RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)							DATE February 2005	
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-wide BA2 Applied Research				R-1 ITEM NOMENCLATURE Biological Warfare Defense PE 0602383E, R-1 # 14				
COST (In Millions)	FY 2004	FY2005	FY2006	FY2007	FY 2008	FY 2009	FY 2010	FY 2011
Total Program Element (PE) Cost	141.921	159.567	145.354	144.050	144.615	140.414	140.914	140.914
Biological Warfare Defense Program BW-01	141.921	159.567	145.354	144.050	144.615	140.414	140.914	140.914

(U) Mission Description:

(U) DARPA's Biological Warfare Defense project is budgeted in the Applied Research Budget Activity because its focus is on the underlying technologies associated with pathogen detection and remediation. This project funds programs supporting revolutionary new approaches to biological warfare (BW) defense and does not duplicate efforts of other government organizations.

(U) Efforts to counter the BW threat include developing barriers to block entry of pathogens into the human body (including unique methods for rapid air and water purification), countermeasures to stop pathogen and chemical consequence and to modulate host immune response, medical diagnostics for the most virulent pathogens and their molecular mechanisms, biological and chemically-specific sensors, advanced decontamination and neutralization techniques, and integrated defensive systems, including detection of chemical and biological agents in sealed containers at entry points of facilities. This program also includes a unique set of BW sensors that will greatly improve sensitivity while decreasing response time. Program development strategies include collaborations with pharmaceutical, biotechnology, government, and academic centers of excellence.

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(U) Program Accomplishments/Planned Programs:

	FY 2004	FY 2005	FY 2006	FY 2007
Unconventional Therapeutics	42.961	38.533	37.202	38.300

(U) This thrust is developing unique and unconventional approaches to ensure that soldiers are protected against a wide variety of naturally occurring, indigenous or engineered threats. Past successes in this effort have come from developing therapeutics that are designed to work against broad classes of pathogens. This has led to several significant transitions and a separate thrust in Accelerated Anthrax. Work in this area has also uncovered new approaches to therapeutics that, rather than attacking specific pathogens, enhance human innate immune mechanisms against broad classes of pathogens. Not only will these approaches be more effective against known pathogens, they also promise to offer substantial protection against unknown pathogens including engineered pathogens and emerging pathogens from third-world environments. Because activation of the innate immune system also provides protection from oxidative DNA and cell membrane damage, these approaches are now known to provide protection against radiation exposure in animals. This thrust is also addressing the difficulty in demonstrating the efficacy of vaccines against threats that cannot undergo human trials through the development of tools such as an artificial immune system that will provide rapid, in vitro assessments of novel countermeasures against unique DoD threat agents.

(U) Program Plans:

- Demonstrated antibacterial activity of heterobiaryl guanidines and transitioned to U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID).
- Demonstrated the use of gene shuffling to restructure enzymes, proteins and other biological agents to make them more potent and transitioned to USAMRIID and the Navy.
- Demonstrated human acetyl cholinesterase production from transgenic plants and transitioned to USAMRIID.
- Identified and developed a new, broad spectrum antibiotic for pathogens targeting CcrM DNA methyltransferases and transitioned to USAMRIID.
- Demonstrated superantigen toxin antagonist and vaccines and transitioned to USAMRIID.
- Demonstrated nonspecific immune stimulation by synthetic lipid A analogues and transitioned to USAMRIID.
- Demonstrated that molecular database construction and mining is a powerful approach to developing unconventional pathogen countermeasures.

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- Establish a common test-bed for efficacy, safety and drug metabolism in FDA validated models.
- Discover broad-spectrum therapeutics that attack fundamental and common biochemical processes in bacteria and/or viruses.
- Explore mechanisms that induce innate immunity and early protection.
- Explore mechanisms of cellular control that are used by pathogens to mask identification.
- Develop therapeutic approaches that target host biochemistry to deny a broad range of pathogens (within or across classes) the opportunity to infect and cause disease thereby radically changing the prophylactic and therapeutic approach of the DoD to protecting the warfighter in hazardous environments.
- Exploit biochemical pathways to develop protective measures against radiation exposure.
- Develop the tools necessary for in vitro fabrication of three dimensional tissue constructs, bioscaffolds and bioreactors.
- Develop and demonstrate an integrated in-vitro immune system that will emulate the human immune response in order to provide a means of evaluating new BW vaccines and therapeutics.
- Examine new approaches to dramatically accelerate the time from discovery of a pathogen to production of a therapeutic.

	FY 2004	FY 2005	FY 2006	FY 2007
Acceleration of Anthrax Therapeutics	4.000	0.000	0.000	0.000

(U) This thrust accelerated promising anthrax therapeutics (antibodies, immunostimulatory approaches and late stage treatment) into the FDA regulatory process and filed an Investigative New Drug (IND) application, which would allow the first human safety trials.

(U) Program Accomplishments:
- Demonstrated through clinical trials the efficacy of using CpG for enhancement of existing anthrax vaccine (AVA), reducing the required shot regimen from six to two.
- Demonstrated the regulation of pathogen gene expression by using DNA-binding polyamides to attack the AT rich DNA of pathogens.
- Demonstrated and brought to IND a small molecule that targets an enzyme necessary for bacterial DNA replication but that has no effect on human cell replication.
- Demonstrated and brought to an IND the use of bacteriophage enzyme specific to anthrax to lyse (disintegrate) anthrax bacteria.

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- Demonstrated and brought to an IND the use of Inhibitor of "protective antigen" that blocks the effect of anthrax toxin on a cell during the late stage of the disease.

	FY 2004	FY 2005	FY 2006	FY 2007
External Protection	6.000	11.000	15.500	17.000

(U) This program is developing and demonstrating a variety of external protection technologies to protect soldiers from the hazards of chemical, biological and radiological attack. This includes novel water purification approaches, and the detection and cleaning of surfaces contaminated by an attack.

(U) Program Plans:
- Developed, tested and transitioned to the Services a water purification pen capable of disinfecting 300 liters of non-brackish water.
- Develop new approaches for self-decontaminating surfaces that will be self-cleaning and be able to deactivate spores.
- Design, develop and demonstrate systems to detect contaminated surfaces down to the human toxicity levels, and to remove the contamination to below those levels.
- Develop and demonstrate new approaches for widespread external decontamination.

	FY 2004	FY 2005	FY 2006	FY 2007
Advanced Diagnostics	7.730	8.534	9.000	9.250

(U) In the early stages, many illnesses caused by biological warfare (BW) agents have flu-like symptoms and are indistinguishable from non-BW related diseases. Early diagnosis is key to providing effective therapy. The advanced diagnostics efforts will develop the capability to detect the presence of infection by biological threat agents, differentiate them from other pathogens (including those of non-BW origin), and identify the pathogen even in the absence of recognizable clinical signs and symptoms (i.e., while the pathogen numbers are still low). Novel approaches including the use of breath and advanced mathematical analysis will be examined.

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(U) Program Plans:

- Develop hyperspectral approaches for presymptomatic diagnosis of exposure to pathogens or other medical issues (including naturally occurring disease) that affect soldier health and performance.
- Validate and demonstrate strategies for rapidly generating new probe panel procedures and analytical tools for obtaining and measuring relevant sample types (e.g., breath, blood). Adapt advances in biosensors as appropriate.
- Evaluate and demonstrate multiplexed pathogen detection in microliter samples.
- Develop new mathematical and diagnostic approaches to interpret biosignature data from individuals to determine if there will be a change in physiological status from health to disease and vice versa. Use these data to identify the kind of disease and need for treatment.

	FY 2004	FY 2005	FY 2006	FY 2007
Sensors	42.000	48.000	48.000	48.000

(U) The sensor program goal is to develop a unique set of BW sensors that will greatly improve sensitivity and response time to bacteria, viruses and/or toxins.

(U) Handheld Isothermal Silver Standard Sensor (HISSS)

- The overall goal of DARPA's Handheld Isothermal Silver Standard Sensor (HISSS) program is to develop a sensor that is capable of detecting the entire biological warfare threat spectrum (bacteria, DNA viruses, RNA viruses and protein toxins) with the same "silver standard" specificity as current laboratory techniques, but in a fast, reliable, handheld unit. Today, this standard is achieved for DNA and RNA threats using polymerase chain reaction, which is slow because of the associated temperature cycling. For proteins, the standard is met using Enzyme Linked Immunosorbent Assay (ELISA), which requires skilled laboratory technicians to complete. The equipment required for these tests is bulky and difficult to use under field conditions. Under HISSS, DARPA will develop fundamentally new ways to exploit previously developed identification mechanisms (DNA and RNA primers, protein antibodies) in an integrated, isothermal system that will allow a single, handheld sensor to detect the full range of BW threats.

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(U) Program Plans:
- Developed isothermal assays for DNA, RNA and protein toxins and demonstrated a false-alarm rate equivalent to the current laboratory technology.
- Developed a microfluidics testbed for assay optimization and system integration.
- Demonstrated that HISSS isothermal assays have a false alarm rate that is better than the current laboratory technology.
- Develop stabilized reagents for fieldability.
- Design and build a prototype HISSS device.
- Characterize HISSS prototype in laboratory and operational environments.

(U) Triangulation Identification for Genetic Evaluation of Biological Risk (TIGER)
- Most nucleic acid based sensors search for an exact sequence match to some unique part of each pathogen. This requires a unique set of primers and probes for every target pathogen; it also means that the sensor can only determine whether that specific (portion of the) target pathogen is present. DARPA is developing a new kind of DNA-based sensor that searches out the universal parts of the genetic code and looks for species-specific variation between these regions. This TIGER sensor will enable a universal sensor for all pathogens and also holds the promise of detecting the presence of never-before-seen (bio-engineered) agents.

(U) Program Plans:
- Designed and built "gold standard" laboratory instruments for high-volume data collection of agent and background signatures.
- Developed and validated end-to-end performance model.
- Completed proof-of-concept analysis and preliminary performance prediction in clutter.
- Completed false alarm testing using complex environmental backgrounds.
- Deployed proof-of-concept prototype to USAMRIID to evaluate performance, describe behavior in operational environments, and augment signature library with live agents and emerging infectious diseases.
- Completed characterization of probability of detection and probability of false alarm performance in low- and high-background samples.
- Developed chemically modified primers to support near-neighbor discrimination, strain typing and broad-range RNA virus identification.
- Develop capability to perform phylogenetic classification of unknown or genetically modified organisms.

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- Optimize system to perform automated calibration to quantify number of organisms present in samples and allow multiplexing of primers to reduce costs.
- Transition and deploy fieldable prototype to support operational bio-protection efforts at USAMRIID and NHRC San Diego.

(U) Spectral Sensing of Bio-Aerosols (SSBA)

- Active probing of bioaerosols with electromagnetic (EM) energy holds the promise of extremely fast, and potentially long-range, detection and identification of bio agents. Only a small portion of the EM spectrum is exploited in today's trigger sensors (e.g., optically based particle sizers, sometimes enhanced with fluorescence measurements). However, anecdotal evidence suggests that other portions of the spectrum may offer substantial improvement in trigger sensors, as well as potentially agent-specific discrimination capability. Various types of spectra in the visible, infrared, and additional UV wavelengths are being measured in laboratory or early prototype systems. Additional spectral information such as UV fluorescence lifetime and single particle mass spectroscopy is also being evaluated. DARPA is investing in this approach, beginning with cross-spectrum data collection and performance models, followed by prototype sensor development. An aerosol testbed has been developed to provide calibrated exposures of threat agent simulants.

(U) Program Plans:

- Completed bioaerosol testbed and standardized data-collection protocols to allow the new sensor technologies to be challenged with both threat agent simulants and typical interferents such as diesel smoke, pollen and natural fibers.
- Investigate spectral response of chemicals unique to BW agents (e.g., picolinic acid in anthrax spores).
- Collect data, and develop performance model, for concepts that exploit a wide part of the electromagnetic (EM) spectrum (e.g., Raman scattering, terahertz spectroscopy, laser-induced breakdown spectroscopy, coherent Raman anti-Stokes spectroscopy, IR/photoacoustics, etc.).
- For sensors that can characterize and separate single particles, evaluate use of mass spectrometry for particle identification.
- Downselect to most promising concepts; design, build, and test prototype sensor.
- Characterize prototype behavior in operational environments.

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	FY 2004	FY 2005	FY 2006	FY 2007
Immune Buildings	25.030	21.000	12.500	10.000

(U) DARPA is developing technologies for integrated defensive systems to be employed in military buildings to protect and respond to the emerging threat of aerosolized Chemical, Biological and Radiological (CBR) releases. The approach is to modify and augment the infrastructure of buildings to allow them to sense and defeat an attack by bio or chem agents in real-time and to find and remove hazardous radiation left behind by a "dirty bomb." The program has three goals: to protect the human inhabitants from the effects of the agents; to restore the building to function quickly after the attack; and to preserve forensic evidence for treatment of victims, if necessary, and for attribution. For CB releases, the DARPA focus is on the challenging problem of protection from internal releases of agent, where active and timely control of airflow is required to prevent a building's HVAC system from spreading the agent throughout the building. To enable such building-protection systems, DARPA is developing component technologies such as optimized filtration systems, advanced neutralization techniques, active building coatings, and remediation techniques appropriate to biological, chemical, and radiological decontamination. In addition, DARPA is investigating the systems-level issues of integrating and optimizing such active systems, including the integration and adaptation of sensors, as well as the simulation of threat events and emergency responses. Several new chemical and biological sensors have been identified for development to address problems that are unique to the building application. Self-assembling nano-structures for building sealants will be investigated to quickly and inexpensively coat building exteriors and completely seal the building, thereby making effective the defensive strategy of sheltering in place. These efforts have used full-scale test facilities to determine the effectiveness of protection components and the optimal architectures for protection. These systems are being transitioned to a full-scale demonstration of a complete building protection system at a military installation and will also leave behind a software tool for the design and optimization of building-protection systems for other military facilities.

(U) Program Plans:

- Developed high-payoff component technologies in the areas of filtration, neutralization, and decontamination; and matured sensors for active CWA/BWA defense applications.
- Continue development of neutralization and building sealant technologies and reduced-false-alarm CW and BW sensors.
- Transitioned rapid-viability testing methods to USAMRIID and Department of Homeland Security (DHS); and decontamination techniques to Joint Program Executive Office–Chem Bio Defense (JPEO-CBD), DHS, and Environmental Protection Agency (EPA).
- Demonstrated performance of component technologies in full-scale prototypes.

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- Optimized active protection system concepts and demonstrated performance in full-scale tests.
- Integrated existing models, and developed new models when required, into a software toolkit that enables performance predictions for protective architectures for diverse building types.
- Selected a site for full-scale demonstration in an operational military building.
- Characterize the demonstration site facility and develop a prototype active protection system optimized for that site.
- Validate toolkit predictions in full-scale test beds and at demonstration site.
- Extend the software toolkit to provide cost analysis of protective system and further validate with performance and cost data from the demonstration site.
- Develop Wide-Area Radionuclide Detection (WARD) technologies to rapidly identify buildings contaminated with radioactive material and Radionuclide Capture Decontamination (RCD) technologies to rapidly remove radioactive contamination from those surfaces.
- Test WARD and RCD technologies on standardized coupons of representative building materials and demonstrate use at full scale.

	FY 2004	FY 2005	FY 2006	FY 2007
Chem Bio Defense (CBD) Portal Security	0.000	5.000	0.000	0.000

(U) There is an enormous payoff in preventing the release of biological warfare agents (BWAs) and chemical warfare agents (CWAs), rather than trying to minimize the damage they cause once released. For this reason, DARPA is investing in technologies and systems to prevent such materials from entering buildings, either in packages or mail, concealed in normal maintenance materials such as wax or paint or as an item hand-carried by a visitor. A variety of energy sources and sensors are being evaluated for their ability to penetrate package and container materials and obtain signatures for anomaly or hazard detection/identification. Novel destruction methods for BWAs are also being evaluated. In FY 2006, this program transitions to the OSD Chemical/Biological Defense Program, PE 0603384BP, Project TT3.

(U) Program Plans:

- Evaluate non-intrusive technologies for destruction of biological agents (e.g., ultrasound, variable frequency microwave and new techniques for X-Ray and gamma irradiation) and/or for the detection of chemical agents (e.g., associated particle neutron elemental analysis, tera-hertz spectroscopy, dielectric spectroscopy, and swept frequency acoustic interferometry).

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- Select the most promising approaches, and use laboratory instrumentation to evaluate collateral damage and false alarms.
- Develop performance model, and carry out system trades and develop required prototypes/components.

	FY 2004	FY 2005	FY 2006	FY 2007
Wide-Area BW Surveillance	1.000	0.000	0.000	0.000

(U) The Wide-Area Biological Warfare Agent (BWA) Surveillance program investigated BWA surveillance systems architectures for urban environments, such as military bases and transportation centers, to effectively and efficiently detect covert aerosol releases of BWA and to determine the approximate release location *before the onset of symptoms in humans*. The program studied the key architecture trades, including: the appropriate mix of stationary and mobile assets (collectors/samplers and identification sensors); the value of distributed sampling and identification (sensing) versus distributed sampling with centralized identification; the role of layered sensing, such as continuous wide-area surveillance followed by focused/targeted collects for confirmation; the importance of spatial and temporal resolution in enabling backtracking to determine release time and release location; and specialized collection and identification requirements in different environments. These trades were carried out by modeling covert releases and then analyzing the ability of various architectures (1) to detect the release quickly and (2) to geo-locate the source. The results of these studies provided much of the analytical basis for the Threat Agent Cloud Tactical Intercept and Countermeasure (TACTIC) program.

(U) Program Plans:

- Conducted trade studies of potential detection architectures in selected urbanized areas; estimate system performance, including probability of detection and false alarm rates, with realistic measures and models of background biological clutter
- Developed analytic methods to geo-locate the BWA release source based on distributed detector system response and, realistic meteorological models.

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	FY 2004	FY 2005	FY 2006	FY 2007
Threat Agent Cloud Tactical Intercept Countermeasure (TACTIC)	0.000	8.500	12.500	10.300

(U) The TACTIC Program will develop and demonstrate the capability to (1) rapidly detect, discriminate and identify an airborne chemical warfare agent/biological warfare agent (CWA/BWA) battlefield threat at stand-off distances, and (2) use countermeasures to neutralize and/or precipitate the threat before it reaches the targeted troops. This program will investigate identification methodologies including: bead-based assays for biological molecules, fluorescent assays for chemicals, retro-reflector assays for chemical and biological agents; all of which can be interrogated with stand-off optical detectors. To accomplish the removal of the threat, technologies that mimic the seeding of rain clouds will be developed for particulate bio-agents, and technologies that polymerize chemical agent vapor will be investigated. Upon successful demonstration of the identification and removal technologies, a system will be developed to demonstrate the removal of chemical and biological simulant clouds from the battlefield.

(U) Program Plans:

- Investigate technologies for CWA/BWA standoff assays that rapidly (within one minute) identify agents.
- Investigate technologies to remove the agent cloud so as to eliminate the threat to unprotected war-fighters.
- Develop models of identification and removal technologies. Carry out systems trades between competing identification and removal technologies.
- Integrate optimal identification and removal components into a prototype system.
- Test prototype system in scaled aerosol test chambers.
- Demonstrate system in full-scale field trials.

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	FY 2004	FY 2005	FY 2006	FY 2007
Mission-Adaptable Chemical Sensors (MACS)	0.750	5.500	10.652	11.200

(U) At present, chemical sensors are unable to combine sensitivity (parts-per-trillion) and selectivity (unambiguous identification of molecular species) with low false alarm rate. This effort will develop a sensor, based upon rotational spectroscopy of gases that will have superior capability in all categories; it will achieve the highest possible sensitivity (parts-per-trillion) for unambiguous detection of all chemical species. A preliminary blind test showed complete and unambiguous identification with a sampling time of one second and a false alarm probability below 0.001%. At present, the program is investigating the nature of the atmospheric background "clutter" at the parts per billion (ppb) level and below, which must be understood for identification of target signatures at highest sensitivity. The program will focus on reduction of size and simplicity of function to achieve portability and simultaneous detection of a large number (hundreds) of species. The capabilities will far surpass all other current sensors.

(U) Program Plans:

- Determine the composition of the "clutter" background of the atmosphere at ppb levels.
- Demonstrate and calibrate improved sensitivity of apparatus for selected species.
- Demonstrate fractionation and related improvements to the system for simultaneous identification of multiple species in seconds.
- Demonstrate capability for dramatic reduction in size and weight of original system, with improved detection sensitivity and selectivity.
- Demonstrate feasibility of prototype portable system for field implementation.

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	FY 2004	FY 2005	FY 2006	FY 2007
Center for Water Security	1.000	1.000	0.000	0.000

(U) Program Plans:
- Established the Center at the University Wisconsin-Milwaukee through engaging essential technical personnel, acquiring state-of-the-art instrumentation dedicated to researching new and highly effective methods of water quality sensing.
- Continued to develop the use of the new methodologies through partnerships with public and private sector agencies to address water security issues related to civilian and military needs.

	FY 2004	FY 2005	FY 2006	FY 2007
Asymmetrical Products for BWD	2.000	2.000	0.000	0.000

(U) Program Plans:
- Continue to develop a technical approach to induce mucosal immunity against BioWarfare (BW) pathogens. Model and synthesize a cytokine-based family of compounds that stimulates mucosal immunity.
- Identify likely cytokine molecules and their combinations that result in resistance to pathogens.

	FY 2004	FY 2005	FY 2006	FY 2007
Desalination Research	2.550	0.000	0.000	0.000

(U) Program Plans:
- Developed a non-traditional approach to large-scale desalination of seawater at the ocean shore near available liquid natural gas (LNG) or liquid methane storage facilities.
- Enabled the formation of gas-hydrate-purified, near-potable water ready for final polish by reduced-cost reverse osmosis processes.

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	FY 2004	FY 2005	FY 2006	FY 2007
Center for Tropical Disease Research and Training	2.000	2.800	0.000	0.000

(U) Program Plans:
- Continue to examine *Leishmania* parasites to identify both *Leishmania* and sand fly molecules that may be useful in developing a protective vaccine against leishmaniasis, a serious disease affecting soldiers returning home from Iraq.

	FY 2004	FY 2005	FY 2006	FY 2007
EluSys Heteropolymer System	1.500	0.000	0.000	0.000

(U) Program Plans:
- Explored heteropolymer-based drugs in the development of multiple therapeutic candidates for removal and destruction of pathogens, pathogenic proteins, and/or antibodies providing a potential effective treatment for a broad array of diseases.

	FY 2004	FY 2005	FY 2006	FY 2007
Hand Held Biosensors for Field Detection of Multiple Bioagents CMIM Palm Pilots	3.400	0.000	0.000	0.000

(U) Program Plans:
- Explored use of hand held biosensors for detection of bioagents.

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	FY 2004	FY 2005	FY 2006	FY 2007
New Approaches to Weaponized Infections Organisms	0.000	1.000	0.000	0.000

(U) Program Plans:
- Evaluate potential new targets for antibiotics based on enzymes.

	FY 2004	FY 2005	FY 2006	FY 2007
Noninvasive Biomodulation	0.000	2.600	0.000	0.000

(U) Program Plans:
- Demonstrate new non-invasive approaches to biomodulation.

	FY 2004	FY 2005	FY 2006	FY 2007
Antimicrobial Research Program	0.000	2.100	0.000	0.000

(U) Program Plans:
- Develop new approaches for antimicrobial compounds.

	FY 2004	FY 2005	FY 2006	FY 2007
Bioscience Center for Informatics	0.000	1.000	0.000	0.000

(U) Program Plans:
- Develop new mathematical concepts to attack large biological data sets.

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	FY 2004	FY 2005	FY 2006	FY 2007
Chemically Programmable Immunity	0.000	1.000	0.000	0.000

(U) Program Plans:
- Demonstrate the use of novel strategies to usurp the natural immune system to fight and remove pathogens.

(U) Program Change Summary: *(In Millions)*	**FY 2004**	**FY 2005**	**FY 2006**	**FY 2007**
Previous President's Budget	149.105	147.533	147.975	146.604
Current Budget	141.921	159.567	145.354	144.050
Total Adjustments	-7.184	12.034	-2.621	-2.554
Congressional program reductions	0.000	-1.466		
Congressional increases	0.000	13.500		
Reprogrammings	-1.000	0.000		
SBIR/STTR transfer	-6.184	0.000		

(U) Change Summary Explanation:

FY 2004	Decrease reflects SBIR transfer and below threshold reprogramming.
FY 2005	Increase reflects eight congressional adds for various biological warfare efforts offset by congressional undistributed reductions.
FY 2006 - 2007	Decrease reflects minor program repricing.

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(U) Other Program Funding Summary Cost:

- Not Applicable.