR DEGRADATION PRODUCTS BY CHROMATOGRAPHY COUPLED WITH MASS SPECTROMETRY

Medical Imaging Week

April 25, 2009

"The degradation of selected organophosphorus pesticides (OPs), i.e., malathion and parathion, in river water, has been studied with solar simulator irradiation. The degradation of OPs and formation of degradation products were determined by chromatography coupled with mass spectrometry analysis."

"The effect of a photosensitizer, i.e., riboflavin, on the photolysis of OPs in a river-water environment was examined. There was no significant increase in the degradation rate in the presence of the photosensitizer. Degradation products of the OPs were identified with gas

chromatography coupled with mass spectrometry (GC-MS) after derivatization by pentafluorobenzyl bromide (PFBB) and with high-performance liquid chromatography-mass spectrometry (HPLC-MS) with electrospray (ESI) or atmospheric pressure chemical ionization (APCI). Malaoxon, paraoxon, 4-nitrophenol, aminoparathion, O,O-dimethylthiophosphoric acid, and O,O-dimethyldithiophosphoric acid, have been separated and identified as the degradation products of malathion and parathion after photolysis in river water. Based on the identified transformation products, a rational degradation pathway in river water for both OPs is proposed."

The full article can be found at: (X. Zhao, et. al., "A study of the degradation of organophosphorus pesticides in river waters and the identification of their degradation products by chromatography coupled with mass spectrometry". Archives of Environmental Contamination and Toxicology, 2009;56(4):646-53). Link not available.

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DEVELOPMENT AND CHARACTERIZATION OF AN AIRCRAFT AEROSOL TIME-OF-FLIGHT MASS SPECTROMETER

News of Science
April 19, 2009

"To gain further insight into the size-resolved chemistry of individual atmospheric particles, a smaller aerosol time-of-flight mass spectrometer (ATOFMS) with increased data acquisition capabilities was developed for aircraft-based studies."

"Compared to previous ATOFMS systems, the new instrument has a faster data acquisition rate with improved ion transmission and mass resolution, as well as reduced physical size and power consumption, all required advances for use in aircraft studies. In addition, real-time source apportionment software allows the immediate identification and classification of individual particles to guide sampling decisions while in the field. The aircraft (A)-ATOFMS was field-tested on the ground during the Study of Organic Aerosols in Riverside, CA (SOAR) and aboard an aircraft during the Ice in Clouds Experiment-Layer Clouds (ICEL). Initial results from ICE-L represent the first reported aircraft-based single-particle dual-polarity mass spectrometry measurements and provide an increased understanding of particle mixing state as a function of altitude. Improved ion transmission allows for the first single-particle detection of species out to similar to m/z 2000, an important mass range for the detection of biological aerosols and oligomeric species."

"In addition, high time resolution measurements of single-particle mixing state are demonstrated and shown to be important for airborne studies where particle concentrations and chemistry vary rapidly."

The full article can be found at: (K.A. Pratt, et. al., "Development and Characterization of an Aircraft Aerosol Time-of-Flight Mass Spectrometer". Analytical Chemistry, 2009;81(5):1792-1800). Link not available.

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