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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Chemical and Biological Defense Program **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE							
0400: <i>Research, Development, Test & Evaluation, Defense-Wide</i>				PE 0601384BP: <i>CHEMICAL/BIOLOGICAL DEFENSE (BASIC RESEARCH)</i>							
BA 1: <i>Basic Research</i>											
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	63.796	49.508	52.617	-	52.617	54.573	57.573	55.650	65.937	Continuing	Continuing
CB1: <i>CHEMICAL/BIOLOGICAL DEFENSE (BASIC RESEARCH)</i>	33.630	31.041	-	-	-	-	-	-	-	0.000	64.671
CI1: <i>CONGRESSIONAL INTEREST ITEMS (BASIC RESEARCH)</i>	7.968	-	-	-	-	-	-	-	-	0.000	7.968
IS1: <i>CHEM/BIOLO DEFENSE - INFORMATION SCIENCES (BASIC RESEARCH)</i>	-	-	2.259	-	2.259	2.382	2.433	2.478	2.900	Continuing	Continuing
LF1: <i>CHEMICAL/BIOLOGICAL DEFENSE - LIFE SCIENCES (BASIC RESEARCH)</i>	-	-	24.838	-	24.838	25.197	26.751	27.246	30.906	Continuing	Continuing
PS1: <i>CHEM/BIO DEFENSE - PHYSICAL SCIENCES (BASIC RESEARCH)</i>	-	-	18.064	-	18.064	18.055	19.455	19.816	23.200	Continuing	Continuing
TB1: <i>MEDICAL BIOLOGICAL DEFENSE (BASIC RESEARCH)</i>	15.246	14.352	7.456	-	7.456	8.939	8.934	6.110	8.931	Continuing	Continuing
TC1: <i>MEDICAL CHEMICAL DEFENSE (BASIC RESEARCH)</i>	6.027	3.144	-	-	-	-	-	-	-	0.000	9.171
TR1: <i>MEDICAL RADIOLOGICAL DEFENSE (BASIC RESEARCH)</i>	0.925	0.971	-	-	-	-	-	-	-	0.000	1.896

A. Mission Description and Budget Item Justification

This program element funds the Joint Service basic research program for Chemical, Biological, and Radiological (CBR) defense. The objective of the basic research program is to advance fundamental knowledge and understanding of the sciences with an emphasis in exploring new and innovative research for combating or countering chemical, biological and radiological weapons. Moreover, basic research supports a Joint Force concept of a lethal, integrated, supportable, highly mobile force with enhanced capability by the individual service member. Specifically, the program promotes theoretical and experimental research and studies in the physical, life and information sciences. A portion of this program element directly supports basic research efforts for the transformational medical technologies program. The work in this program element is consistent with the Chemical Biological Defense Program Research, Development and Acquisition (RDA) Plan. Basic research technological breakthroughs support applied research (PE 0602384BP) activities. Basic research activities described in this budget justification leverage existing research programs and activities within the DoD and other government agencies and promotes cross-pollination between government and academia, as well as

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0400: <i>Research, Development, Test & Evaluation, Defense-Wide</i>	PE 0601384BP: <i>CHEMICAL/BIOLOGICAL DEFENSE (BASIC RESEARCH)</i>
BA 1: <i>Basic Research</i>	

sponsors world class scientists. The projects in this PE are placed in BA1, because they are basic research efforts directed towards non-specific or non-unique military applications. The project names within this BA are changing in FY12 to reflect the research areas of Information Science (IS1), Life Science (LF1), and Physical Science (PS1), but retained is TB1, Transformational Medical Technologies. The projects of CB1, TC1, TR1, will no longer be used after FY11.

B. Program Change Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	78.764	49.508	52.024	-	52.024
Current President's Budget	63.796	49.508	52.617	-	52.617
Total Adjustments	-14.968	-	0.593	-	0.593
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-1.796	-			
• SBIR/STTR Transfer	-0.963	-			
• Other Adjustments	-12.209	-	0.593	-	0.593

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: CI1: CONGRESSIONAL INTEREST ITEMS (BASIC RESEARCH)

Congressional Add: *In Vitro Models for Biodefense Vaccine*

Congressional Add: *Synchotron Beamline and Experimental Station*

Congressional Add: *Detection and Remediation of Bio/Chemical Weapons Programs*

Congressional Add: *Real Time Test Monitoring of Chemical Agents, Chemical Agent Stimulants and Toxic Industrial Chemicals (TICs)*

Congressional Add Subtotals for Project: CI1

Congressional Add Totals for all Projects

	FY 2010	FY 2011
	1.484	-
	3.217	-
	1.992	-
	1.275	-
Congressional Add Subtotals for Project: CI1	7.968	-
Congressional Add Totals for all Projects	7.968	-

Change Summary Explanation

Funding: FY10 - Realignment of Congressional Adds to correct Budget Activity/Program Element (-\$12,068K CI1; -\$52K CB1); Program realignments to support CBDP and DoD program initiatives (-\$1,209K CB1; +\$624K TC1; -\$1,211K TB1; -\$89K TR1); SBIR Transfer (-\$584K CB1; -\$270K TB1; -\$93K TC1; -\$16K TR1).

FY12 - Adjustments less than 10% of total program.

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0400: <i>Research, Development, Test & Evaluation, Defense-Wide</i> BA 1: <i>Basic Research</i>	PE 0601384BP: <i>CHEMICAL/BIOLOGICAL DEFENSE (BASIC RESEARCH)</i>

Schedule: N/A

Technical: N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Chemical and Biological Defense Program **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE				PROJECT			
0400: <i>Research, Development, Test & Evaluation, Defense-Wide</i> BA 1: <i>Basic Research</i>				PE 0601384BP: <i>CHEMICAL/BIOLOGICAL DEFENSE (BASIC RESEARCH)</i>				CB1: <i>CHEMICAL/BIOLOGICAL DEFENSE (BASIC RESEARCH)</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
CB1: <i>CHEMICAL/BIOLOGICAL DEFENSE (BASIC RESEARCH)</i>	33.630	31.041	-	-	-	-	-	-	-	0.000	64.671

A. Mission Description and Budget Item Justification

This project (CB1) supports basic research efforts in fundamental science phenomenology to include: life sciences; physical sciences; environmental sciences; mathematics; psychology and social sciences; and engineering. The objective of the Basic Research program is to successfully support the advancement of fundamental knowledge and understanding of the sciences with an emphasis on exploring new and innovative research for Chemical and Biological (CB) Defense. It includes new study areas, such as: nanoscale sciences; chemical, biological, and bio-inspired sciences; surface and signature sciences (with an emphasis on non-traditional agents (NTAs); and information sciences. The aim is to promote innovative concepts and directions of research, which could lead to transformational capabilities to enhance the performance and ensure the safety of the Warfighter. Research in nanoscale sciences (nanoelectromechanical systems, molecular motors, and nanometer imaging) may bring about improvements in protection, decontamination and other core CB defense fields. Research in chemical, biological, and bio-inspired sciences includes research in concepts such as synthetic biology, biomimetics, and other emerging areas of science to build a foundation for developing novel smart materials. This will combine multiple functionalities into a common autonomous unit or network. Surface and signature sciences focuses on the study of physical and chemical properties, especially with regard to NTAs, that seek to improve physical capabilities such as detection and decontamination. Informational Sciences includes research in understanding cognitive and physiological effects on human decision-making, behavior and performance, and modeling and simulation of CB threats. Breakthroughs and advances in functional capabilities gained from these scientific disciplines could impact the entire chemical and biological defense science and technology program. Basic research activities described in this budget justification leverage existing research programs and activities within the DoD and other government agencies to accelerate transformational breakthroughs, which may be transitioned to applied research or advanced development initiatives. Due to the exploratory, academic, and theoretical nature of basic research efforts, projects described in this justification typically have a duration period, from conception to completion, of three to five years. Promising basic research efforts will be further exploited for their application to chemical and biological defense in Budget Activity 2 (Applied Science). The basic research program promotes cross-pollination between government and academia, as well as sponsors world class scientists while promoting the development of young researchers.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
<p>Title: 1) Basic Research Core</p> <p>Description: Chemical, Biological, and Bio-Inspired Science: Focuses on discovering fundamental phenomena that could impact chemical and biological defense. In FY12, all Chemical, Biological, and Bio-Inspired Science efforts are re-aligned to a new project within BA1 - Life Sciences Basic Research (LF1).</p> <p>FY 2010 Accomplishments: Continued research to investigate new hybrid nanomaterials that bridge nanoparticle and metallic surfaces to make biological interfaces, allowing for improved understanding of cellular reactions and responses to chemical and biological agents. Continued to characterize new mechanisms of reaction for these new materials. Began developing novel tools to investigate cells and</p>	10.982	8.341	-

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APPROPRIATION/BUDGET ACTIVITY 0400: <i>Research, Development, Test & Evaluation, Defense-Wide</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601384BP: <i>CHEMICAL/BIOLOGICAL DEFENSE (BASIC RESEARCH)</i>	PROJECT CB1: <i>CHEMICAL/BIOLOGICAL DEFENSE (BASIC RESEARCH)</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<p>cell mechanisms. Characterized NTA toxicokinetic properties and mechanisms of toxicity for NTAs. Assessed effectiveness of developmental general purpose decontaminants and explored new formulations. Maintained visibility of relevant research which could be leveraged for the benefit of chemical and biological defense.</p> <p>FY 2011 Plans: Continue developing novel tools to investigate cells and cell mechanisms. Continue to investigate and leverage developments in bioscience, bio-inspired science, and chemical sciences to support and improve fundamental scientific understanding. Leverage and merge developments with other basic research areas such as information sciences and surface and signature sciences. Initiate efforts in response to identified science gaps.</p>				
<p>Title: 2) Basic Research Core</p> <p>Description: Information Science: Leverages new developments in information and computation to impact modeling and other chemical and biological defense efforts. In FY12, all Information Science efforts are re-aligned to a new project within BA1 - Information Sciences Basic Research (IS1).</p> <p>FY 2010 Accomplishments: Initiated efforts to investigate genetic algorithms. Sought to understand cognitive effects of heightened sensory input. Conducted research that drew from many disciplines, including: cognitive psychology; neuroscience; linguistics; medical sciences; and will leverage advances in physics, mathematics, biology, and other relevant sciences to improve informational and decision making tools.</p> <p>FY 2011 Plans: Continue investigating genetic algorithms and studying effects of heightened sensory input during chemical biological warfare events. Utilize efforts in information sciences to inform other areas of core chemical and biological defense programs, such as modeling and computational efforts.</p>		5.694	6.000	-
<p>Title: 3) Basic Research Core</p> <p>Description: Surface and Signature Sciences: The study of physical and chemical properties that seeks to improve physical capabilities, such as, detection and decontamination. In FY12, all Surface and Signature Sciences efforts are re-aligned to a new project within BA1 - Physical Sciences Basic Research (PS1).</p> <p>FY 2010 Accomplishments: Identified and exploited novel tools to investigate surface and signature sciences to inform capability gaps in fields such as detection and decontamination. Initiated and combined the efforts that improve the phenomenology needed to protect, detect,</p>		8.225	8.000	-

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APPROPRIATION/BUDGET ACTIVITY 0400: <i>Research, Development, Test & Evaluation, Defense-Wide</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601384BP: <i>CHEMICAL/BIOLOGICAL DEFENSE (BASIC RESEARCH)</i>	PROJECT CB1: <i>CHEMICAL/BIOLOGICAL DEFENSE (BASIC RESEARCH)</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
decontaminate, or otherwise counter chemical (to include NTAs) and biological threats. Studied interactions of chemical and biological agents with biological and environmental matrices. FY 2011 Plans: Continue studying interactions of chemical and biological agents with biological and environmental matrices, and develop novel tools to investigate surface and signature sciences to address capability gaps. Study signature sciences and surface interactions.			
Title: 4) Basic Research Core Description: Nano-Scale Sciences: Improve understanding of nano-scale materials (scale of 1-100 nanometers in length) for use in chemical and biological defense. In FY12, all Nano-Scale Science efforts are re-aligned to a new project within BA1 - Physical Sciences Basic Research (PS1). FY 2010 Accomplishments: Completed study of selected compounds which mimic biological organisms and nano-scale sensing technologies for identification of agents. Continued investigations into new textiles with a higher resistance to oily substances or with adjustable porosity. Continued studying systems found in nature as part of a broad effort for creative solutions for future protection concepts. Completed initial exploration of interfaces between nanomaterials and living cells. Investigated new concepts in nano-scale chemical and biological sensing/detection. Initiated new studies to develop nano-scaled porous materials. Identified/leveraged state-of-the-art breakthroughs to fill capability gaps. FY 2011 Plans: Complete projects originating in FY09, including new textiles with a higher resistance to oily substances or with adjustable porosity efforts. Study interfaces between nano-materials and living cells, and study systems found in nature for creative solutions for future protection concepts. Advancements made in nano-scale sciences may apply to and be leveraged by other basic research areas such as biosciences and bio-inspired sciences, surface and signature science, informational science, and threat agent science (TAS) activities funded in Budget Activity 2.	8.729	8.700	-
Accomplishments/Planned Programs Subtotals	33.630	31.041	-

C. Other Program Funding Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
• CB2: <i>CHEMICAL BIOLOGICAL DEFENSE (APPLIED RESEARCH)</i>	110.937	88.897	97.774		97.774	94.721	89.677	90.823	108.941	Continuing	Continuing

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APPROPRIATION/BUDGET ACTIVITY 0400: <i>Research, Development, Test & Evaluation, Defense-Wide</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601384BP: <i>CHEMICAL/BIOLOGICAL DEFENSE (BASIC RESEARCH)</i>	PROJECT CB1: <i>CHEMICAL/BIOLOGICAL DEFENSE (BASIC RESEARCH)</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u> <u>Base</u>	<u>FY 2012</u> <u>OCO</u>	<u>FY 2012</u> <u>Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• CB3: <i>CHEMICAL BIOLOGICAL DEFENSE (ATD)</i>	26.964	15.410	23.818		23.818	30.514	37.806	38.139	38.586	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

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APPROPRIATION/BUDGET ACTIVITY 0400: <i>Research, Development, Test & Evaluation, Defense-Wide</i> BA 1: <i>Basic Research</i>				R-1 ITEM NOMENCLATURE PE 0601384BP: <i>CHEMICAL/BIOLOGICAL DEFENSE (BASIC RESEARCH)</i>				PROJECT C11: <i>CONGRESSIONAL INTEREST ITEMS (BASIC RESEARCH)</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
C11: <i>CONGRESSIONAL INTEREST ITEMS (BASIC RESEARCH)</i>	7.968	-	-	-	-	-	-	-	-	0.000	7.968

A. Mission Description and Budget Item Justification

The efforts listed in this project include congressional interest programs for FY10.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011
Congressional Add: In Vitro Models for Biodefense Vaccine FY 2010 Accomplishments: Developed improved vaccines to be used in the field to protect and save the lives of soldiers who might be exposed to airborne pathogens such as anthrax.	1.484	-
Congressional Add: Synchotron Beamline and Experimental Station FY 2010 Accomplishments: Built an experimental end-station at National Synchotron Light Source-II for the purpose of conducting basic research on the structure and processes of pathogens, toxins and their antidotes. Conducted research efforts on biological agents most likely to be used against our military by bioterrorists, including Staphylococcal Enterotoxin B and anthrax to determine the molecular structures of toxins, viruses, and bacteria.	3.217	-
Congressional Add: Detection and Remediation of Bio/Chemical Weapons Programs FY 2010 Accomplishments: Developed detection capability for chemical agents and chemical neutralization methods.	1.992	-
Congressional Add: Real Time Test Monitoring of Chemical Agents, Chemical Agent Stimulants and Toxic Industrial Chemicals (TICs) FY 2010 Accomplishments: Conducted a study on a semi-conducting metal oxide (SMO) nano-cluster array, within a standalone prototype footprint, to understand the array's ability to withstand outdoor operation while reliably and predictably detecting, identifying, and quantifying target TICs in real-time.	1.275	-
Congressional Adds Subtotals	7.968	-

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APPROPRIATION/BUDGET ACTIVITY 0400: <i>Research, Development, Test & Evaluation, Defense-Wide</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601384BP: <i>CHEMICAL/BIOLOGICAL DEFENSE (BASIC RESEARCH)</i>	PROJECT C11: <i>CONGRESSIONAL INTEREST ITEMS (BASIC RESEARCH)</i>

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u> <u>Base</u>	<u>FY 2012</u> <u>OCO</u>	<u>FY 2012</u> <u>Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• C12: <i>CONGRESSIONAL INTEREST ITEMS (APPLIED RESEARCH)</i>	27.186	0.000	0.000		0.000	0.000	0.000	0.000	0.000	0.000	27.186
• C13: <i>CONGRESSIONAL INTEREST ITEMS (ATD)</i>	30.172	0.000	0.000		0.000	0.000	0.000	0.000	0.000	0.000	30.172

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

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APPROPRIATION/BUDGET ACTIVITY 0400: <i>Research, Development, Test & Evaluation, Defense-Wide</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601384BP: <i>CHEMICAL/BIOLOGICAL DEFENSE (BASIC RESEARCH)</i>	PROJECT IS1: <i>CHEM/BIOLO DEFENSE - INFORMATION SCIENCES (BASIC RESEARCH)</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
IS1: <i>CHEM/BIOLO DEFENSE - INFORMATION SCIENCES (BASIC RESEARCH)</i>	-	-	2.259	-	2.259	2.382	2.433	2.478	2.900	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project (IS1) advances fundamental knowledge in mathematics, modeling and bioinformatics. Research efforts include exploration of macro- and micro-scale meteorological effects on CB agent transport and dispersion that can lead to new and improved algorithms for hazard prediction and new CB decision support tools; and computational algorithm development of biological processes that can lead to new or improved medical countermeasures.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
Title: 1) Information Sciences Basic Research	-	-	2.259
Description: Information Science Basic Research focuses on advancing knowledge of in silico modeling techniques for both physical and physiological environments to enable a greater understanding of CB threats.			
FY 2012 Plans: Develop quantitative computational models for metabolic networks of pathogens which include interactions with host cell environments. Use computational models to identify interactions that are candidate targets for medical countermeasures.			
Accomplishments/Planned Programs Subtotals	-	-	2.259

C. Other Program Funding Summary (\$ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
<i>LF1: CHEMICAL/BIOLOGICAL DEFENSE - LIFE SCIENCES (BASIC RESEARCH)</i>	-	-	24.838	-	24.838	25.197	26.751	27.246	30.906	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project (LF1) supports research efforts in fundamental science phenomenology in microbiology, biochemistry, pathogenic mechanisms, cell and molecular biology, and immunology that are investigating molecular signatures, mechanisms of action, recognition, catalysis, and biomimetics. Efforts in Life Sciences Basic Research include innovative biotechnology approaches with potential application for rapidly identifying, diagnosing, preventing, and treating disease resulting from exposure to biological or chemical agents, or from radiological exposure; biological and bio-inspired science addressing concepts such as synthetic biology, biomimetics; and other emerging areas of science to build a foundation for developing novel materials. Ultimately, knowledge gained through research in this area supports the development of medical and physical countermeasures against biological or chemical agents in areas such as diagnostics, detection, biosurveillance, protection (both physical and vaccine) and therapeutic intervention.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
<p>Title: 1) Life Sciences Basic Research</p> <p>Description: Life Sciences Basic Research focuses on fundamental efforts to investigate molecular signatures, mechanisms of action, recognition, catalysis and biomimetics, as well as agent interactions and evolution.</p> <p>FY 2012 Plans: Elucidate interactions between biological (bacterial, viral or toxin) or chemical agents and their host and host cells to understand mechanisms of pathogenesis and/or protective immunity. Examine polymicrobial interactions that may impact the growth of biological agents and/or their course of disease. Investigate immunological and physiological bases for tolerance to, or protection against, organophosphorous agents. Characterize the host response to ionizing radiation and mechanisms of injury. Study the evolution of viral and bacterial families at the genomic and phenotypic levels and characterize molecular signatures of virulence and/or manipulation in the laboratory (e.g., genetic modification and culturing.) Explore the mechanisms by which viruses modulate virulence and target host species. Understand mechanisms behind the functionality of biological systems. Explore novel techniques for the design and synthesis of biomimetic reagents for affinity and reactivity.</p>	-	-	24.838
Accomplishments/Planned Programs Subtotals	-	-	24.838

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C. Other Program Funding Summary (\$ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

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0400: <i>Research, Development, Test & Evaluation, Defense-Wide</i> BA 1: <i>Basic Research</i>				PE 0601384BP: <i>CHEMICAL/BIOLOGICAL DEFENSE (BASIC RESEARCH)</i>				PS1: <i>CHEM/BIO DEFENSE - PHYSICAL SCIENCES (BASIC RESEARCH)</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
PS1: <i>CHEM/BIO DEFENSE - PHYSICAL SCIENCES (BASIC RESEARCH)</i>	-	-	18.064	-	18.064	18.055	19.455	19.816	23.200	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project (PS1) advances fundamental scientific knowledge in physical science areas that include chemistry, physics, materials science, environmental sciences, and nanotechnology that could potentially lead to transformational CB defensive capabilities enhancing Warfighter performance and safety. Research results in physics, chemistry and materials sciences have potential application in point and standoff detection, as well as protection and decontamination. Surface and environmental sciences focus on the study of physical and chemical properties and phenomena of interactions, especially with regard to Non Traditional Agents (NTAs), that seek to improve capabilities such as detection, protection, and decontamination. Research in nanotechnology and nanoscale sciences, such as nanoelectromechanical systems, molecular motors, nanomechanical resonance sensing, and nanometer imaging, has potential application across CB capability areas to provide significant enhancement by, for example, decreasing detection response times, increasing medical countermeasure effectiveness against a wider array of threat agents, and providing currently unavailable modalities like detection imbedded in fabrics.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
<p>Title: 1) Physical Sciences Basic Research</p> <p>Description: Physical Sciences Basic Research focuses on fundamental scientific phenomena including chemistry, physics, materials science, environmental science, and nanotechnology.</p> <p>FY 2012 Plans: Explore improved surface and interfacial analytical methods for chemical and biological detection, particularly nanoscale chemical and biological sensing/detection, with the goal of more sensitive and selective recognition of molecular or surface interaction signatures. Investigate advances in materials science that might ultimately contribute to enhanced protection and improved detection capabilities. Initiate studies in the design, synthesis, and fundamental understanding of novel materials for improved filtration and decontamination of chemical or biological threats. Initiate studies in spectroscopic methods, novel detection approaches, and materials science for detecting chemical or biological threats on surfaces. Initiate studies to improve fundamental understanding of fluidic behavior at the nanoscale, as well as new spectra for potentially improved point detection capabilities. Explore how computational chemistry and physics, including theoretical predictions of optical and THz signatures, might contribute to improved analytical methods and materials science.</p>	-	-	18.064
Accomplishments/Planned Programs Subtotals	-	-	18.064

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APPROPRIATION/BUDGET ACTIVITY 0400: <i>Research, Development, Test & Evaluation, Defense-Wide</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601384BP: <i>CHEMICAL/BIOLOGICAL DEFENSE (BASIC RESEARCH)</i>	PROJECT PS1: <i>CHEM/BIO DEFENSE - PHYSICAL SCIENCES (BASIC RESEARCH)</i>

C. Other Program Funding Summary (\$ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Chemical and Biological Defense Program **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE				PROJECT			
0400: <i>Research, Development, Test & Evaluation, Defense-Wide</i> BA 1: <i>Basic Research</i>				PE 0601384BP: <i>CHEMICAL/BIOLOGICAL DEFENSE (BASIC RESEARCH)</i>				TB1: <i>MEDICAL BIOLOGICAL DEFENSE (BASIC RESEARCH)</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
TB1: <i>MEDICAL BIOLOGICAL DEFENSE (BASIC RESEARCH)</i>	15.246	14.352	7.456	-	7.456	8.939	8.934	6.110	8.931	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project (TB1) funds basic research of vaccines, diagnostic tools, and therapeutic drugs to provide effective medical defense against validated biological threat agents including bacteria, toxins, and viruses. Advance innovative biotechnology approaches with the potential to rapidly identify, diagnose, prevent, and treat disease due to exposure to biological threat agents. This project supports core science efforts that may be applied to biological defense capability areas, such as Pretreatments, Diagnostics, and Therapeutics. Starting in FY10, all efforts were combined into a single capability area called Biological Based Basic Research.

This project also includes efforts such as the Transformational Medical Technologies Initiative (TMTI). Effective FY12 this effort is funded as the Transformational Medical Technologies (TMT) Program. The program was launched to respond to the threat of emerging or intentionally bioengineered biological threats. TMT's mission is to protect the Warfighter from genetically engineered biological threats by providing a rapid response capability from identification of pathogens to the delivery of medical countermeasures. This mission is accomplished through two main efforts: 1) developing broad spectrum (multi-agent) therapeutics against biological warfare (BW) agents (e.g. one drug that treats multiple agents); and 2) developing platform technologies to assist in the rapid development of medical countermeasures (MCMs) in response to BW agents (e.g. developing new and innovative ways to mass produce drugs in the event of a biological incident). Through FY11 TB1 funded all ChemBio Medical Biological Basic Research efforts. Beginning in FY12, this project focuses solely on basic research in support of TMT.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
Title: 1) Biological Based Basic Research	8.151	8.899	-
Description: Research to understand biological agents of interest, their pathways, virulence, immunization factors and identification. In FY12, all Biological Based Basic Research efforts are realigned to Life Sciences Basic Research (LF1).			
FY 2010 Accomplishments: Determined mechanisms of pathogenesis for viral and bacterial biothreat agents and toxins. Defined immune responses and mechanisms that confer protection against biothreat agents. Identified novel and/or shared antigens from viral and bacterial threat agents to be used in the design of future vaccine formulations. Determined the contribution of post-translational modification of Botulinum Neurotoxin (BoNT) to the intracellular biology of the toxin. Determined advanced pharmacokinetic models of BoNT intoxication to define the therapeutic window of opportunity.			
FY 2011 Plans: Conduct studies of pathogenic mechanisms for viral and bacterial biothreat agents and toxins. Clarify mechanisms of host-pathogen interaction to identify mechanisms of pathogenesis and/or correlates of protective immunity against biothreat agents. Define novel and/or shared antigens from viral and bacterial threat agents to be used in the design of future treatment options.			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Chemical and Biological Defense Program		DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 0400: <i>Research, Development, Test & Evaluation, Defense-Wide</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601384BP: <i>CHEMICAL/BIOLOGICAL DEFENSE (BASIC RESEARCH)</i>	PROJECT TB1: <i>MEDICAL BIOLOGICAL DEFENSE (BASIC RESEARCH)</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
Define the contribution of post-translational modification to the structure and biology of BoNT. Research novel constructs for affinity reagents for the identification of biological warfare agents and biomarkers.				
<p>Title: 2) Transformational Medical Technologies Initiative</p> <p>Description: Multiagent (Broad Spectrum) Medical Countermeasures: Basic research efforts focused on the early drug discovery phase of MCM development for biological threat agents. The goal is to identify and develop brand new compounds that could lead to successful therapeutic candidates. Projects will review scientific findings and assess a foundation for characterizing new therapeutics, use computer simulation or other virtual platforms to test hypotheses and begin research, data collection, and analysis to test hypotheses to explore alternative concepts, identify and evaluate critical technologies and components, and begin characterization of MCM candidates.</p> <p>FY 2010 Accomplishments: Initiated support for the discovery of conserved host and pathogen directed targets for the development of broad spectrum drugs against BW agents. Validated computer models and other methodologies for rational drug design. Initiated investigation of technological advancements in genetic sequencing and drugs based on protein-to-protein interactions. All successful and promising efforts will transition to BA2 during FY11.</p>		5.258	-	-
<p>Title: 3) Transformational Medical Technologies Initiative</p> <p>Description: Platform Technologies are standalone enabling technologies that support MCM development and when strategically aligned, provide a system of systems response capability to an adverse biological event - from the identification of an unknown pathogen to the development of an approved countermeasure ready for delivery to the Warfighter and the nation. The enabling technologies are divided into five platform areas: Pathogen Characterization, Target Identification, Countermeasure Discovery, Countermeasure Evaluation, and Bioinformatics.</p> <p>FY 2010 Accomplishments: Initiated the development of host and pathogen based platforms, such as cell, animal and computer models to describe and predict drug interactions during treatment for BW agent exposure. Initiated projects to generate animal models to characterize BW agent disease and to compare human and animal model responses to infection for use in live biological agent testing. Explored pathogen identification and characterization capabilities, which included genetic sequencing and integration of existing capabilities. Assessed future sequence and analysis needs to characterize advance threats. Determined bioinformatics infrastructure needs.</p> <p>FY 2011 Plans:</p>		1.837	5.453	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Chemical and Biological Defense Program **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 0400: <i>Research, Development, Test & Evaluation, Defense-Wide</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601384BP: <i>CHEMICAL/BIOLOGICAL DEFENSE (BASIC RESEARCH)</i>	PROJECT TB1: <i>MEDICAL BIOLOGICAL DEFENSE (BASIC RESEARCH)</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
Continue to investigate new drug-based platforms which may be able to generate families of broad spectrum drugs to protect against bio-threat agents. Develop components to evaluate which technologies are appropriate for each aspect of the countermeasure development. Continue to support discovery of conserved host and pathogen directed targets for the development of broad spectrum drugs against BW agents. Continue to develop leading edge technologies to assist in pathogen characterization, target identification, countermeasure discovery and countermeasure evaluation.			
Title: 4) Transformational Medical Technologies Description: Platform Technologies are standalone enabling technologies that support MCM development and when strategically aligned, provide a system of systems response capability to an adverse biological event - from the identification of an unknown pathogen to the development of an approved countermeasure ready for delivery to the Warfighter and the nation. The enabling technologies are divided into five platform areas: Pathogen Characterization, Target Identification, Countermeasure Discovery, Countermeasure Evaluation, and Bioinformatics. FY 2012 Plans: Continue efforts previously funded under the Transformational Medical Technologies Initiative. Continue to increase investment in the exploration of genetic approaches to describe host susceptibility to infectious disease and immune response. Investigate alternatives to animal models using markers of virulence, and therapeutic toxicity and efficacy. Assess developments in technologies for formulation and delivery of MCMs.	-	-	7.456
Accomplishments/Planned Programs Subtotals	15.246	14.352	7.456

C. Other Program Funding Summary (\$ in Millions)											
Line Item	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
• TB2: <i>MEDICAL BIOLOGICAL DEFENSE (APPLIED RESEARCH)</i>	54.858	43.858	84.747		84.747	85.493	76.011	52.527	75.583	Continuing	Continuing
• TB3: <i>MEDICAL BIOLOGICAL DEFENSE (ATD)</i>	196.007	115.233	172.636		172.636	180.913	167.900	149.413	148.398	Continuing	Continuing

D. Acquisition Strategy
N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Chemical and Biological Defense Program		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 0400: <i>Research, Development, Test & Evaluation, Defense-Wide</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601384BP: <i>CHEMICAL/BIOLOGICAL DEFENSE (BASIC RESEARCH)</i>	PROJECT TB1: <i>MEDICAL BIOLOGICAL DEFENSE (BASIC RESEARCH)</i>

E. Performance Metrics

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Chemical and Biological Defense Program **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE				PROJECT			
0400: <i>Research, Development, Test & Evaluation, Defense-Wide</i> BA 1: <i>Basic Research</i>				PE 0601384BP: <i>CHEMICAL/BIOLOGICAL DEFENSE (BASIC RESEARCH)</i>				TC1: <i>MEDICAL CHEMICAL DEFENSE (BASIC RESEARCH)</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
TC1: <i>MEDICAL CHEMICAL DEFENSE (BASIC RESEARCH)</i>	6.027	3.144	-	-	-	-	-	-	-	0.000	9.171

A. Mission Description and Budget Item Justification

This project (TC1) emphasizes the understanding of the basic action mechanisms of nerve, blister, blood, and respiratory agents within the body. Basic studies are performed to delineate biological mechanisms for identified and emerging chemical threats to generate required information for initial design and synthesis of chemical medical countermeasures. Starting in FY10, all efforts were combined into a new capability area termed Chemical Based Basic Research.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
<p>Title: 1) Chemical Based Basic Research (CBBR)</p> <p>Description: Research focuses on understanding chemical agents, their mechanism of action, toxicity, cellular injury, and identification. In FY12, all Chemical Based Basic Research efforts are re-aligned to a new project within BA1 - Life Sciences Basic Research (LF1).</p> <p>FY 2010 Accomplishments: Investigated new tissue engineering technologies to reduce reliance on skin grafts. Assessed the results of genotoxicity studies. Researched mechanisms of action of nerve agents and therapeutic interventions using whole animal models, with a focus on data required to support FDA submissions. Initiated research into the development for novel nerve agent therapeutics with reduced impact on visual performance. Initiated development of new animal models to characterize in vivo effects of Non-Traditional Agent (NTAs). Demonstrated the biological equivalency of NTA toxicity mechanisms across relevant species.</p> <p>FY 2011 Plans: Research pathways of molecular mechanisms of injury associated with chemical warfare agents. Conduct mechanistic studies using appropriate in vitro models to identify the biochemical cascade of effects following chemical agent exposure. Based on these studies, generate basic information for initial design and synthesis of medical countermeasures, located in Budget Activity 2, Project TC2.</p>	6.027	3.144	-
Accomplishments/Planned Programs Subtotals	6.027	3.144	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Chemical and Biological Defense Program		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 0400: <i>Research, Development, Test & Evaluation, Defense-Wide</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601384BP: <i>CHEMICAL/BIOLOGICAL DEFENSE (BASIC RESEARCH)</i>	PROJECT TC1: <i>MEDICAL CHEMICAL DEFENSE (BASIC RESEARCH)</i>

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u> <u>Base</u>	<u>FY 2012</u> <u>OCO</u>	<u>FY 2012</u> <u>Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• TC2: <i>MEDICAL CHEMICAL DEFENSE (APPLIED RESEARCH)</i>	38.644	33.648	36.546		36.546	36.993	37.789	38.163	39.395	Continuing	Continuing
• TC3: <i>MEDICAL CHEMICAL DEFENSE (ATD)</i>	28.046	29.134	21.582		21.582	21.900	22.695	23.193	23.919	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Chemical and Biological Defense Program **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 0400: <i>Research, Development, Test & Evaluation, Defense-Wide</i> BA 1: <i>Basic Research</i>				R-1 ITEM NOMENCLATURE PE 0601384BP: <i>CHEMICAL/BIOLOGICAL DEFENSE (BASIC RESEARCH)</i>				PROJECT TR1: <i>MEDICAL RADIOLOGICAL DEFENSE (BASIC RESEARCH)</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
TR1: <i>MEDICAL RADIOLOGICAL DEFENSE (BASIC RESEARCH)</i>	0.925	0.971	-	-	-	-	-	-	-	0.000	1.896

A. Mission Description and Budget Item Justification

This project (TR1) emphasizes the research and study of medical countermeasures to protect the Warfighter against radiation exposure. Specifically, this project identifies the basic action mechanisms of Acute Radiation Syndrome (ARS) and Delayed Effects of Acute Radiation Exposure (DEARE), as well as, develops possible radioprotectants (Pretreatments), post-irradiation exposure treatments (Therapeutics), and the ability to identify exposure to radiation (Diagnostics). These Basic Research efforts advance promising technology with the potential to rapidly identify, diagnose, prevent, and mitigate ARS and/or DEARE in the event of a radiological incident.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
Title: 1) Medical Radiological Defense	0.925	0.971	-
Description: Research focuses on understanding mechanisms of injury from radiation exposure. In FY12, all Medical Radiological Defense efforts are re-aligned to a new project with BA1 - Life Sciences Basic Research (LF1).			
FY 2010 Accomplishments: Initiated efforts to identify mechanisms of injury from acute radiation exposure and delayed health effects following radiation exposure. Explored novel assays to diagnose radiation injury, through studies of cellular science, metabolism, and bioregulators.			
FY 2011 Plans: Continue projects begun in FY10 to understand cellular and molecular responses to ionizing radiation and identify biomarkers of radiation exposure.			
Accomplishments/Planned Programs Subtotals	0.925	0.971	-

C. Other Program Funding Summary (\$ in Millions)

Line Item	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
• TR2: <i>MEDICAL RADIOLOGICAL DEFENSE (APPLIED RESEARCH)</i>	1.818	2.884	0.806		0.806	0.605	0.603	0.379	0.335	Continuing	Continuing
	4.086	0.957	0.000		0.000	0.200	0.200	0.434	0.484	Continuing	Continuing

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Chemical and Biological Defense Program	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 0400: <i>Research, Development, Test & Evaluation, Defense-Wide</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601384BP: <i>CHEMICAL/BIOLOGICAL DEFENSE (BASIC RESEARCH)</i>	PROJECT TR1: <i>MEDICAL RADIOLOGICAL DEFENSE (BASIC RESEARCH)</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u> <u>Base</u>	<u>FY 2012</u> <u>OCO</u>	<u>FY 2012</u> <u>Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• TR3: <i>MEDICAL RADIOLOGICAL DEFENSE (ATD)</i>											

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A