Chemical and Biological Defense
CBIAC Information Analysis Center
Newsletter
Fall 2000 Volume 1 Number 4
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Genomics and Proteomics: The Future of Defense Toxicology

By Dr. Jennifer W. Sekowski, Dr. Akbar S. Khan, Dr. Kevin P. O'Connell, and Dr. James. J. Valdes

The cutting edge of Department of Defense toxicology is pushing the capabilities of military toxicology far beyond the foundations built during the World Wars. Toxicology, most simply defined, is the study of poisons. The history of modern military toxicology can be traced to World War I, when 100,000 Allied soldiers were killed and 1 million wounded by poison gas (1). At the same time, the incredible growth of the U.S. munitions industry brought to light the importance of industrial environmental toxicology. After thousands were killed or injured due to exposure to TNT and nitrous gases in U.S. munitions plants it was impossible to deny the critical importance of understanding industrial as well as warfare toxicants (2). The vast arsenal of chemicals developed during World War II brought with it new toxicological issues as soldiers were exposed to increasingly complex chemical mixtures during the routine operation and maintenance of their machinery and, in some climates, to the protective agents designed to combat disease-carrying insects and pathogens.

Since then, the continued development of chemical warfare agents worldwide, as well as their demilitarization, has created a growing operational concern for exposure to these agents not only in wartime activities, but also from potential terrorist activities. Occupational and environmental concerns have grown too, not only due to aging arsenal stockpiles in the U.S., but also due to exposure of U.S. troops to toxic industrial chemicals (TICs) and materials (TIMs) and natural environmental toxicants during deployments to countries where manufacturing and disposal methods are outdated and virtually unregulated. Overall, concerns for soldier and civilian chemical safety have created an impetus for research regarding the physiology, pathology, and therapy of acute and chronic chemical agent injury (1). In fact, much of that toxicology work was carried out at the Chemical Systems Laboratory at the Edgewood Area of Aberdeen Proving Ground (APG), Maryland, from WWI through 1979 (1) and continues today under the auspices of the Edgewood Chemical Biological Center (ECBC) and the U.S. Army Medical Research Institute of Chemical Defense (ICD).

Since the Gulf War, however, there has been increased concern for exposure to sub-acute and low levels of chemical warfare agents (3,4). Personnel involved in the decontamination of equipment, the destruction of chemical weapons, and those on the periphery of an attack are at risk for such low-level, possibly asymptomatic exposure to chemical warfare agents. Although

Left to Right: Dr. Akbar S. Khan, Dr. Kevin P. O'Connell, Dr. Jennifer W. Sekowski, Dr. James J. Valdes

such exposure may not cause immediate or obvious pathology at the time of exposure, it may cause alterations at the molecular level that will be manifest as altered genetic regulation, and this may predispose the exposed person to some ailment that will arise later in life. While acute, high-dose exposure to a single chemical is a straightforward toxicological issue, the reality is that low level exposures are far more likely and often occur in combination with other wartime chemicals such as large area insecticides, skin insect repellents (e.g. DEET), medical counter- measures (e.g. pyridostigmine bromide, atropine, oximes), vaccinations, depleted uranium, chemical agent resistant coatings, and a host of other factors (3,4). Thus, defense toxicology will increasingly rely on advances in science that will facilitate investigation into the molecular underpinnings of injury and disease that result from low-level exposure to complex chemical mixtures. This article briefly describes two complementary approaches that identify the molecular targets of low-level chemical exposure.

The vast majority of drugs and toxicants act by binding to protein targets, these being receptors, ion channels, enzymes, or secondary messenger molecules. These interactions almost inevitably affect a signal within the cell, often a stimulus that alters gene expression (4). These alterations, which can occur weeks before any obvious pathology or morbidity, can be measured and visualized by changesin global mRNA or protein

See **"Genomics and Proteomics"**
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Chemical and Biological Defense
CBIAC
Information Analysis Center

The **Chemical Warfare/Chemical and Biological Defense Information Analysis Center (CBIAC)** is a Department of Defense (DoD) Information Analysis Center (IAC) operated by Battelle Memorial Institute and administered by the Defense Information Systems Agency (DISA), Defense Technical Information Center (DTIC) under the DoD IAC Program Office (Contract No. SPO700-00-D-3180). The CBIAC **Contracting Officer's Technical Representative (COTR), Mr. Joseph D. Williams,** may be contacted by email at Joseph.Williams@sbccom.apgea.army.mil or at the following address:

CDR USA SBCCOM
Edgewood Chemical Biological Center
Attn: AMSSB-RRT-OM (Joseph Williams E3330)
5183 Blackhawk Road
Aberdeen Proving Ground, MD 21010-5424

U.S. Government agencies and private industry under contract to the DoD can contact the CBIAC for informational products and services. CBIAC services also extend to all state and local government s and the first responder community-local emergency planners, firefighters, medics and law enforcement personnel.

The CBIAC is located in Building E3330, Aberdeen Proving Ground - Edgewood Area, MD 21010. For further information or assistance, visit or contact the CBIAC.

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The ***CBIAC Newsletter,*** a quarterly publication of the CBIAC, is a public release, unlimited distribution forum for chemical and biological defense information. It is distributed in hardcopy format, and posted in Portable Document Format (PDF) on the **CBIAC Homepage.**

The CBIAC welcomes unsolicited articles on topics that fall within its mission scope. All articles submitted for publication consideration must be cleared for public release prior to submission. The CBIAC reserves the right to reject submissions. For each issue, articles must be received by the following dates:Winter (First Quarter)-November 1st; Spring (Second Quarter)-February 1st; Summer (Third Quarter)-May 1st; Fall (Fourth Quarter)-August 1st.

All paid advertisements are subject to the review and approval of the CBIAC COTR prior to publication. The appearance of an advertisement in the ***CBIAC Newsletter*** does not constitute endorsement by the DoD or the CBIAC.

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PEGEM Version 3.6 Release

The CBIAC, through Technical Area Task (TAT) 268, announces a 4th quarter 2000 release of version 3.6. of the Ballistic Missile Defense Organization (BMDO) sponsored Post Engagement Ground Effects Model (PEGEM).

Funded by the BMDO, PEGEM version 3.6 includes all the capabilities within version 3.5, PLUS:

- PSE is more robust
- Capability to use LandScan population data
- Statistical Casualty model for very large chemical agent droplets
- Additional meteorological input features
- ADRG/DTED map display capability
- NBC3 hazard area calculation and display
- Probabilistic hazard areas
- Improved submunition algorithms and databases
- Advanced Graphical User Interface
- STEM database - an easy to use payload damage model at PEELS level of accuracy
- Easy event relocation for “what if” analysis

PEGEM was developed by the BMDO to support the acquisition of ballistic missile defense. The model provides the ability to demonstrate the benefit of missile defense capability through estimation of the extent of ground hazard resulting from either an intercepted missile or from a nominally functioning threat. PEGEM provides high explosive, chemical, and biological weapon ground hazard assessment for multiple threat types and event times. PEGEM makes use of the missile defense specific environments - payload response to impact, high altitude effect and dynamic release of payload elements - to produce the source terms for modeling transport and dispersion of the residual debris and the resulting ground hazard. PEGEM invokes Defense Transport and Dispersion models (VLSTRACK or HPAC) for position estimate of wind borne agents.

PEGEM end-to-end calculations as well as parametric analysis capabilities can be applied to offensive deployments and intercepts. Model outputs consist of deposition mass, dosage, and fragment and debris kinetic energy grids, as well as instantaneous concentrations and casualty grids at user-specified times-of-interest on assets-of-interest.

Due to its acquisition support role, distribution is controlled by the BMDO, but PEGEM is available at no cost for release to BMDO authorized users. Further information about PEGEM is available at www.mevatec.com/pegem.

To request PEGEM 3.6 contact:

Donnie Shumate-Configuration Manager
e-mail: donnie.shumate@mevatec.com

Mr. William K. Moore-Program Manager
MEVATEC Corporation
1525 Perimeter Parkway, Suite 500
Huntsville, AL 35806
Phone: 256-890-8000
Fax: 256-890-0000

Government Sponsor
Ms. Maria Larsen
Ballistic Missile Defense Organization /TEM
7100 Defense, The Pentagon
Washington D.C. 20301-7100

CBD CONTRACT AWARDS

By Mary Frances Tracy

Design and Production of an Organophosphorous-Bioscavenger via Protein Engineering of Human Acetylcholinesterase
Israel Institute for Biological Research
PO Box 19
70450 Hess Ziona, Israel
$596,752. June 1, 2000
By U.S. Army Medical Research Acquisition Activity, Ft. Detrick, MD

Development of Human Skin Model for Sulfur Mustard Research
MatTek Corporation
200 Homer Avenue
Ashland, MA 01721
$70,000. June 2, 2000
By U.S. Army Medical Research Acquisition Activity, Ft. Detrick, MD

RD&T of Remote Sensors, Identifiers and Networks Designed to Counter Nuclear, Biological, and Chemical (NBC) Threats
Sentel Corporation
225 Reinekers Lane, Suite 500
Alexandria, VA 22314
$Unknown. June 16, 2000
By Naval Surface Warfare Center, Dahlgren, VA

Research and Development on Detection of Chemical Warfare Agents
Temple University
3400 North Broad Street
Philadelphia, PA 19140
$1,249,975. June 5, 2000
By SPAWARSYSCEN - San Diego, CA

Mask Assembly
Taipalus Marketing and Consulting
429 South Tyndall Parkway, Suite C
Panama City, FL 32404
$97,676. June 8, 2000
By DPSC - Philadelphia, PA

Folding, Quick-don Mask Assembly
Scott Aviation
Division of Scott Technologies, Inc.
225 Erie Street
Lancaster, NY 14086-9502
$122,720. June 9, 2000
By DGSC - Richmond, VA

Mark I Nerve Agent Antidote Training Kit
Meridian Medical Technologies Inc.
10240 Old Columbia Road
Columbia, MD 21046
$44,240. June 13, 2000
By DPSC - Philadelphia, PA

Johnston Island Chemical Agent Demilitarization
Raytheon Demilitarization Company
2850 PA'A Street
Honolulu, HA 96819
$1,304,759. July 6, 2000
By Operations Support Command (PROV), Rock Island Arsenal, Rock Island, IL

Maintenance of Data Acquisition System and Technical Labor in Support of the Chemical Agent Munitions Disposal System
SciTech Services, Inc.
Edgewood, MD
$17,500,000. July 7, 2000
By U.S. Army Corps of Engineers, Huntsville, AL

Development and Building of a Completely Automated and Portable Biological Agent Detection System (MIDAS II - Microfluidic DNA Analysis System)
Cepheid
Sunnyvale, CA
$1,800,000. July 10, 2000
By Department of the Army

Program Definition and Risk Reduction of the Joint Service Aircrew Mask (JSAM)
Gentex Corp.
Rancho Cucamonga, CA
and
Science Applications International Corp (SAIC)
Abingdon, MD
$12,487,768 ($6,376,227 Gentex; $6,108,541 SAIC). July 17, 2000
By 311th Human Systems Wing, Brooks AFB, TX

Professional Advisory and Assistance Services to Support the Defense Threat Reduction Agency (DTRA)
Logicon, Inc.
San Pedro, CA
$2,863,900 (increment of a $70,707,838). July 17, 2000
By DTRA, Alexandria, VA

M93 Fox NBC Tactical Vehicle
General Dynamics Land Systems, Inc.
Sterling Heights, MI 48310-3268
$3,638,968. July 27, 2000
By TACOM - Rock Island, IL

Counter-Terrorism Technology Assessment and Methodology Study
Research Associates for Defense Co.
10002 Hillside Terrace
Marcy, NY
$390, 078. July 31, 2000
By Air Force Research Laboratory, Rome, NY

Nerve Agent Auto-injectors and Life Cycle Management, Industrial Base Maintenance Agreement Contract Extension
Meridian Medical Technologies
10240 Old Columbia Road
Columbia, MD 21046
$15,000,000 (approximate). August 1, 2000
By DSC-Philadelphia, PA

Multiplexed Sensing and Genetically Specific Identification of Chemical/Biological Warfare Agents
ACLARA Biosciences
1288 Pear Avenue
Mountain View, CA 94043
$3,199,684. August 2, 2000
By SPAWARSYSCEN - San Diego, CA

Environmental Support for Civil and Military Activities and Biological Monitoring and Service in the Southwestern U.S.
Viva Environmental, Inc.
San Antonio, TX
$3,200,000. August 18, 2000
By U.S. Army Corps of Engineers, Fort Worth, TX

Micro-Monitoring Instrument (MMI) Capable of Characterizing the Chemical and Physical Constituents of its Environment
University of South Florida
Tampa, FL
$21,552,423. September 7, 2000
By U.S. Army Space and Missile Defense Command, Huntsville, AL

expression profiling. Thus, for every drug or toxicant there exists a gene profile regulation pattern, or molecular "fingerprint". A molecular fingerprint of a toxicant contains valuable information regarding both its mechanism of action and route of toxicity. Molecular profiling of a toxicant will greatly enhance detection of molecular events altered by low-level exposures, identification of biomarkers of exposure, determination of individual sensitivities to certain agents, and serve as prognostic indicators of injury or disease. The great advantages of this approach over traditional toxicology are that it gives a very early indication of toxicity, and can provide a before-and-after deployment genetic profile of the individual.

GENOMICS

The first part of building a molecular profile of a particular toxicant entails gaining an understanding of which genes' expression are altered as a result of exposure to it. Measurement and analysis of the genetic material of an organism is known as genomics. The quantification of the level of message coded from a particular gene (i.e. transcription) is made possible through measurement of the level of mRNAs.

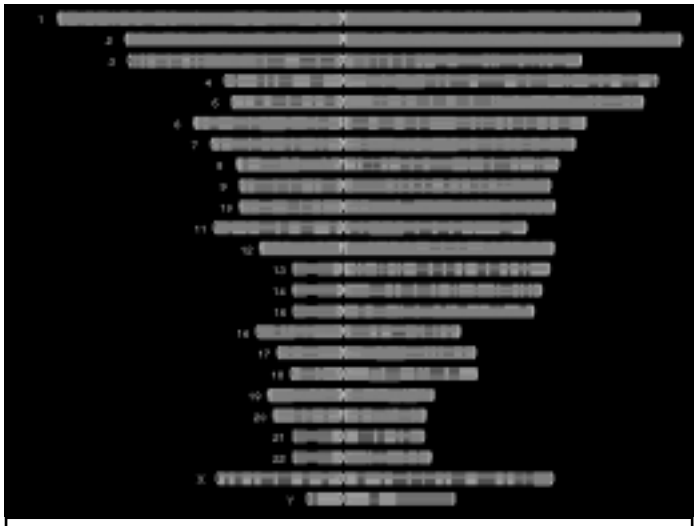
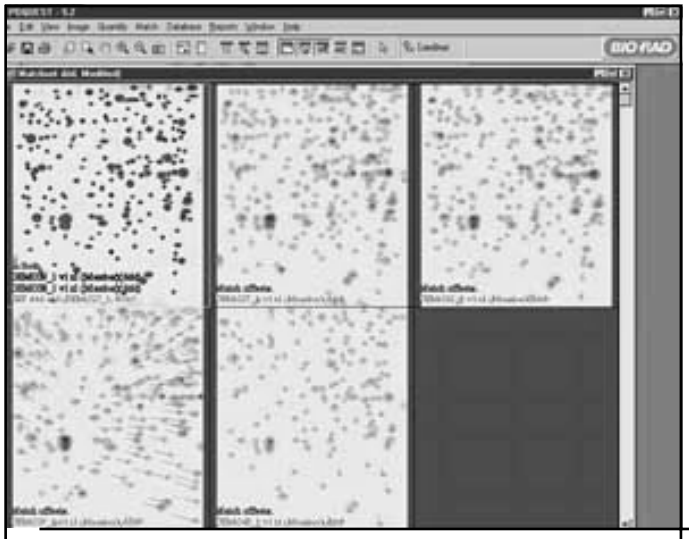


Image of the human chromosomes. The intensity of expression of the genes detected by the Human Genome U95 Set GeneChip (Affymetrix) is displayed at the location of the particular gene on the chromosomes. This display of data was generated from an analysis performed using GeneSpring software (Copyright Silicon Genetics).

Several important developments in the field have made the quantification and identification of mRNAs (i.e. transcripts) possible. First, rapid and automated large-scale DNA sequencing (reading of the code) technology has made it possible for laboratories around the world to decode the entire genomes of many organisms, including humans. Having access to the entire sequence of a normal genome makes it possible to identify differences in a diseased organism's genome, or one that has been exposed to a chemical agent. A second technological advance, made possible through progress in genome sequence knowledge, is DNA array technology. Through DNA array (or "gene chip") technology, the simultaneous increase or decrease in abundance of a gene's mRNA molecules, the messages that code for cellular proteins, is made possible. Briefly, the mRNA is prepared from control and treated cells, or tissue from exposed animals or humans, and DNA copies are made enzymatically in the presence of fluorescently labeled nucleotides. The labeled cDNAs are then hybridized to the gene chip and the pattern of fluorescent signals from the array is measured by laser scanning confocal microscopy. The pattern is then translated by a computer into meaningful expression profile data. The ratio between the signals from the control and exposed sample arrays reflect the relative toxicant-induced change in the genes' response to the toxicant exposure.

PROTEOMICS

While the first half of a molecular toxicological profile explores the effects of toxicants at the level of gene transcript regulation, there are other toxicological effects that may only manifest in the downstream molecular events. The downstream processes following gene transcription, such as translation (i.e. assembly of the amino acids, the building blocks of proteins, according to the mRNA transcript), coding of the polypeptide or protein, post-translational processing of the polypeptide or protein, and subsequent activity of the coded protein, are very sensitive to perturbation by toxicants. The study of these events and cellular proteins is termed proteomics. Overall, proteomics strives to capture a picture of the control of the production and processing of proteins, the ultimate products of genes. Thus, the perspective gained from proteomic analysis is much closer to the ultimate control of cellular function than is the perspective gained from genomics, and together they provide a complete molecular analysis. The two technologies which have made proteomics possible are two-dimensional gel electrophoresis (2-DE) and mass spectrometry. 2-DE can separate nearly all of the proteins in a cell or tissue by their isoelectric point and by mass/charge ratio (5). The product is a rectangular slab of protein spots that are usually visualized by staining. From this the ratio between the optical density of the 2-DE spots of the control and exposed samples are compared to search for toxicant-associated alterations. In addition, the composition and identity of the interesting altered polypeptide spots can be determined by mass spectrometry. This provides a very sensitive means by which to discover protein alterations caused by exposure to a particular toxicant, which might not be otherwise detected at the level of gene expression.



Comparative analysis of 2-dimensional electrophoresis (2-DE) data from several experiments using PD Quest software (Copyright BioRad Laboratories). This type of proteomic analysis can detect subtle changes in cellular proteins, which occur in the tissue or cells of an animal or human, as a result of exposure to various military and industrial chemicals.

See **"Genomics and Proteomics"**
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CALENDAR OF EVENTS

*For a more extensive CB defense calendar of events, visit the **CBIAC Homepage** at http://www.cbiac.apgea.army.mil/!*

2000 MEETINGS

November 6-9, 2000
DTIC 2000
DoubleTree Hotel Rockville
Rockville, Maryland
POC: Julia Foscue
Tel: (703) 767-8222/DSN 427-8222
Fax: (703) 767-8228/DSN 427-8228
Email: jfoscue@dtic.mil
URL: http://www.dtic.mil/dtic/conferences.html

November 12-15, 2000
International Society for Respiratory Protection (ISRP) 10th International Conference: "Respiratory Protection for First Response, Domestic Preparedness and Anti-Terrorism Personnel"
The Manly Pacific Parkroyal Hotel
Sydney, Australia
POC: Goran Berndtsson
Telephone: 61 2 9910 7500
E-mail: goran@isrp.com.au
POC: Dana Lundmark
Tel: 61 2 9261 5746
E-mail: sydney2K@isrp.com.au
URL: http://www.llnl.gov/isrp/conf00.html

November 15, 2000
Joint/CINC Operational Testing Annual DO-49 Meeting
ANSER Conference Complex
Arlington, Virginia
POC: Paula Nicholson
Tel: (435) 831-3816
DSN: 789-3816
Email: nicholsn@dugway-emh3.army.mil

November 28-29, 2000
Second National Symposium on Medical and Public Health Response to Bioterrorism
Marriott Wardman Park Hotel
Washington, DC
POC: Conference Management Systems (CMS)
Tel: (800) 431-5638
(847) 384-7654
URL: http://www.hopkins-biodefense.org

November 28-December 1, 2000
Alternative Toxicology Methods for the New Millennium: Science and Application
Lister Hill Center, National Institute of Medicine
National Institutes of Health
Bethesda, MD
POC: Deborah Bilotto
Tel: (410)-612-8247
Email: bilotto_deborah@bah.com

5 - 6 December 2000
Jane's 4th Non-Lethal Weapons Conference
The Caledonian Hilton Hotel
Edinburgh, Scotland
POC: Jane's Conferences
Tel: (800) 243-3852
(703) 683-3700
Email: conferences@janes.com
URL: http://conference.janes.com

December 5, 6, and 7, 2000
LIVE SATELLITE BROADCAST: Medical Response to Chemical Warfare and Terrorism 2000
POC: Chemical Casualty Care Division, USAMRICD
Tel: (410) 436-2230
DSN: 584-2230
Email: ccc@apg.amedd.army.mil
URL: http://ccc.apgea.army.mil

December 5-7, 2000
(Pre-symposium meeting December 4th see website for details)
2nd Singapore International Symposium on Protection Against Toxic Substances (SISPAT)
Goodwood Park Hotel
Singapore
POC: DSO National Laboratories/Ms LEE Chai Ling
Tel: +65 871 2912
Email: sispat@dso.org.sg
URL: http://www.dso.org.sg/sispat/Symposium/sispat_main.html

December 12-13, 2000
22nd Army Science Conference (ASC) "Accelerating the Pace of the Transformation to the Objective Force."
Renaissance Harborplace Hotel
Baltimore, MD
Tel: (757) 357-4011
Email: asc2000info@aol.com
URL: http://www.asc-2000.com/

2001 MEETINGS

February 28-March 2, 2001
AUSA Winter Symposium and Exhibition
Brownard County Convention Center
Ft. Lauderdale, Florida
POC: AUSA
Tel: (703) 841-4300
URL: http://www.ausa.org

April 22-27, 2001
CBMTS-Industry II: First World Congress on Chemical and Biological Terrorism
Dubrovnik, Croatia
POC: ASA/Richard Price or Barbara Price
Tel: (207) 829-6376
Email: asa@ime.net or asa@maine.rr.com
URL: http://www.asanltr.com/wbiot.htm
POC: Lt. Col. Zvonko Orehovec
Tel: 385-1-455-1513
385-1-371-8308
Email: cbmts_hr@zvonimir.morh.tel.hr
zbikarlo@zvonimir.morh.hr

April 23-26, 2001
27th Environmental Symposium & Exhibition: "A New Era for Federal Environmental Leadership, Management and Technology"
(Event # 144E-3140)
Austin Convention Center
Austin, Texas
POC: Kira Migliore (Exhibits)
Tel: (703) 247-2590
Email: kmigliore@ndia.org
URL: http://www.ndia.org

June 15-19, 2001
The Seventh International CBW Protection Symposium and Exhibition of CBW Defence Equipment
Stockholm City Conference Centre
Norra Latin, Stockholm, Sweden
POC: Kurt Persson (scientific programme)
Tel: +46-90-106 773
Email: persson@ume.foa.se
POC: Asa Lundvall (exhibition)
Tel: +46-90-106 698
Email: lundvall@ume.foa.se
POC: Marianne Olofsson (registration)
Tel: +46-90-106 602
Email: molofsson@ume.foa.se
URL: http://www.cbwsymp.foa.se/

CBIAC PRODUCTS

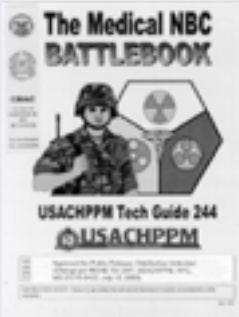
Chemical Biological/Smoke Modeling and Simulation (M&S) Newsletter Compilation

CBIAC Product Number: CR-00-01
Product Category: Critical Review
Media: CD-ROM
Price: $75.00
Distribution Limitation: U.S. Government Agencies and their M&S Contractors
Classification: Unclassified
Publication Date: December 1999
Availability: CBIAC

Description: This report contains the complete text of all 12 issues of the ***Chemical Biological/Smoke Modeling and Simulation (M&S) Newsletter,*** published from spring 1995 through fall 1999. These newsletters provide an excellent overview, review and summary of defense-related chemical, biological and smoke modeling and simulation activities during this period. Adobe Acrobat Reader (TM) is required to view the individual newsletters, which are presented as PDF files on two CD-ROMs.

Medical NBC Battlebook

CBIAC Product Number: SOAR-00-01
Product Category: State-of-the-Art Report
Media: Paperback
Price: $5.00
Distribution Limitation: Unlimited
Classification: Unclassified
Publication Date: April 1999
Availability: CBIAC



Description: The Medical NBC Battlebook (U.S. Army Center for Health Promotion and Preventive Medicine [USACHPPM] Tech Guide 244) can now be ordered from the CBIAC. The Battlebook covers nuclear weapons, radiological hazards, biological agents, chemical agents, lasers and radiofrequency hazards, NBC defense equipment, and points of contact. ***The CBIAC distributes the Battlebook quantities of five or less.***

CBIAC products can also be ordered through the ***Interactive Product Request Form*** *on our website!*

NEW CBD INFORMATION RESOURCES

By Richard M. Gilman

Documents from the Web

Chow, Brian G. et al. **Air Force Operations in a Chemical and Biological Environment.** Santa Monica, CA: Rand Corporation, 1998.
http://www.rand.org/publications/DB/DB189.1/DB189.1.pdf

"This study examines how adversaries might use chemical and biological weapons (CBWs) to paralyze U.S. Air Force operations, how the Air Force might continue operations despite a contaminated environment, and how additional measures might enable the Air Force to sustain operations. The work should be of interest to policy makers and military planners in countering CBWs." (Preface).

Includes chapter length treatments of "The Character of CBW Threats," "U.S. Response Options for Tactical Air Operations: Standoff," "U.S. Response Options for Tactical Air Operations: Protected Posture," and "U.S. Response Options for Airlift Operations." Contains numerous charts and list of acronyms.

CB-174857
AD-A341140
Rand Corporation
1700 Main Street
Santa Monica, California 90401
Phone: (310) 393-0411
Fax (310) 393-4818

Hickman, Donald C. **A Chemical and Biological Warfare Threat: USAF Water Systems at Risk. Counterproliferation Paper No. 3.** Maxwell Air Force Base, Alabama: USAF Counterproliferation Center, Air War College, Air University, 1999.
http://www.au.af.mil/au/awc/awcgate/cpc-pubs/hickman.htm

"Water and the systems that supply it are national critical infrastructures. Attack to deny or disrupt these systems could have catastrophic effects on the U.S. economy and military power. Water is particularly vulnerable to chemical or biological attack..."

"The U.S. Air Force water supplies are particularly assailable by asymmetric attack...Understanding this vulnerability requires systemic analysis...The author proposes four thrusts to improve force protection: comprehensive threat and risk assessment, focused water system vulnerability assessments, re-evaluation of the CW/BW conventional wisdom, and a review of Civil Engineering water system outsourcing and management practices." (author's abstract)

CB-174228
U.S. Air Force Counter-Proliferation Center
325 Chennault Circle
Air War College
Air University
Maxwell Air Force Base, Alabama 36112-6427
Phone: (334) 953-7538
Fax: (334) 953-7538

Smart, Jeffery K. **History of Chemical and Biological Detectors, Alarms, And Warning Systems.** Aberdeen Proving Ground, MD: U.S. Army Soldier and Biological Chemical Command, PMNBC, 2000.
http://www.sbccom.apgea.army.mil/RDA/pmnbc/pdfs/detectors.pdf

This overview of the history of CB detectors, alarms and warning systems examines approximately 75 such devices. Starting with a brief look at analytical chemical instruments of the 17th through 19th centuries the illustrated narrative then successively highlights the more prominent chemical detection and warning devices utilized during World War I, the Inter-War years, World War II, the 1950's, the 1960's, the 1970's, the 1980's and the 1990's. It concludes with a brief look at some of the devices now in the developmental pipeline. Includes numerous photos and endnotes.

CB-168225
Program Manager
NBC Defense Systems
Aberdeen Proving Ground, MD 21010-5424
Phone: (410) 436-2566

Journals

Biosensors for Identification of Biological Warfare Agents special theme issue Biosensors & Bioelectronics. Vol. 14, Nos. 10-11 (January 2000), pp. 751-861.

"This issue highlights the wide variety of technologies used to make biosensors for identification of bioagents including fluorescence, refractometry, magnetometry, potentiometry, and chemiluminescence. Each biosensor is first evaluated for sensitivity and specificity. After these parameters are established, potential interferences from sample matrix components are evaluated. Sensors which satisfy the criteria associated with sensitivity, specificity and resistance to interferences are then automated and eventually made user-friendly. The papers here include biosensors in all stages of this progression." (Excerpt from editorial by Dr. Francis S. Ligler)

CB-172191
Biosensors & Bioelectronics
Elsevier Science
P.O. Box 945
New York, N.Y. 10159-0945
Phone: (212) 633-3730
Fax: (212) 633-3680

"Genomics and Proteomics"

Continued from page 5

TOTAL EXPRESSION ANALYSIS

Bioinformatics plays a key role in organizing, storing, and making sense of the massive amounts of data accumulated in the generation of genomic and proteomic expression profiling. Once a mass of high quality quantitative expression data has been collected, it is important to visualize the complex patterns of gene and protein expression. This is necessary in order to correlate toxicant exposure with the involved genes, or sets of genes, and to identify key biochemical pathways that may be affected. As the database grows, powerful software is required to identify differences and trends between different sets of exposure regimens and between different toxicants.

Now and in the future, this type of complex toxicological profiling will yield critical information needed to make strategic military decisions. In fact, the Joint Future Operational Committee (JFOC) has issued recommendations to develop these types of toxicological capabilities including the ability to 1) detect acute as well as low level chronic exposure to toxicants (JFOC 3.3 -3.4); 2) predict disease association with toxicants (i.e. find biomarkers/ prognostic indicators) (JFOC 3.3-3.4); 3) assess chemical predispositions and sensitivities of soldiers to toxicants (JFOC 3.1, 3.3); and 4) improve point detection of toxicants necessary for battle management, contamination avoidance, and individual and collective protection (JFOC 3.1-3.4). These are precisely the types of questions that are suited to investigation using genomic and proteomic approaches.

CONCLUSION

The basic methodology of chemical warfare agent, TIC, and TIM toxicological safety evaluation has changed little during the decades following the World Wars. In the years following the Gulf War, however, attention has shifted toward lower level exposures, exposure to complex mixtures of military and industrial chemicals, and toward the more subtle molecular consequences of these types of exposures. Genomic and proteomic technologies are poised to address the current high priority JFOC initiatives and to grow with the future of defense toxicology, providing the tools to improve risk assessment, enhance soldier performance, and protect both the short and long-term health of the soldier.

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BIOGRAPHICAL NOTES

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CBD TOXICOLOGY PRESENTATIONS ARE PLANNED FOR THESE UPCOMING CONFERECES:

Alternative Toxicology Methods for the New Millenium: Science and Application
Nov. 28- Dec. 1, 2000, in Bethesda, MD

22nd Army Science Conference (ASC) "Accelerating the Pace of the Transformation to the Objective Force."
Dec. 12-13, 2000, in Baltimore, MD

CBD IN THE NEWS

By Mary Frances Tracy

Growth Medium for the Rapid Isolation and Identification of Anthrax
Kiel, Johnathan
AFRL Technology Horizons
June 2000
The Human Effectiveness Directorate of the U.S. Air Force Research Laboratory (AFRL) has designed culture techniques to rapidly isolate and identify "live" anthrax from suspected environmental release. The unique medium discriminates between closely related bacteria and non-pathogenic strains of anthrax. The medium has been developed for accelerating the growth and modifying the metabolism of anthrax bacteria and other microbes in order to rapidly determine viability and identity.

Military Praises Device That Detects Deadly Viruses
Curreri, Frank
http://www.tribaccess.com
June 24, 2000
In preliminary trials, a DNA detector created by Idaho Tech-nologies of Salt Lake City, has confirmed the presence of deadly viruses or bacteria within 15 minutes. The device uses DNA testing and RNA sequencing to rapidly detect many deadly pathogens, including anthrax and plague. The diagnostic detector comes in a 40-pound camouflaged backpack, resembles a miniature record player, and is connected to a laptop computer.

Arthur D. Little Unveils Non-Toxic Foam that Neutralizes Biological and Chemical Weapons
Puleo, Steve
Arthur D. Little News Release
June 29, 2000
Arthur D. Little has created a non-toxic, non-hazardous foam that neutralizes chemical and biological (CB) agents. The decontamination foam is intended for use at emergency or disaster sites by first responders. Sarin and Anthrax are among the many CB agents this foam is designed to neutralize.

Sandia chem-bio decon foam licensed to Modec
Kalamanka, Brian
Sandia News Release
July 20, 2000
Sandia National Laboratories has announced that its foam for the rapid decontamination of chemical and biological (CB) warfare agents has been licensed to Modec Inc. The Sandia formulation neutralizes both chemical and biological agents and can begin decontaminating a disaster scene even before a specific contaminant has been identified. The Sandia foam can be deployed as a foam, mist, liquid, spray or fog. It is nontoxic, noncorrosive and environmentally friendly.

Scientists Decipher Structure of Toxin Responsible for Botulism
Brookhaven National Laboratory
http://www.sciencedaily.com/releaes/2000/08/000801075333.html
August 1, 2000
Clostridium botulinum bacteria are among the deadliest toxins known to humankind and, now, scientists at Brookhaven National Laboratory have deciphered the structure on one of the toxins and learned the mechanism of binding to the nerve cells it attacks. Detailed knowledge of the toxin's mechanism of action allows for the possible design of a vaccine to prevent the toxin from attaching. Detailed knowledge of binding could also enhance the use of the toxin in several therapeutic applications.

New Technology Will Revolutionize Medical Responses to Chemical and Biological Terrorism
Poser, Stephanie
http://www.usnewswire.com/topnews/Current_Releases/0817110.html
August 17,2000
C2 Multimedia has released a DVD-ROM entitled, "Chemical, Biological & Radiological Defense Management Interactive Multimedia Training Product," that will provide diagnosis exposures to chemical and biological agents in the field and treatment procedures. This program will be available to doctors in the field on laptop computers.

Army Asks For Help In Setting Acute Nerve gas Exposure Limits
Ember, Lois
Chemical & Engineering News
August 21, 2000
The U.S. Army is responsible for the disposal of the U.S. stockpiles of chemical weapons by 2007. Incineration is the method the Army has chosen to dispose of the stockpiles. However, with this disposal method there is a possibility of accidental releases to the environment, so the Army has asked a federal advisory committee to set short-term exposure limits for the inadvertent releases of six nerve agents. The initial stages for the development of the acute exposure guidelines levels (AEGLs) are being addressed by the 30-member National Advisory Committee for Acute Exposure Guideline Levels. The AEGLs are not regulations but rather parameters for safe short-term exposure limits for the general population. The AEGLs are being determined for tabun (GA), Sarin (GB), Soman (GD), and VX. The AEGLs have already been established for mustard gas.

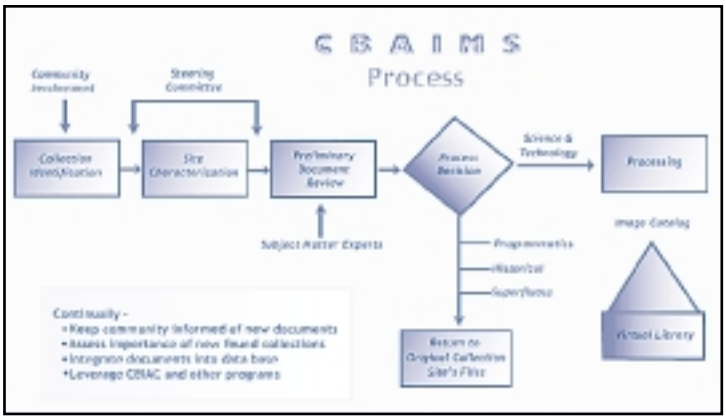
UCSD Chemists Develop Portable Nerve Gas Sensor
McDonald, Kim
http://ucsdnews.ucsd.edu/newsrel/science/mcnerve.html
August 21, 2000
Chemists at the University of California, San Diego used a silicon chip and parts from a CD player to develop a portable device capable of detecting G-type nerve agents, such as sarin, soman and GF. The silicon sensor works by selectively detecting compounds with a phosphorus-fluorine chemical bond at very low concentrations. The key to the detection is the small laser that measures the small changes in intensity of light reflecting from the optical coating on the surface of the silicon chip. The size and low-cost feature potentially makes it possible to deploy handfuls of sensors. Additionally, since the laser is capable of recording the accumulation of hydrogen fluoride molecules on the silicon chip's surface, the sensor can also be used as a dosimeter.

CBIAC MISSION SUCCESS STORIES

By James M. King, Ph.D.

Chemical and Biological Archival Information Management System (CBAIMS)

The Chemical and Biological Archival Information Management System (CBAIMS) is a Defense Threat Reduction Agency sponsored effort. The objective of CBAIMS is to consolidate Chemical and Biological Defense (CBD) archival information into a single database and virtual repository. This database and repository will be available to the entire CBD community. CBAIMS will produce a range of benefits for the CBD community. It will enable the CBIAC to provide real time support to warfighters twenty-four hours per day, seven days per week anywhere in the world. CBAIMS will also accelerate delivery of mission-critical resources throughout the CBD community. Because it will be a single virtual repository for CBD information, CBAIMS will reduce the programmatic risk associated with CBD research and development efforts.



CBAIMS will reduce cost to research and development efforts by eliminating unnecessary duplication of previous efforts, while reducing the cost to maintain CBD information resources by ensuring that they are consolidated for ready access.

CBAIMS will fully define and characterize all existing CBD collections to meet the objectives of the Program. Major CBD information repositories and data systems are currently being worked under this program: the CBIAC, the West Desert Technical Information Center at Dugway Proving Ground, the Soldier and Biological Chemical Command (SBCCOM) Technical Library and SBCCOM Historical Office collection, the U.S. Army Chemical School collection, the U.S. Air Force CBD collection at Wright Patterson, AFB, the Naval Research Laboratory, and the National Archives.

Joint Service General Purpose Mask (JSGPM)

The CBIAC supported the Edgewood Chemical Biological Center (ECBC), U.S. Army Soldier and Biological Chemical Command (SBCCOM) in developing a novel filtration system for the Joint Service General Purpose Mask (JSGPM). The JSGPM is to be the next generation protective mask for many warfighter applications. The development goals set for the JSGPM pushed the technological envelope for protective masks and filter media.

The CBIAC's contributions focused on the physiological burden imposed on the warfighter wearing the mask by the airflow resistance of the filtration system intended for the JSGPM while maintaining the necessary high standards of user protection against chemical and biological agents.

The CBIAC's program developed and demonstrated an innovative filter system that employed electret media in order to provide excellent aerosol filtration in a low profile, lightweight package. The CBIAC's filter media also provided greater than a 50 percent reduction in breathing resistance. The filter technology developed under this CBIAC effort has been selected for implementation in the JSPGM program.

For more details about CBAIMS and the JSGPM, or to read more IAC mission success stories, visit the IAC Mission Success Stories feature of the DTIC website at http://iac.dtic.mil/mss/!

Chemical and Biological Defense

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