4 June 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.

Should you wish to be removed from this S&T Supplement address group, just send an email to one of the people listed at the bottom of this message. This will not affect your continued receipt of the CB Daily

Chem-Bio News - S&T Edition

1. EVAPORATION AND DEGRADATION OF VX ON SILICA SAND: *"After four days, no further change in the concentration of vapor emitted was detected; approximately 9% of the incident VX drop on sand and similar to 60% of the incident VX drop on glass had been recovered as VX vapor."*

2. COMPARATIVE GENOMIC CHARACTERIZATION OF FRANCISELLA TULARENSIS STRAINS BELONGING TO LOW AND HIGH VIRULENCE SUBSPECIES: *"Our findings suggest that in addition to the duplication of the Francisella Pathogenicity Island, and acquisition of individual loci, adaptation by gene loss in the more recently emerged tularensis, holarctica, and mediasiatica subspecies occurred and was distinct from evolutionary events that differentiated these subspecies, and the novicida subspecies, from a common ancestor."*

3. QUICKER, CHEAPER SARS VIRUS DETECTOR: *"Members of a USC-led research team say they've made a big improvement in a new breed of electronic detectors for viruses and other biological materials — one that may be a valuable addition to the battle against epidemics."*

4. PROMISING ANTIMICROBIAL AGENT KILLS VIRUSES, STIMULATES IMMUNE SYSTEM: *"In a paper appearing online June 4 in the Journal of Investigative Dermatology, Michael Howell, PhD, Assistant Professor of Pediatrics, and his colleagues demonstrated that the synthetic compound CSA-13 can kill vaccinia virus in cell cultures and in mice. Additionally, they showed that CSA-13 stimulates cells to produce their own antimicrobial proteins."*

5. MYCOTOXIN DETECTION IN HUMAN SAMPLES FROM PATIENTS EXPOSED TO ENVIRONMENTAL MOLDS: *"These data show that mycotoxins can be detected in body fluids and human tissue from patients exposed to mycotoxin producing molds in the environment, and demonstrate which human tissues or fluids are the most likely to yield positive results."*

6. GENE EXPRESSION IN PRIMATE LIVER DURING VIRAL HEMORRHAGIC FEVER:

"The genes that are expressed early and differently in mild and virulent disease are potential biomarkers for prognosis and triage of acute viral disease."

7. ULTRASOUND-TRIGGERED CONTROLLED DRUG DELIVERY AND BIOSENSING USING SILICA NANOTUBES: "Observance of significant enhancement in direct electron transfer of Hb makes the SNTs also promising for application in biosensors."

8. RENEWABLE SURFACE FLUORESCENCE SANDWICH IMMUNOASSAY BIOSENSOR FOR RAPID SENSITIVE BOTULINUM TOXIN DETECTION IN AN AUTOMATED FLUIDIC FORMAT: *"In a rapid screening approach to sample analysis, the toxin simulant was detected to concentrations of 10 pM in less than 20 minutes using this system."*

CB Daily Report

Chem-Bio News

EVAPORATION AND DEGRADATION OF VX ON SILICA SAND
News of Science
June 7, 2009

"The evaporation and degradation of VX (O-ethyl S-[2-N,N-(diisopropylamino)ethyl] methylphosphonothioate) on silica sand and borosilicate glass were measured using vapor analysis and IT solid state magic angle spinning nuclear magnetic resonance (SSMAS NMR) spectroscopy. IT SSMAS NMR studies of VX degradation on crushed glass, air-dried sand, and oven-dried sand at a variety of temperatures showed that the final product was nontoxic ethyl methylphosphonic acid (EMPA), produced via the toxic diethyl dimethylpyrophosphonate intermediate."

"The reaction exhibited a lag time that depended upon the quantity of water and EMPA that were present in the initial sample of VX and was autocatalytic; EMPA was both the catalyst and product for the degradation of VX. P-31 SSMAS NMR studies of VX on moist sand at a variety of temperatures showed that the final product was nontoxic EMPA; observed intermediates were protonated VX, O-ethyl methylphosphonothioic acid, and toxic EA-2192 (S-[2-NN-(diisopropylamino)ethyl methylphosphonothioic acid). The VX degradation mechanism differed on the moist and dry surfaces; the activation energies were 80 kJ/mol on moist sand and similar to 46 kJ/mol on glass, air-dried, and oven-dried sand. The VX degradation rate was 5 to 9 times slower on moist sand than on air-dried sand. Analysis of the vapor emitted showed that the maximum vapor concentration coincided with the maximum surface area of the droplets, which was at similar to 300 min."

"After four days, no further change in the concentration of vapor emitted was detected; approximately 9% of the incident VX drop on sand and similar to 60% of the incident VX drop on glass had been recovered as VX vapor."

The full article can be found at: (C.A.S. Brevett, et. al., "Evaporation and Degradation of VX on Silica Sand". Journal of Physical Chemistry C, 2009;113(16):6622-6633). Link not available.

Return to Top

COMPARATIVE GENOMIC CHARACTERIZATION OF FRANCISELLA TULARENSIS STRAINS BELONGING TO LOW AND HIGH VIRULENCE SUBSPECIES

By Mia D. Champion, Qiandong Zeng, Eli B. Nix, Francis E. Nano, Paul Keim, Chinnappa D. Kodira, Mark Borowsky, Sarah Young, Michael Koehrsen, Reinhard Engels, Matthew Pearson, Clint Howarth, Lisa Larson, Jared White, Lucia Alvarado, Mats Forsman, Scott W. Bearden, Anders Sjöstedt Richard Titball, Stephen L. Michell, Bruce Birren, James Galagan

PLoS Pathogens
May 29, 2009

“Tularemia is a geographically widespread, severely debilitating, and occasionally lethal disease in humans. It is caused by infection by a gram-negative bacterium, Francisella tularensis. In order to better understand its potency as an etiological agent as well as its potential as a biological weapon, we have completed draft assemblies and report the first complete genomic characterization of five strains belonging to the following different Francisella subspecies (subsp.): the F. tularensis subsp. tularensis FSC033, F. tularensis subsp. holarctica FSC257 and FSC022, and F. tularensis subsp. novicida GA99-3548 and GA99-3549 strains. Here, we report the sequencing of these strains and comparative genomic analysis with recently available public Francisella sequences, including the rare F. tularensis subsp. mediasiatica FSC147 strain isolate from the Central Asian Region. We report evidence for the occurrence of large-scale rearrangement events in strains of the holarctica subspecies, supporting previous proposals that further phylogenetic subdivisions of the Type B clade are likely. We also find a significant enrichment of disrupted or absent ORFs proximal to predicted breakpoints in the FSC022 strain, including a genetic component of the Type I restriction-modification defense system. Many of the pseudogenes identified are also disrupted in the closely related rarely human pathogenic F. tularensis subsp. mediasiatica FSC147 strain, including modulator of drug activity B (mdaB) (FTT0961), which encodes a known NADPH quinone reductase involved in oxidative stress resistance. We have also identified genes exhibiting sequence similarity to effectors of the Type III (T3SS) and components of the Type IV secretion systems (T4SS). One of the genes, msrA2 (FTT1797c), is disrupted in F. tularensis subsp. mediasiatica and has recently been shown to mediate bacterial pathogen survival in host organisms. Our findings suggest that in addition to the duplication of the Francisella Pathogenicity Island, and acquisition of individual loci, adaptation by gene loss in the more recently emerged tularensis, holarctica, and mediasiatica subspecies occurred and was distinct from evolutionary events that differentiated these subspecies, and the novicida subspecies, from a common ancestor. Our findings are applicable to future studies focused on variations in Francisella subspecies pathogenesis, and of broader interest to studies of genomic pathoadaptation in bacteria.”

The full article can be found at: http://www.plospathogens.org/article/info%3Adoi%2F10.1371%2Fjournal.ppat.1000459;jsessionid=C898E337ADC2C6EA6889150DEF5D204B

Return to Top

QUICKER, CHEAPER SARS VIRUS DETECTOR
Infection Control Today Magazine
May 29, 2009

“Members of a USC-led research team say they've made a big improvement in a new breed of electronic detectors for viruses and other biological materials — one that may be a valuable addition to the battle against epidemics. It consists of a piece of synthetic antibody attached to a nanowire that's attached to an electrical base, immersed in liquid. If the protein the antibody binds to is present in the liquid, it will bind to these antibodies, immediately creating a sharply measurable jump in current through the nanowire.

The basic principle of nanotube and nanowire biosensors for protein detection was first demonstrated in 2001, but the new design by a team headed by Zhongwu Chou and Mark Thompson of the University of Southern California uses two new elements.

First, it takes advantage of bioengineered synthetic antibodies, much, much smaller versions of the natural substances that are designed to bind with a specific protein and only that protein.

Second, it uses indium oxide (In2O3) nanowires instead of silicon and other materials previously tried. Metal oxides, according to a new study published in ACSNano, do not, unlike silicon, develop "an insulating native oxide layer that can reduce sensitivity."

The result, according to the paper, is a device that can detect its target molecules with a sensitivity as great as the best alternative modes, do so more rapidly and without use of chemical reagents. It is also potentially considerably cheaper than alternatives.”

The full article can be found at: http://www.infectioncontroltoday.com/hotnews/sars-virus-detector.html

Return to Top

PROMISING ANTIMICROBIAL AGENT KILLS VIRUSES, STIMULATES IMMUNE SYSTEM
The Medical News
June 04, 2009

“A promising antimicrobial agent already known to kill bacteria can also kill viruses and stimulate the innate immune system, according to researchers at National Jewish Health.

In a paper appearing online June 4 in the Journal of Investigative Dermatology, Michael Howell, PhD, Assistant Professor of Pediatrics, and his colleagues demonstrated that the synthetic compound CSA-13 can kill vaccinia virus in cell cultures and in mice. Additionally, they showed that CSA-13 stimulates cells to produce their own antimicrobial proteins.

"This compound is demonstrating broad effectiveness," said Dr. Howell. "While our

experiments were designed to test its ability to attack the vaccinia virus, its immune-stimulating ability was a surprising observation."

CSA-13 is one of a class of compounds known as ceragenins, which were developed by Brigham Young University Professor Paul Savage to mimic antimicrobial proteins that occur naturally in the body. The ceragenins are smaller than antimicrobial proteins, and are not as vulnerable to degradation in the body. They have previously been shown to be effective against a variety of bacterial species."

The full article can be found at: http://www.news-medical.net/news/20090604/Promising-antimicrobial-agent-kills-viruses-stimulates-immune-system.aspx

Return to Top

MYCOTOXIN DETECTION IN HUMAN SAMPLES FROM PATIENTS EXPOSED TO ENVIRONMENTAL MOLDS
Energy & Ecology
June 5, 2009

"The goal of this study was to determine if selected mycotoxins (trichothecenes, aflatoxins, and ochratoxins) could be extracted and identified in human tissue and body fluids from patients exposed to toxin producing molds in their environment. Human urine and methanol extracted tissues and sputum were examined."

"Trichothecenes were tested using competitive ELISA techniques. Aflatoxins B1, B2, G1, and G2, and ochratoxin A were tested by using immunoaffinity columns and fluorometry. Test sensitivity and specificity were determined. Levels of detection for the various mycotoxins varied from 0.2 ppb for trichothecenes, 1.0 ppb for aflatoxins, and 2.0 ppb for ochratoxins. Trichothecene levels varied in urine, sputum, and tissue biopsies (lung, liver, brain) from undetectable (&t; 0.2 ppb) to levels up to 18 ppb. Aflatoxin levels from the same types of tissues varied from 1.0 to 5.0 ppb. Ochratoxins isolated in the same type of tissues varied from 2.0 ppb to &t; 10.0 ppb. Negative control patients had no detectable mycotoxins in their tissues or fluids."

"These data show that mycotoxins can be detected in body fluids and human tissue from patients exposed to mycotoxin producing molds in the environment, and demonstrate which human tissues or fluids are the most likely to yield positive results."

The full article can be found at: (D.G. Hooper, et. al., "Mycotoxin Detection in Human Samples from Patients Exposed to Environmental Molds". International Journal of Molecular Sciences, 2009;10(4):1465-1475). Link not available.

Return to Top

GENE EXPRESSION IN PRIMATE LIVER DURING VIRAL HEMORRHAGIC FEVER

Medical Letter on the CDC & FDA
June 7, 2009

“Previously, we profiled the blood transcriptome of LCMV-infected monkeys (M. Djavani et al J. Virol. 2007) showing distinct pre-viremic and viremic stages that discriminated virulent from benign infections. In the present study, changes in liver gene expression from macaques infected with virulent LCMV-WE were compared to gene expression in uninfected monkeys as well as to monkeys that were infected but not diseased. Based on a functional pathway analysis of differentially expressed genes, virulent LCMV-WE had a broader effect on liver cell function than did infection with non-virulent LCMV-Armstrong. During the first few days after infection, LCMV altered expression of genes associated with energy production, including fatty acid and glucose metabolism. The transcriptome profile resembled that of an organism in starvation: mRNA for acetyl-CoA carboxylase, a key enzyme of fatty acid synthesis was reduced while genes for enzymes in gluconeogenesis were up-regulated. Expression was also altered for genes associated with complement and coagulation cascades, and with signaling pathways involving STAT1 and TGF-beta. Most of the 4500 differentially expressed transcripts represented a general response to both virulent and mild infections. However, approximately 250 of these transcripts had significantly different expression in virulent infections as compared to mild infections, with approximately 30 of these being differentially regulated during the pre-viremic stage of infection.”

"The genes that are expressed early and differently in mild and virulent disease are potential biomarkers for prognosis and triage of acute viral disease."

The full article can be found at: (M. Djavani, et. al., “Gene expression in primate liver during viral hemorrhagic fever”. Virology Journal, 2009;6():20). Link not available.

Return to Top

ULTRASOUND-TRIGGERED CONTROLLED DRUG DELIVERY AND BIOSENSING USING SILICA NANOTUBES
Science Letter
June 2, 2009

“Silica nanotubes (SNTs) have been demonstrated here as a versatile host for controlled drug delivery and biosensing. The sol-gel template synthesized SNTs have a slow rate of drug release.”

"Application of an external stimulus in the form of ultrasound to or chemical functionalization of synthesized SNT results in higher yield of drug release as well as yield of drug release varying linearly with time. In case of controlled drug delivery triggered by ultrasound, drug yield as function of time is found to be heavily dependent on the ultrasound impulse protocol. Impulses of shorter duration (similar to 0.5 min) and shorter time intervals between successive impulses resulted in higher drug yields. Confinement of hemoglobin (Hb) inside nanometer sized channels of SNT does not have any detrimental effect on the native protein structure and function.”

"Observance of significant enhancement in direct electron transfer of Hb makes the SNTs also promising for application in biosensors."

The full article can be found at: (S. Kapoor, et. al., “Ultrasound-Triggered Controlled Drug Delivery and Biosensing Using Silica Nanotubes”. Journal of Physical Chemistry C, 2009;113 (17):7155-7163). Link not available.

Return to Top

RENEWABLE SURFACE FLUORESCENCE SANDWICH IMMUNOASSAY BIOSENSOR FOR RAPID SENSITIVE BOTULINUM TOXIN DETECTION IN AN AUTOMATED FLUIDIC FORMAT
Drug Week
June 5, 2009

“A renewable surface biosensor for rapid detection of botulinum neurotoxin serotype A is described based on fluidic automation of a fluorescence sandwich immunoassay, using a recombinant protein fragment of the toxin heavy chain (similar to 50 kDa) as a structurally valid simulant. Monoclonal antibodies AR4 and RAZ1 bind to separate non-overlapping epitopes of the full botulinum holotoxin (similar to 150 kDa).”

"Both of the targeted epitopes are located on the recombinant fragment. The AR4 antibody was covalently bound to Sepharose beads and used as the capture antibody. A rotating rod flow cell was used to capture these beads delivered as a suspension by a sequential injection flow system, creating a 3.6 mu L column. After perfusing the bead column with sample and washing away the matrix, the column was perfused with Alexa 647 dye-labeled RAZ1 antibody as the reporter. Optical fibers coupled to the rotating rod flow cell at a 90 degrees angle to one another delivered excitation light from a HeNe laser (633 nm) using one fiber and collected fluorescent emission light for detection with the other. After each measurement, the used Sepharose beads are released and replaced with fresh beads.”

"In a rapid screening approach to sample analysis, the toxin simulant was detected to concentrations of 10 pM in less than 20 minutes using this system."

The full article can be found at: (J.W. Grate, et. al., “Renewable surface fluorescence sandwich immunoassay biosensor for rapid sensitive botulinum toxin detection in an automated fluidic format”. Analyst, 2009;134(5):987-996). Link not available.

Return to Top

END of CB Daily Report.

Send subscription requests, unsubscribing requests, questions and comments to**:**

Steve Tesko: Steve.Tesko@anser.org

Copyright 2008. *Analytic Services Inc.*

Analytic Services Inc. DMCA Copyright Notice: http://www.homelandsecurity.org/bulletin/Draft_ANSER_DCMA_Copyright_Notice.htm

Use of these news articles does not reflect official endorsement.
In accordance with Title 17 (USC), Section 107, this material is distributed without profit or payment and is intended for nonprofit research and educational purposes only.
Reproduction for private use or gain is subject to original copyright restrictions.

PRIVACY POLICY

Content provided in the *CB Daily Report* does not reflect the viewpoint(s) of Analytic Services Inc. Analytic Services Inc. does not share, publish, or in any way redistribute subscriber email addresses or any other personal information.