

1 October 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 Edition**

1. DRIED-RESWOLLEN IMMOBILIZED BIOCATALYSTS FOR DETOXIFICATION OF ORGANOPHOSPHOROUS COMPOUNDS IN THE FLOW SYSTEMS: *"New immobilized biocatalysts based on polypeptides containing N- or C-terminal polyhistidine sequences and possessing organophosphorus hydrolase activity were investigated for detoxification of organophosphorous neurotoxic compounds in the flow systems."*

2. BOTULINUM NEUROTOXINS C, E AND F BIND GANGLIOSIDES VIA A CONSERVED BINDING SITE PRIOR TO STIMULATION-DEPENDENT UPTAKE WITH BOTULINUM NEUROTOXIN F UTILISING THE THREE ISOFORMS OF SV2 AS SECOND RECEPTOR: *"Using the mice phrenic nerve hemidiaphragm assay as a physiological model system, cross-competition of full-length neurotoxin binding by recombinant binding fragments, plus accelerated neurotoxin uptake upon increased electrical stimulation, indicate that BoNT/F employs SV2 as protein receptor, whereas BoNT/C and D utilise different SV receptor structures."*

3. GOLD NANOPARTICLE-BASED ENHANCED CHEMILUMINESCENCE IMMUNOSENSOR FOR DETECTION OF STAPHYLOCOCCAL ENTEROTOXIN B (SEB) IN FOOD: *"SEB was detected by a "sandwich-type" ELISA assay on the polycarbonate surface with a secondary antibody and ECL detection."*

4. DESIGNING PROBIOTICS THAT AMBUSH GUT PATHOGENS: *"If given during an infection caused by a toxin-producing bacterium, these "receptor-mimic probiotics" will bind the toxins in the gut very strongly, thereby preventing the toxins from interacting with receptors on host intestinal cells and causing disease."*

5. MORPHOLOGY OF SINGLE-WALL CARBON NANOTUBE AGGREGATES GENERATED BY ELECTROSPRAY OF AQUEOUS SUSPENSIONS: *"Possible mechanisms are suggested to explain the formation of the different shapes, which could be used to produce SWCNT aerosols with different morphologies.."*

6. SIMULTANEOUS ENRICHMENT OF SALMONELLA SPP, ESCHERICHIA COLI O157:H7, VIBRIO PARAHAEMOLYTICUS, STAPHYLOCOCCUS AUREUS, BACILLUS CEREUS, AND LISTERIA MONOCYTOGENES BY SINGLE BROTH AND SCREENING OF THE PATHOGENS BY MULTIPLEX REAL-TIME PCR: *"The results were comparable to conventional methods that require 4-6 days."*

7. STRUCTURAL AND KINETIC FEATURES OF FAMILY I INORGANIC PYROPHOSPHATASE FROM VIBRIO CHOLERA: *"Since V-PPase has been found to retain its hydrolytic activity in high ionic strength media, the observed structural and kinetic features are analyzed in view of the possible osmoadaptation of this protein."*

8. OVEREXPRESSION OF VPSS, A HYBRID SENSOR KINASE, ENHANCES BIOFILM FORMATION IN VIBRIO CHOLERA: *"Thus, VpsS utilizes components of the quorum-sensing pathway to modulate biofilm formation in V. cholerae."*

9. UNUSUAL MOLECULAR ARCHITECTURE OF THE MACHUPO VIRUS ATTACHMENT GLYCOPROTEIN: *"This provides a blueprint of the New World arenavirus attachment glycoproteins and reveals a new architecture of viral attachment, using a protein fold of unknown origins."*

10. REDUCED APOPTOSIS OF MOUSE MACROPHAGES INDUCED BY YSCW MUTANT OF YERSINIA PESTIS RESULTS FROM THE REDUCED SECRETION OF YOPJ AND RELATES TO CASPASE-3 SIGNAL PATHWAY: *"This means although YscW does not induce apoptosis directly, it can indirectly affect apoptosis through reducing the secretion of YopJ."*

11. NON-HUMAN PRIMATE STUDY RESULTS OF RESTANZA RELEASED: "Advanced Life Sciences Holdings, Inc. today announced positive top-line results from a pivotal, non-human primate study involving its novel, once-a-day, oral antibiotic Restanza(TM) (cethromycin) demonstrating statistical significance at a 90% survival rate against an inhaled lethal dose of plague."

12. BACILLUS ANTHRACIS LETHAL TOXIN DISRUPTS TCR SIGNALING IN CD1D-RESTRICTED NKT CELLS LEADING TO FUNCTIONAL ANERGY: "We propose that Bacillus anthracis-derived LT causes a novel form of functional anergy in NKT cells and therefore has potential for contributing to immune evasion by the pathogen."

CB Daily Report

Chem-Bio News

DRIED-RESWOLLEN IMMOBILIZED BIOCATALYSTS FOR DETOXIFICATION OF ORGANOPHOSPHOROUS COMPOUNDS IN THE FLOW SYSTEMS

Proteomics Weekly
September 28, 2009

"New immobilized biocatalysts based on polypeptides containing N- or C-terminal polyhistidine sequences and possessing organophosphorus hydrolase activity were investigated for detoxification of organophosphorous neurotoxic compounds in the flow systems."

"The biocatalysts were revealed to have a high catalytic activity within wide pH and temperature ranges 7.5-12.5 A degrees C and 15-65 A degrees C, respectively. The immobilized biocatalysts can be dried and reswollen before use with 92-93% catalytic activity remaining after drying and rehydration procedures."

"The half-lives of the biocatalysts under wet and dry storage conditions were 420 and 540 days, respectively."

The full article can be found at: (E.N. Efremenko, et. al., "Dried-Reswollen Immobilized Biocatalysts for Detoxification of Organophosphorous Compounds in the Flow Systems". Applied Biochemistry and Biotechnology, 2009;159(1):251-260). Link not available.

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BOTULINUM NEUROTOXINS C, E AND F BIND GANGLIOSIDES VIA A CONSERVED BINDING SITE PRIOR TO STIMULATION-DEPENDENT UPTAKE WITH BOTULINUM NEUROTOXIN F UTILISING THE THREE ISOFORMS OF SV2 AS SECOND RECEPTOR

Health & Medicine Week
September 28, 2009

'Botulinum neurotoxins C, E and F bind gangliosides via a conserved binding site prior to stimulation-dependent uptake with botulinum neurotoxin F utilising the three isoforms of SV2 as second receptor' have been presented. According to recent research from Hannover, Germany, "The high toxicity of clostridial neurotoxins primarily results from their specific binding and uptake into neurons. At motor neurons, the seven botulinum neurotoxin serotypes A-G (BoNT/A-G) inhibit acetylcholine release, leading to flaccid paralysis, while tetanus neurotoxin blocks neurotransmitter release in inhibitory neurons, resulting in spastic paralysis."

"Uptake of BoNT/A, B, E and G requires a dual interaction with gangliosides and the synaptic vesicle (SV) proteins synaptotagmin or SV2, whereas little is known about the entry mechanisms of the remaining serotypes. Here, we demonstrate that BoNT/F as well depends on the presence of

gangliosides, by employing phrenic nerve hemidiaphragm preparations derived from mice expressing GM3, GM2, GM1 and GD1a or only GM3. Subsequent site-directed mutagenesis based on homology models identified the ganglioside binding site at a conserved location in BoNT/E and F. Using the mice phrenic nerve hemidiaphragm assay as a physiological model system, cross-competition of full-length neurotoxin binding by recombinant binding fragments, plus accelerated neurotoxin uptake upon increased electrical stimulation, indicate that BoNT/F employs SV2 as protein receptor, whereas BoNT/C and D utilise different SV receptor structures."

The full article can be found at: (A. Rummel, et. al., "Botulinum neurotoxins C, E and F bind gangliosides via a conserved binding site prior to stimulation-dependent uptake with botulinum neurotoxin F utilising the three isoforms of SV2 as second receptor". Journal of Neurochemistry, 2009;110(6):1942-54). Link not available.

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GOLD NANOPARTICLE-BASED ENHANCED CHEMILUMINESCENCE IMMUNOSENSOR FOR DETECTION OF STAPHYLOCOCCAL ENTEROTOXIN B (SEB) IN FOOD

Nanotechnology Weekly
September 21, 2009

"Staphylococcal enterotoxins (SEs) are major cause of foodborne diseases, so sensitive detection (<1 ng/ml) methods are needed for SE detection in food, The surface area, geometric and physical properties of gold nanoparticles make them well-suited for enhancing interactions with biological molecules in assays. To take advantage of the properties of gold nanoparticles for immunodetection, we have developed a gold nanoparticle-based enhanced chemiluminescence (ECL) immunosensor for detection of Staphylococcal Enterotoxin B (SEB) in food."

"Anti-SEB primary antibodies were immobilized onto a gold nanoparticle surface through physical adsorption and then the antibody-gold nanoparticle mixture was immobilized onto a polycarbonate surface. SEB was detected by a "sandwich-type" ELISA assay on the polycarbonate surface with a secondary antibody and ECL detection. The signal from ECL was read using a point-of-care detector based on a cooled charge-coupled device (CCD) sensor or a plate reader. The system was used to test for SEB in buffer and various foods (mushrooms, tomatoes, and baby food meat). The limit of detection was found to be similar to 0.01 ng/ml, which is similar to 10 times more sensitive than traditional ELISA. The gold nanoparticles were relatively easy to use for antibody immobilization because of their physical adsorption mechanism; no other reagents were required for immobilization."

The full article can be found at: (M.H. Yang, et. al., "Gold nanoparticle-based enhanced chemiluminescence immunosensor for detection of Staphylococcal Enterotoxin B (SEB) in food". International Journal of Food Microbiology, 2009;133(3):265-271). Link not available.

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DESIGNING PROBIOTICS THAT AMBUSH GUT PATHOGENS

Preventive Medicine Week
September 27, 2009

"Researchers in Australia are developing diversionary tactics to fool disease-causing bacteria in the gut. Many bacteria, including those responsible for major gut infections, such as cholera, produce toxins that damage human tissues when they bind to complex sugar receptors displayed on the surface of cells in the host's intestine.

At the Society for General Microbiology's meeting at Heriot-Watt University, Edinburgh, today (8 September), Professor James Paton and colleagues from the University of Adelaide explained how they had added molecular mimics of these host cell receptors onto the surface of harmless bacteria capable of surviving in the human gut. If given during an infection caused by a toxin-producing bacterium, these "receptor-mimic probiotics" will bind the toxins in the gut very strongly, thereby preventing the

toxins from interacting with receptors on host intestinal cells and causing disease.

Effective vaccines are not yet available for many diarrhoeal diseases; and trying to control or treat these diseases with antibiotics can lead to the development of drug-resistance. One advantage of this approach to treatment is that the pathogenic bacteria are unlikely to develop a resistance to it, as that would destroy the basic mechanism by which they cause disease.

A further advantage is that the receptor-mimic bacteria bind toxins more strongly than previous technologies in which synthetic receptors were displayed on inert silica particles. They are also more cost effective, as the bacteria can be grown cheaply in large-scale fermenters.

"We initially developed this technology to prevent disease caused by strains of E. coli bacteria that produce Shiga toxin. These include the infamous E. coli O157 strain, which causes outbreaks of severe bloody diarrhoea and the potentially fatal haemolytic uraemic syndrome. Our prototype receptor mimic probiotic provided 100% protection against otherwise fatal E. coli disease in an animal model." said Professor Paton, "We have also developed similar receptor mimic probiotics that are capable of preventing cholera and travellers' diarrhoea. As well as being able to treat disease, these probiotics could be given to vulnerable populations following natural disasters to help prevent outbreaks of diseases like cholera".

Link not available.

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MORPHOLOGY OF SINGLE-WALL CARBON NANOTUBE AGGREGATES GENERATED BY ELECTROSPRAY OF AQUEOUS SUSPENSIONS

Journal of Technology & Science

September 20, 2009

"Airborne single-wall carbon nanotubes (SWCNTs) have a high tendency to agglomerate due to strong interparticle attractive forces. The SWCNT agglomerates generally have complex morphologies with an intricate network of bundles of nanotubes and nanoropes, which limits their usefulness in many applications."

"It is thus desirable to produce SWCNT aerosol particles that have well-defined, unagglomerated fibrous morphologies. We present a method to generate unagglomerated, fibrous particles of SWCNT aerosols using capillary electrospray of aqueous suspensions. The effects of the operating parameters of capillary electrospray such as strength of buffer solution, capillary diameter, flow rate, and colloidal particle concentration on the size distributions of SWCNT aerosols were investigated. electrospray from a suspension of higher nanotube concentration produced a bimodal distribution of SWCNT aerosols. Monodisperse SWCNT aerosols below 100 nm were mostly non-agglomerated single fibers, while polydisperse aerosols larger than 100 nm had two distinct morphologies: a ribbon shape and the long, straight fiber."

"Possible mechanisms are suggested to explain the formation of the different shapes, which could be used to produce SWCNT aerosols with different morphologies.."

The full article can be found at: (B.K. Ku, et. al., "Morphology of single-wall carbon nanotube aggregates generated by electrospray of aqueous suspensions". Journal of Nanoparticle Research, 2009;11(6):1393-1403). Link not available.

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SIMULTANEOUS ENRICHMENT OF SALMONELLA SPP, ESCHERICHIA COLI O157:H7, VIBRIO PARAHAEMOLYTICUS, STAPHYLOCOCCUS AUREUS, BACILLUS CEREUS, AND LISTERIA MONOCYTOGENES BY SINGLE BROTH AND SCREENING OF THE PATHOGENS BY MULTIPLEX REAL-TIME PCR

"Simultaneous enrichment broth (SEB) was developed for the single-enrichment simultaneous screening of six, major food poisoning bacteria. After enrichment in SEB for 18 h at 37 degrees C, viable counts of six major food poisoning bacteria (*Staphylococcus aureus*, *Salmonella* spp., *Escherichia coli* O157:H7, *Vibrio parahaemolyticus*, *Bacillus cereus*, and *Listeria monocytogenes*) were sufficient for 5' nuclease multiplex real-time PCR assay using existing primers and probes."

"By labeling the probes with three different fluorescent dyes, the assay could be carried out in 2 tubes. The whole process, including enrichment and PCR, was completed within 24 h and the detection limits for the target bacteria from the food sample (boiled chicken) were 36 cfu/25 g for *S. aureus*, 5.3 cfu/25 g for *Salmonella* spp, 2.9 cfu/25 g for *E. coli* O157:H7, 2.0 cfu/25 g for *V. parahaemolyticus*, 5.5 cfu/25 g for *B. cereus*, and 6.2 cfu/25 g for *L. monocytogenes*."

"The results were comparable to conventional methods that require 4-6 days."

The full article can be found at: (H. Kobayashi, et. al., " Simultaneous Enrichment of *Salmonella* spp, *Escherichia coli* O157:H7, *Vibrio parahaemolyticus*, *Staphylococcus aureus*, *Bacillus cereus*, and *Listeria monocytogenes* by Single Broth and Screening of the Pathogens by Multiplex Real-time PCR". *Food Science and Technology Research*, 2009;15(4):427-438). Link not available.

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STRUCTURAL AND KINETIC FEATURES OF FAMILY I INORGANIC PYROPHOSPHATASE FROM VIBRIO CHOLERA

Gastroenterology Week
September 28, 2009

"In this paper, kinetic properties of a soluble inorganic pyrophosphatase of family I from *Vibrio cholerae* (V-PPase), intestinal pathogen and causative agent of human cholera, are characterized in detail, and the crystal structure of a metal-free enzyme is reported. Hydrolytic activity of V-PPase has been studied as a function of pH, concentration of metal cofactors (Mg^{2+} or Mn^{2+}), and ionic strength."

"It has been found that, despite the high conservation of amino acid sequences for the known bacterial PPases of family I, V-PPase differs from the other enzymes of the same family in a number of parameters. Dissociation constants of V-PPase complexed with Mg^{2+} or Mn^{2+} were essentially the same as for *Escherichia coli* PPase (E-PPase). However, the pH optimum of $MgPPi$ hydrolysis by V-PPase was shifted to more alkaline pH due to higher values of the $pK(a)$ of ionizable groups for both the free enzyme and the enzyme-substrate complex. The stability of a hexameric form of V-PPase has been studied as a function of pH. The corresponding $pK(a)$ of a group that controls the stability of the hexamer at pH below 6 ($pK(a) = 4.4$) was significantly lower than in the other hexameric PPases. The crystal structure reported here is analyzed and compared with the structure of E-PPase. The location of amino acid residues that differ in V-PPase and E-PPase is discussed."

"Since V-PPase has been found to retain its hydrolytic activity in high ionic strength media, the observed structural and kinetic features are analyzed in view of the possible osmoadaptation of this protein."

The full article can be found at: (E.V. Rodina, et. al., "Structural and kinetic features of family I inorganic pyrophosphatase from *Vibrio cholera*". *Biochemistry - Moscow*, 2009;74(7):734-742). Link not available.

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OVEREXPRESSION OF VPSS, A HYBRID SENSOR KINASE, ENHANCES BIOFILM FORMATION IN VIBRIO CHOLERA

Health & Medicine Week
September 28, 2009

"Mature biofilms rely on *Vibrio* polysaccharide to connect cells to each other and to a surface. We previously described a core regulatory network, which consists of two positive transcriptional regulators, VpsR and VpsT, and a negative transcriptional regulator HapR, that controls biofilm formation by regulating the expression of vps genes. In this study, we report the identification of a sensor histidine kinase, VpsS, which can control biofilm formation and activates the expression of vps genes. VpsS required the response regulator VpsR to activate vps expression. VpsS is a hybrid sensor histidine kinase that is predicted to contain both histidine kinase and response regulator domains, but it lacks a histidine phosphotransferase (HPT) domain. We determined that VpsS acts through the HPT protein LuxU, which is involved in a quorum-sensing signal transduction network in *V. cholerae*. In vitro analysis of phosphotransfer relationships revealed that LuxU can specifically reverse phosphotransfer to CqsS, LuxQ, and VpsS. Furthermore, mutational and phenotypic analyses revealed that VpsS requires the response regulator LuxO to activate vps expression, and LuxO positively regulates the transcription of vpsR and vpsT. The induction of vps expression via VpsS was also shown to occur independent of HapR."

"Thus, VpsS utilizes components of the quorum-sensing pathway to modulate biofilm formation in *V. cholerae*."

The full article can be found at: (N.J. Shikuma, et. al., "Overexpression of VpsS, a Hybrid Sensor Kinase, Enhances Biofilm Formation in *Vibrio cholerae*". *Journal of Bacteriology*, 2009;191(16):5147-5158). Link not available.

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UNUSUAL MOLECULAR ARCHITECTURE OF THE MACHUPO VIRUS ATTACHMENT GLYCOPROTEIN

Medical Letter on the CDC & FDA
September 27, 2009

"New World arenaviruses, which cause severe hemorrhagic fever, rely upon their envelope glycoproteins for attachment and fusion into their host cell."

"Here we present the crystal structure of the Machupo virus GP1 attachment glycoprotein, which is responsible for high-affinity binding at the cell surface to the transferrin receptor. This first structure of an arenavirus glycoprotein shows that GP1 consists of a novel alpha/beta fold."

"This provides a blueprint of the New World arenavirus attachment glycoproteins and reveals a new architecture of viral attachment, using a protein fold of unknown origins."

The full article can be found at: (T.A. Bowden, et. al., "Unusual Molecular Architecture of the Machupo Virus Attachment Glycoprotein". *Journal of Virology*, 2009;83(16):8259-8265). Link not available.

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REDUCED APOPTOSIS OF MOUSE MACROPHAGES INDUCED BY YSCW MUTANT OF YERSINIA PESTIS RESULTS FROM THE REDUCED SECRETION OF YOPJ AND RELATES TO CASPASE-3 SIGNAL PATHWAY

Immunotherapy Weekly
September 30, 2009

"Reduced apoptosis of mouse macrophages induced by yscW mutant of *Yersinia pestis* results from the reduced secretion of YopJ and relates to caspase-3 signal pathway,' are discussed in a new report. "The virulence of the pathogenic *Yersinia* species depends on a plasmid-encoded type III secretion system (T3SS) that injects six *Yersinia* outer protein (Yop) effector proteins into the cytosol of macrophages,

leading to disruption of host defence mechanisms. Here, we report that a T3SS structural protein YscW of *Yersinia pestis* contributed to the induction of apoptosis of murine macrophages.”

“The apoptotic percentage of macrophages, from both mouse peritoneal cavity and spleen, and of RAW264.7 cell line, caused by the *yscW* mutant strain was significantly lower than that by wild type (WT) *Y. pestis* and *yscW* complemented strain. Meanwhile, detection of caspase-3 activity in macrophages, a key apoptosis-inducing protein, showed coincident results with the changes of macrophage apoptosis induced by WT, *yscW* mutant and complemented strains, indicating that macrophage apoptosis was related to caspase-3 signal pathways. However, ectopic expression of YscW in RAW264.7 cells cannot increase the macrophage apoptosis and death, suggesting that YscW itself could not induce macrophage apoptosis directly. To get insight into the mechanism of this phenomenon, we investigated the secretion of YopJ, which has been thought to be the only Yop effector related to apoptosis, in WT, mutant and complemented strains, respectively. Results showed that in *yscW* mutant strain, secretion of YopJ was decreased significantly in the supernatant than that in WT or complemented strain.”

“This means although YscW does not induce apoptosis directly, it can indirectly affect apoptosis through reducing the secretion of YopJ.”

The full article can be found at: (Y. Bi, et. al., “Reduced apoptosis of mouse macrophages induced by *yscW* mutant of *Yersinia pestis* results from the reduced secretion of YopJ and relates to caspase-3 signal pathway”. *Scandinavian Journal of Immunology*, 2009;70(4):358-67). Link not available.

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NON-HUMAN PRIMATE STUDY RESULTS OF RESTANZA RELEASED

The Medical News
September 30, 2009

“Advanced Life Sciences Holdings, Inc. today announced positive top-line results from a pivotal, non-human primate study involving its novel, once-a-day, oral antibiotic Restanza(TM) (cethromycin) demonstrating statistical significance at a 90% survival rate against an inhaled lethal dose of plague. The study tested Restanza's protective efficacy at various doses up to 64 mg/kg, where nine out of ten animals in the study that received a 14-day course of Restanza initiated within 24 hours after exposure to a lethal dose of plague survived while only one out of ten of the animals that received placebo survived.”

.....

“Advanced Life Sciences is developing Restanza as a broad spectrum medical countermeasure for biodefense to combat multiple high priority bioterror agents, such as anthrax, *Francisella tularensis* (tularemia), *Yersinia pestis* (plague) and *Burkholderia pseudomallei* (melioidosis) under a two-year, \$3.8 million contract with the U.S. Department of Defense. The FDA has designated Restanza as an orphan drug for the post-exposure prophylactic treatment of inhalation anthrax, plague and tularemia, but the FDA has not yet approved the drug for marketing in this or any other indication.”

The full article can be found at: <http://www.news-medical.net/news/20090930/Non-human-primate-study-results-of-Restanza-released.aspx>

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BACILLUS ANTHRACIS LETHAL TOXIN DISRUPTS TCR SIGNALING IN CD1D-RESTRICTED NKT CELLS LEADING TO FUNCTIONAL ANERGY

By Sunil K. Joshi, Gillian A. Lang, Jason L. Larabee, T. Scott Devera, Lindsay M. Aye, Hemangi B. Shah, Jimmy D. Ballard, Mark L. Lang
PloS Pathogens
September 25, 2009

“Abstract

Exogenous CD1d-binding glycolipid (α -Galactosylceramide, α -GC) stimulates TCR signaling and activation of type-1 natural killer-like T (NKT) cells. Activated NKT cells play a central role in the regulation of adaptive and protective immune responses against pathogens and tumors. In the present study, we tested the effect of *Bacillus anthracis* lethal toxin (LT) on NKT cells both in vivo and in vitro. LT is a binary toxin known to suppress host immune responses during anthrax disease and intoxicates cells by protective antigen (PA)-mediated intracellular delivery of lethal factor (LF), a potent metalloprotease. We observed that NKT cells expressed anthrax toxin receptors (CMG-2 and TEM-8) and bound more PA than other immune cell types. A sub-lethal dose of LT administered in vivo in C57BL/6 mice decreased expression of the activation receptor NKG2D by NKT cells but not by NK cells. The in vivo administration of LT led to decreased TCR-induced cytokine secretion but did not affect TCR expression. Further analysis revealed LT-dependent inhibition of TCR-stimulated MAP kinase signaling in NKT cells attributable to LT cleavage of the MAP kinase kinase MEK-2. We propose that *Bacillus anthracis*-derived LT causes a novel form of functional anergy in NKT cells and therefore has potential for contributing to immune evasion by the pathogen.”

The full article can be found at: <http://www.plospathogens.org/article/info%3Adoi%2F10.1371%2Fjournal.ppat.1000588;jsessionid=06418FCA4D152CC405AF18773418EFC6>
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