Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Chemical and Biological Defense Program	Date: February 2015
Appropriation/Budget Activity 0400: *Research, Development, Test & Evaluation, Defense-Wide* / BA 1: *Basic Research*	**R-1 Program Element (Number/Name)** PE 0601384BP / *CHEMICAL/BIOLOGICAL DEFENSE (BASIC RESEARCH)*

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
Total Program Element	-	50.738	48.261	46.261	-	46.261	45.364	44.854	44.302	47.239	Continuing	Continuing
LF1: *CHEMICAL/BIOLOGICAL DEFENSE - LIFE SCIENCES (BASIC RESEARCH)*	-	34.623	31.727	28.588	-	28.588	29.744	28.606	28.215	31.043	Continuing	Continuing
PS1: *CHEM/BIO DEFENSE - PHYSICAL SCIENCES (BASIC RESEARCH)*	-	16.115	16.534	17.673	-	17.673	15.620	16.248	16.087	16.196	Continuing	Continuing

A. Mission Description and Budget Item Justification

Advances fundamental knowledge and promotes theoretical and experimental research in life and physical sciences.

The Projects within this BA reflect the research areas of Life Sciences(LF1) (e.g. microbiology, biochemistry, pathogenic mechanisms, cell and molecular biology, immunology, and information science) which focus on fundamental efforts to understand living systems' response to biological or chemical agents, to support detection, diagnostics, protection, and medical treatment.

The projects within in this BA also include efforts in Physical Sciences (PS1) (e.g. chemistry, physics, materials science, and environmental science) which focus on fundamental scientific phenomena. These support investigation of physical and chemical properties and interactions for enhanced functionalities important to detection, protection, and decontamination. BA1 also supports Science, Technology, Engineering, and Math (STEM) efforts through the National Research Council with Post-Doctorate research associate program, a two week summer camp for high school students and teachers, and Military Internships at West Point.

The projects in this PE are placed in BA1 because they are basic research efforts directed towards non-specific or non-unique military applications. Basic research technological breakthroughs support applied research (PE 0602384BP) activities.

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B. Program Change Summary ($ in Millions)	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total
Previous President's Budget	51.426	48.261	46.832	-	46.832
Current President's Budget	50.738	48.261	46.261	-	46.261
Total Adjustments	-0.688	-	-0.571	-	-0.571
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.688	-			
• Other Adjustments	-	-	-0.571	-	-0.571

Change Summary Explanation

Funding: N/A

Schedule: N/A

Technical: N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Chemical and Biological Defense Program			Date: February 2015
Appropriation/Budget Activity 0400 / 1	R-1 Program Element (Number/Name) PE 0601384BP / *CHEMICAL/BIOLOGICAL DEFENSE (BASIC RESEARCH)*	Project (Number/Name) LF1 / *CHEMICAL/BIOLOGICAL DEFENSE - LIFE SCIENCES (BASIC RESEARCH)*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
LF1: *CHEMICAL/BIOLOGICAL DEFENSE - LIFE SCIENCES (BASIC RESEARCH)*	-	34.623	31.727	28.588	-	28.588	29.744	28.606	28.215	31.043	Continuing	Continuing

A. Mission Description and Budget Item Justification

Focuses on fundamental efforts to understand living systems' response to biological or chemical agents, to support detection, protection, diagnostics, and medical treatment.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: 1) Life Sciences	34.623	31.279	28.588

Description: Focuses on fundamental efforts to understand living systems' response to biological or chemical agents, to support detection, protection, diagnostics, and medical treatment.

FY 2014 Accomplishments:

Developed understanding of pathogens, novel threats and host responses (including human and zoonotic) to prevent/minimize host injury. Investigated and evaluated systemic biological responses following exposure of living systems to CB agents. Improved understanding of how polymicrobial interactions interfere with bacterial activities (through investigation of genetic networks) to influence discovery of novel antagonists for medical countermeasures, thus influencing response to or course of disease. Explored materials in biotic/abiotic interface and biomimetics to enable design of robust synthetic enzymes. Explored nano- and nanostructured materials as approaches to the needs of chemical and biological countermeasures, including behavior in biological systems and how morphology relates to biological interaction and function.

FY 2015 Plans:

Continue efforts to understand pathogens, novel threats and host responses (including human and zoonotic) to prevent/minimize host injury. Continue to investigate and evaluate systemic biological responses following exposure of living systems to CB agents. Improve understanding of how polymicrobial interactions interfere with bacterial activities to influence discovery of novel antagonists for medical countermeasures, thus influencing response to or course of disease. Continue to explore computational infectious models that utilize experimental data to generate mathematical models of infection and immunity. Continue exploration of approaches to enable design of robust synthetic enzymes and proteins. Continue to explore micro-, nano- and nanostructured materials as approaches to the needs of chemical and biological countermeasures, including behavior in biological systems and how morphology relates to biological interaction and function. Continue exploring functional cellular and molecular systems and integration of functionality that may provide adaptive materials and/or autonomously functioning materials and capabilities for CB defense countermeasures that sense and transduce threats. Develop understanding and means to recognize the interaction of

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
pathogens, toxicants, and novel threats with the blood-brain barrier and central nervous system. Continue consortium approach to explore the importance of bacterial persistence and antibiotic tolerance in the establishment of recurring/chronic infections such as melioidosis. Initiate evaluation of role of Gene Amplification and Duplication in the development of multiple drug resistance in bacterial pathogens. Investigate the influence of glycosylation patterns on biologic stability and pharmacologic characteristics. ***FY 2016 Plans:*** Continue efforts to understand pathogens, novel threats and host responses (including human and zoonotic) to prevent/minimize host injury. Continue to investigate and evaluate systemic biological responses following exposure of living systems to CB agents. Improve understanding of how polymicrobial interactions interfere with bacterial activities to influence discovery of novel antagonists for medical countermeasures, thus influencing response to or course of disease. Continue to explore nano- and nano-structured materials as approaches to the needs of chemical and biological countermeasures, including behavior in biological systems and how morphology relates to biological interaction and function. Continue consortium approach to explore the importance of bacterial persistence and antibiotic tolerance in the establishment of recurring/chronic infections such as melioidosis. Investigate the influence of glycosylation patterns on biologic stability and pharmacologic characteristics.			
Title: 2) SBIR/STTR ***FY 2015 Plans:*** SBIR/STTR - FY15 - Small Business Innovative Research.	-	0.448	-
Accomplishments/Planned Programs Subtotals	34.623	31.727	28.588

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
• CB2: *CHEMICAL BIOLOGICAL DEFENSE (APPLIED RESEARCH)*	44.102	54.061	52.131	-	52.131	54.321	53.348	47.020	47.407	Continuing	Continuing
• TM2: *TECHBASE MED DEFENSE (APPLIED RESEARCH)*	85.828	100.722	88.933	-	88.933	80.082	82.046	85.283	85.795	Continuing	Continuing
• CB3: *CHEMICAL BIOLOGICAL DEFENSE (ATD)*	19.317	17.722	16.062	-	16.062	16.676	15.982	15.577	15.698	Continuing	Continuing
• TM3: *TECHBASE MED DEFENSE (ATD)*	93.949	110.310	93.725	-	93.725	96.359	97.445	96.329	98.080	Continuing	Continuing

Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2016 Chemical and Biological Defense Program		Date: February 2015
Appropriation/Budget Activity 0400 / 1	**R-1 Program Element (Number/Name)** PE 0601384BP / *CHEMICAL/BIOLOGICAL DEFENSE (BASIC RESEARCH)*	**Project (Number/Name)** LF1 / *CHEMICAL/BIOLOGICAL DEFENSE - LIFE SCIENCES (BASIC RESEARCH)*

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Chemical and Biological Defense Program			Date: February 2015
Appropriation/Budget Activity 0400 / 1	R-1 Program Element (Number/Name) PE 0601384BP / *CHEMICAL/BIOLOGICAL DEFENSE (BASIC RESEARCH)*	Project (Number/Name) PS1 / *CHEM/BIO DEFENSE - PHYSICAL SCIENCES (BASIC RESEARCH)*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
PS1: *CHEM/BIO DEFENSE - PHYSICAL SCIENCES (BASIC RESEARCH)*	-	16.115	16.534	17.673	-	17.673	15.620	16.248	16.087	16.196	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, nano-mechanical resonance sensing, and nano-meter 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 2014	FY 2015	FY 2016
Title: 1) Physical Sciences	16.115	16.315	17.673
Description: Focuses on fundamental scientific phenomena including chemistry, physics, materials science, environmental science, and nanotechnology.			
FY 2014 Accomplishments: Continued exploring multifunctional material design and synthesis to identify dynamic materials that combine functionality and durability to improve CB protection by increasing protection factors and reducing physical burden. Designed and synthesized novel decontamination options that are broadly applicable to multiple chemicals or biologicals and are less harmful to equipment. Continued investigations into novel signatures and analytical methods, new separation approaches, and recognition elements to reduce logistical burden while increasing specificity to overcome limitations in current approaches to identifying and quantifying CB threats. Explored nano- and nanostructured materials as novel approaches to needs in chemical and biological countermeasures. Continued exploring integration of functionality that may provide adaptive materials and capabilities for CB defense countermeasures that sense, transduce, respond and mitigate threats.			
FY 2015 Plans: Continue exploring multifunctional material design and synthesis to identify dynamic materials that combine functionality and durability to improve CB protection by increasing protection factors and reducing physical burden. Design and synthesize novel decontamination options that are broadly applicable to multiple chemicals or biologicals and are less harmful to equipment.			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Continue investigations into novel signatures and analytical methods, new separation approaches, and recognition elements to reduce logistical burden while increasing specificity to overcome limitations in current approaches to identifying and quantifying CB threats. Continue exploration of nano- and nanostructured materials as novel approaches to needs in chemical and biological countermeasures. Continue exploring materials and integration of functionality that may provide adaptive materials and capabilities for CB defense countermeasures that bind, catalyze, sense, transduce, respond and/or mitigate threats. Investigate impact of ambient surface reactivity and structure on performance of state-of-the-art and novel CB mitigating materials. Develop understanding of chemical behavior in the environment, such as atmospheric reactivity and intra material interactions. ***FY 2016 Plans:*** Continue exploring multifunctional material design and synthesis to identify dynamic materials that combine functionality and durability to improve CB protection by increasing protection factors and reducing physical burden. Design and synthesize novel decontamination options that are broadly applicable to multiple chemicals or biologicals and are less harmful to equipment. Continue exploration of micro-, nano- and nanostructured materials as novel approaches to needs in chemical and biological countermeasures. Continue exploring materials and integration of functionality that may provide adaptive materials and capabilities for CB defense countermeasures that bind, catalyze, respond and/or mitigate threats. Continue to investigate impact of ambient surface reactivity and structure on performance of state-of-the-art and novel CB mitigating materials. Continue to develop understanding of chemical behavior in the environment, such as intra material interactions.			
Title: 2) SBIR/STTR ***FY 2015 Plans:*** SBIR/STTR - FY15 - Small Business Innovative Research.	-	0.219	-
Accomplishments/Planned Programs Subtotals	16.115	16.534	17.673

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
• CB2: *CHEMICAL BIOLOGICAL DEFENSE (APPLIED RESEARCH)*	44.102	54.061	52.131	-	52.131	54.321	53.348	47.020	47.407	Continuing	Continuing
• CB3: *CHEMICAL BIOLOGICAL DEFENSE (ATD)*	19.317	17.722	16.062	-	16.062	16.676	15.982	15.577	15.698	Continuing	Continuing

Remarks

D. Acquisition Strategy

N/A

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E. Performance Metrics

N/A