



# **The Rapidly Changing International Landscape for Advanced Research Technologies: Implications for Law Enforcement, National Security and Industrial Espionage**

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**Keynote Presentation at FBI Campus Liaison Initiative Conference  
Tempe, Arizona • 17 March 2010**

# **Personal Engagement with the Challenge of Terrorism, Industrial Espionage and National Security**

- **President, R&D, GlaxoSmithKline (1991-2000)**
- **Member, Defense Science Board, DoD (2000 – 2009)**
  - **Chair, Bioterrorism Task Force (2001 – 2003)**
  - **Chair, ChemBio Defense Review Panel, DTRA (2002 – 2004)**
  - **Chair, Synthetic Biology Task Force (2008 – 2009)**
- **Member, Defense Health Board, DoD (2008 – present)**
- **Member, National Academy of Sciences – Institute of Medicine Panels**
  - **Global Forum on Infectious Diseases (2003 – present)**
  - **Dual-Use Technologies and WMD Proliferation (2003 – present)**
- **Member, Council for Foreign Relations**
- **Advisory Roles to DHS and IC**

# Campus Liaison Initiative

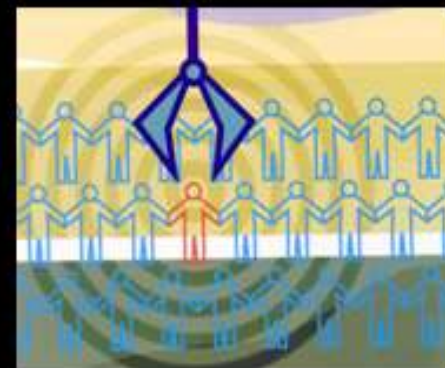
- **contacts**
- **culture**
- **cynicism**
- **compartments**
- **compliance**
- **(keeping) current**
- **convergence**
- **connecting the dots**
- **consistency**
- **credibility**

# Navigating a World of Increasingly Complex and Diverse Threats

## NEW THREATS



## NEW CAPABILITIES



## **An Unbounded Problem?**

- **No Clear Enemy**
- **No Front Line**
- **No Set Definition of Victory**

**Success is Measured by Things That “Don’t Happen”**

# New Polarities and Asymmetries

- |                                                                                 |   |                                               |
|---------------------------------------------------------------------------------|---|-----------------------------------------------|
| ● nation state adversaries                                                      | ➔ | ● non-state actors                            |
| ● geographically constrained adversaries                                        | ➔ | ● new group identities in virtualscapes       |
| ● dominant concepts of nationality                                              | ➔ | ● virtual Jihadist movement/caliphate         |
| ● formal, national governing structures for diplomacy                           | ➔ | ● autonomous cells and global terror networks |
| ● western social democratic ideologies and international legal codes of conduct | ➔ | ● theocratic fundamentalism                   |
|                                                                                 |   | ● 'no limits'                                 |





COMMISSION ON THE PREVENTION OF WEAPONS OF  
MASS DESTRUCTION PROLIFERATION AND TERRORISM

# Prevention of WMD Proliferation and Terrorism Report Card

An Assessment of the U.S. Government's Progress  
in Protecting the United States from Weapons of  
Mass Destruction Proliferation and Terrorism

January 2010

**“Each of the three last Administrations  
have been slow to recognize and respond  
to the biothreat”**

# Escalating Polarities and New Asymmetries








- geographic concentration of technological/economic/military power



- rapid diffusion of critical technologies
- rise of new economic centers



# From Small-Time to Prime-Time: Companies with #1 Global Market Share

Company	Industry	Country
	flash memories, hard disks, flat screen monitors	South Korea
	market pulp for paper products	Brazil
	synthetic fuels	South Africa
	logic semiconductors	Taiwan
	liquefied natural gas shipping	Malaysia
	natural gas	Russia
	oil pipes	Argentina

# RED STAR OVER



# IRAQ

China's ambitions in the Iraqi oil fields could change the landscape

By Stanley Reed and Dexter Roberts

**Business Week**  
2/2/10

## CHINA'S RELIANCE ON MIDEAST OIL

MILLIONS OF BARRELS PER DAY

MIDDLE EAST 1.8

AFRICA 1.1

0.1 ASIA-PACIFIC

OTHER 0.6

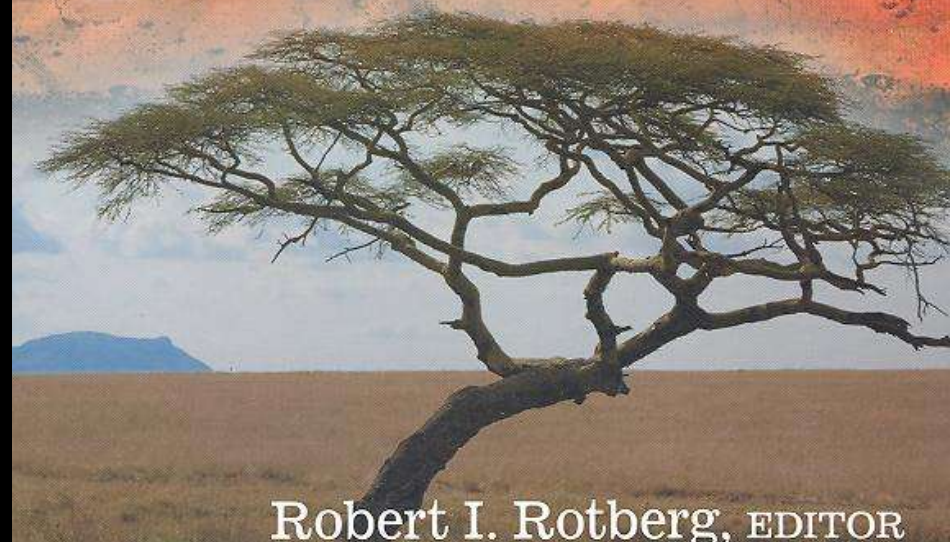
CHINA'S OIL IMPORTS BY REGION, 2008

TOTAL IMPORTS: 3.6 MILLION BARRELS A DAY

Data: Energy Information Administration, FACTS Global Energy



# CHINA INTO AFRICA

TRADE, AID, AND INFLUENCE



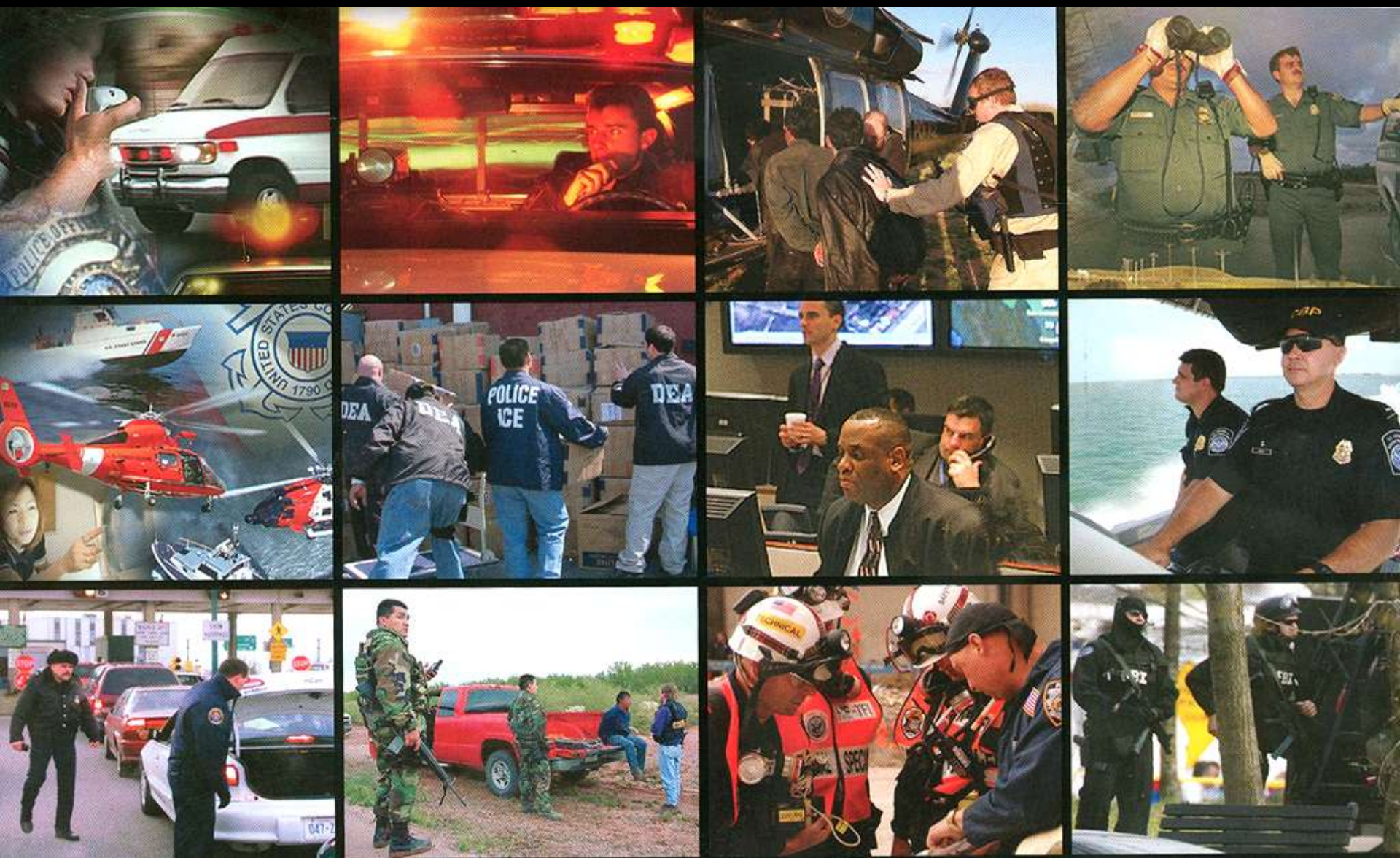
Robert I. Rotberg, EDITOR

# New Polarities and Asymmetries

- **'flat world' globalization and supply chain outsourcing** 
- **new 'blowback' vulnerabilities from supply chain choke points/trojan horses**
- **structured global trade and formal economies** 
- **parallel universe of uncharted economies of criminal capital and goods**
  - **smugglers, traffickers, counterfeiters**
  - **linkage of organized crime and terror networks**



# The Enormous Complexity and Expansion of CONUS Threat Response Capabilities



# Ubiquitous Sensing: Everything Becomes a Sensor

**Managing  
Natural Risks  
and Resources**

- **Biosecurity**

**Identification  
and Pre-emption  
of Adversarial  
Threats**

- **Military,**
- **Intelligence  
and Law  
Enforcement  
Capabilities**

**Global  
Security**

- **Socio-Cultural**
- **Economic**
- **Infrastructure**
- **Information  
Networks**



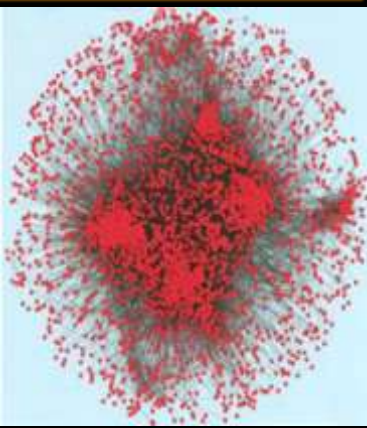
**ZONE 5: 2035-2050**

- ▲ Major nano-tech accident
- ▲ Space weather disruption to comms
- ▲ Aliens visit earth
- ▲ Return of the Messiah
- ▲ People taking trend maps too seriously

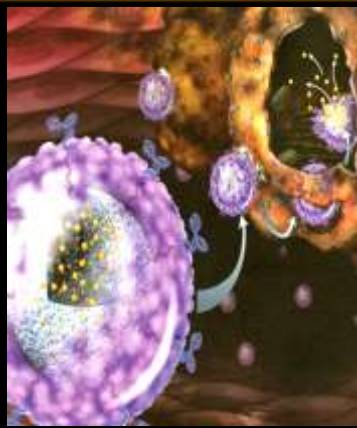


# Transcending Boundaries: Emergent Domains Arising from Technology Convergence

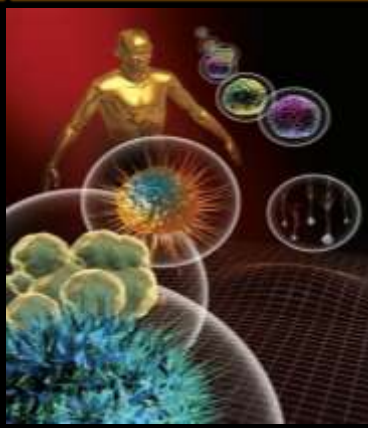
**Systems  
Biology**



**Targeted  
Rx**



**Regenerative  
Medicine**



**HPO**



**Genetic  
Identity**



**Bio-  
Enhancement**



**Bionic-  
Enhancement**



**Cognitive  
Enhancement**



**Genetic  
Enhancement**

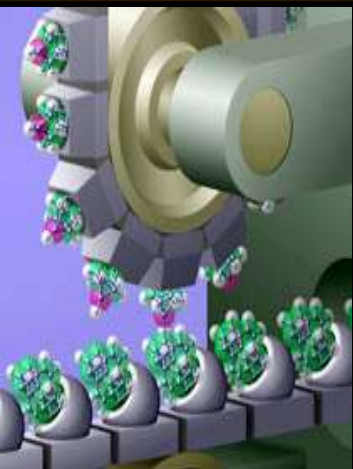


**Bio-Stratified  
Population**

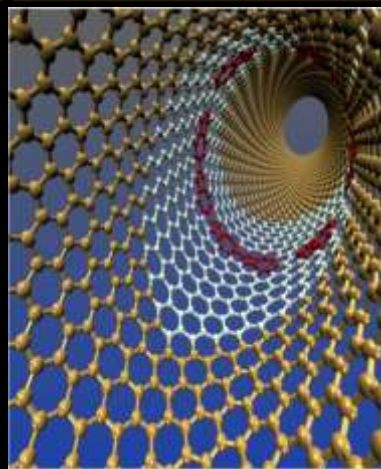




**Molecular  
Foundries**



**Novel  
Materials**



**Micro-  
Devices**



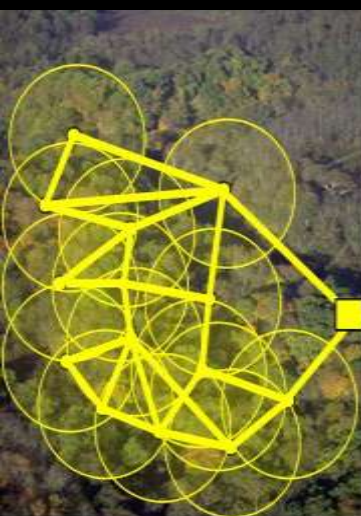
**Ubiquitous  
Sensing**



**Robotics**



**Ambient  
Intelligence**



**Digital  
Anthropology**



**Cogint**



**Intelligent  
Machines**



**Competition  
and Espionage**



**Massive Computing Power and Analytical Parsing**



# The Scale and Complex Diversity of a Major Campus



# **Intelligent Monitoring Systems for Detection of Emerging Infectious Diseases and Global Public Health**



**Emerging Infectious  
Diseases (EIDs)**



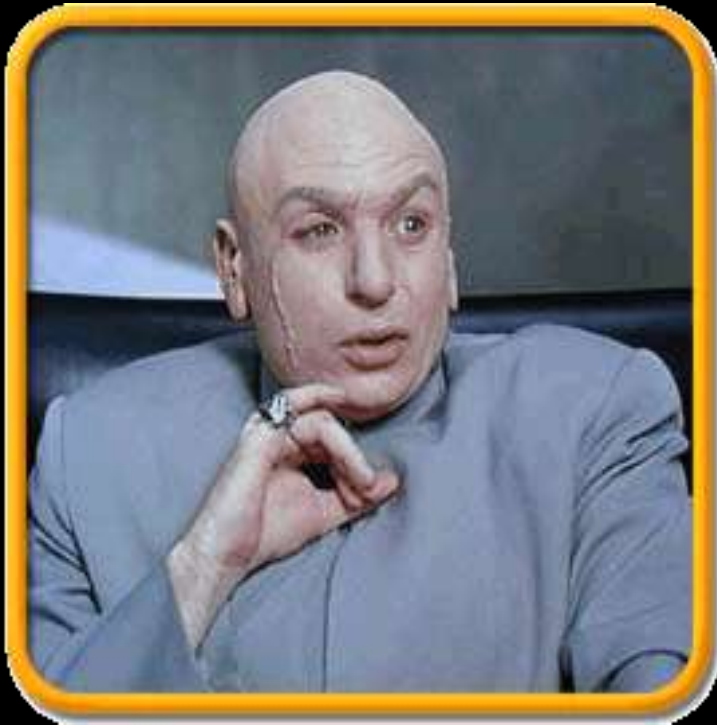
**Urbanization in  
Developing Countries**



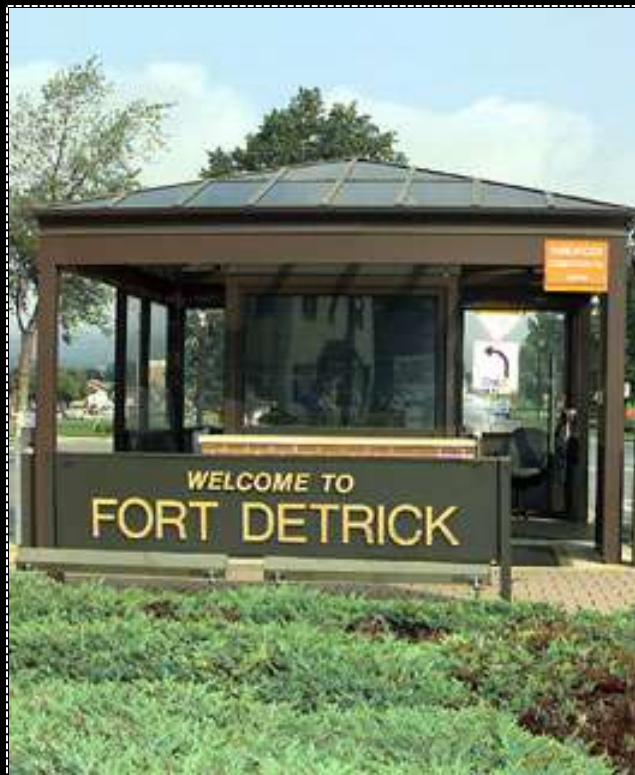
**Bioterrorism**



# Future Trajectory Trends and Threat Expansion

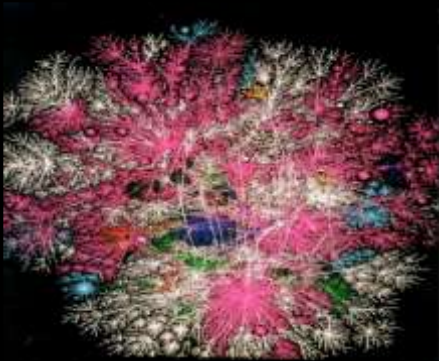


**New 'Dual-Use' Technologies**



**Executive Order: Strengthening  
Laboratory Biosecurity in  
the United States  
January 9, 2009**

# The Expanded Dimension of the CB Challenge






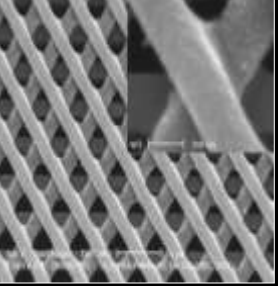








- **thinking beyond 'bio' as just infectious agents (bugs)**
- **systems biology**
  - **targeted disruption of ANY body function**
  - **novel Chem and Bio threats**
- **synthetic biology**
  - **exploring biospace: designing new life forms**
  - **designer organisms to attack materials/infrastructure**



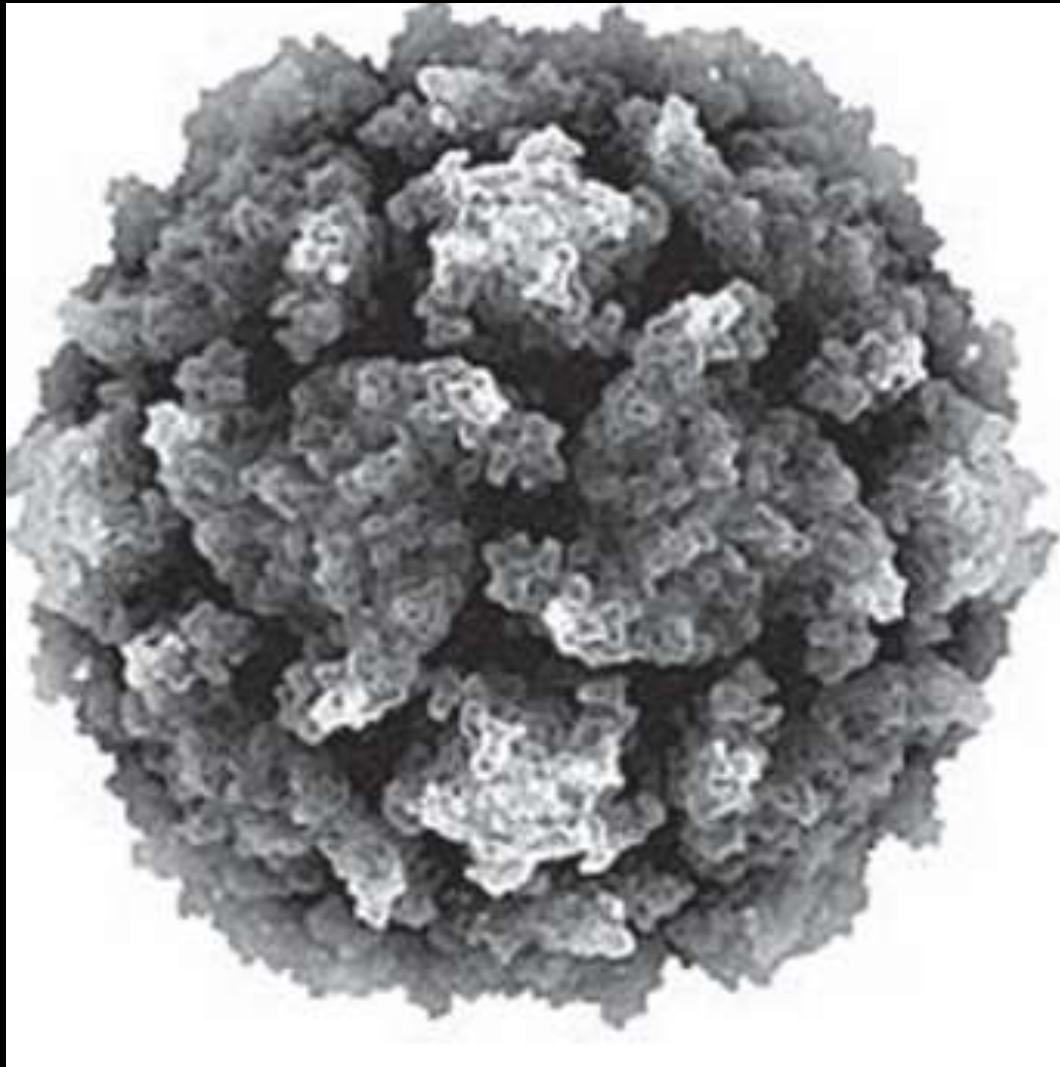
# Synthetic Biology

- emerging technology with myriad applications across diverse industrial sectors

Healthcare	Public Health	Agriculture	Functional Foods	Novel Materials	Textiles
					
					
Bioenergy and Biofuels	Industrial Enzymes	'Green' Mfg	Bio-remediation	Clean Water	Ubiquitous Sensors



**C332,652; H492, 388; N98, 245; O131, 196 P7, 501; S2,340  
(a.k.a. poliovirus)**



**ATTGACTGCAA .....(design specifications)**

# Biohackers: An Emerging Challenge



# RESPONSIBLE RESEARCH

WITH BIOLOGICAL SELECT  
AGENTS AND TOXINS



NATIONAL RESEARCH COUNCIL  
OF THE NATIONAL ACADEMIES



# **Executive Order (EO 13486) 9 January 2009**

## **“Strengthening Laboratory Biosecurity In the United States”**

- **working group reported January 2010**
- **improve agency coordination in classification, inventory, inspection process and regulations for select agents (SA)**
- **improve security risk assessment (SRA) vetting at Federal level and continuous monitoring of individuals with BSAT access**
- **physical security and transportation of BSAT materials**



dna: Deoxyribonucleic acid

bases: Adenine

Thymine

Guanine

Cytosine

structure: Double Helix

22-26 Angstroms

ACGT  
DNA





# The Infocosm: Emerging Networks of Global Connectivity



# **The Future Environment for Intelligence and National Security: A Burgeoning Infocosm and An Expanding Metaverse**

- **everything will become a reporter**
- **everything will move faster**
- **everything can go everywhere**
- **everything carries a signature**



# Its all about signatures...

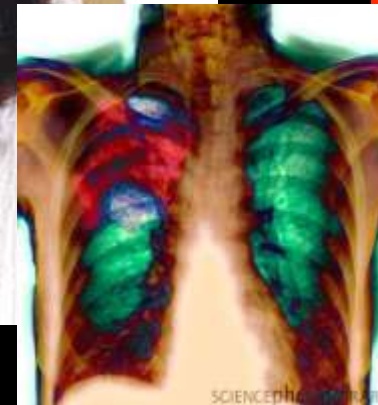
Who's been using explosives?

Is this someone I'm looking for?



Who's lying?

Who's handled a biothreat?



Who's been inoculated against an agent?

Can a biosignature tell me where someone has been and whom they interacted with?

# ...and the systems required to collect them



**Contact**



**Close-in**



**Proximate**



**Novel Tags**



**Invasive**



**Space**



**Terrestrial**



**Airborne**



# Coming To Our House





# Biometric Screening Regime

## Unknown Terrorists

*Collection of latent prints*

Provided by cooperating governments from crime scene files, arrest records

Collection during overseas intelligence exploitation and clandestine operations

Domestic law enforcement collection during arrest and from crime scenes

Defense collection from detainees and battlefield collection of latents from safehouses, weapons, and IEDs

## Known Terrorists

*Collection of 10-print sets*

## National fingerprint database (IAFIS)

*Central repository of all known terror-related latent and ten-print sets*

*Full interoperability with all relevant biometric screening systems*

Screening of detainees in theater

US-VISIT: at the border

Trusted traveler programs

Visa adjudication

Domestic law enforcement

TWIC, TWP, others ...

# Next Generation Identification (NGI)

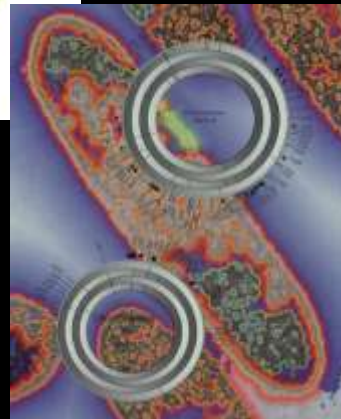
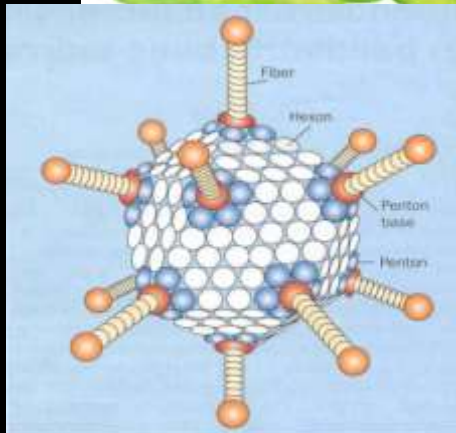
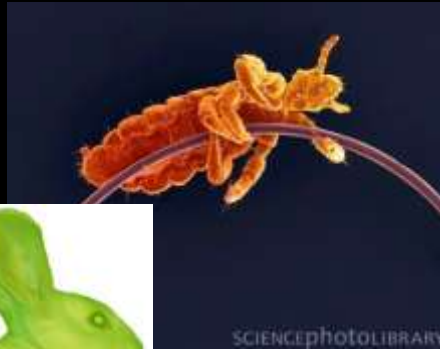
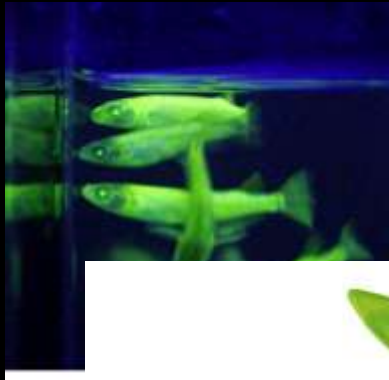
**NEXT  
GENERATION  
IDENTIFICATION**







# Commensal Microorganisms, Viruses and Parasites as Sensors and Taggants



- **engineered tag insertion into carrier organism/materials**
  - constitutive or induced expression of tag
  - activatable tags
- **variable standoff detection range**
  - magnetic, metallic, spectral tags
- **induction of biomarkers by exposure as evidence of presence in red location**

# Ubiquitous Sensing and Ambient Intelligence

- **profound national security, legal and societal implications**
- **improved supply chain logistics and industrial automation and reduced dependence on human labor**
- **foreign suppliers as simultaneous single-source and single point-of-failure/vulnerability**
- **cost of high false positive and false negative detection in early era may jeopardize public trust**
- **massively parallel sensor fusion may undermine social cohesion if incompatible with privacy and Fourth-amendment guarantees against unreasonable search**

# Cyber-Attacks and Vulnerable Infrastructure: Compromising Critical Systems



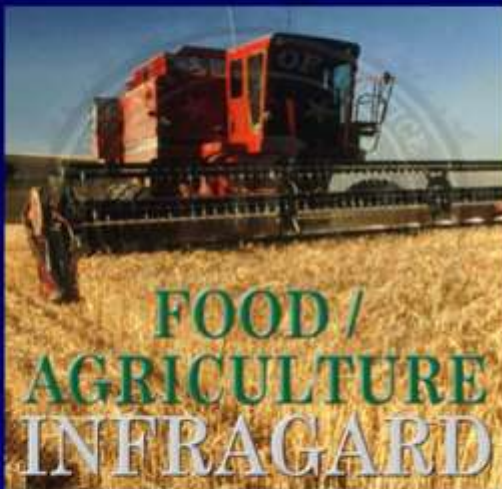




InfraGard®

a collaboration for  
infrastructure protection

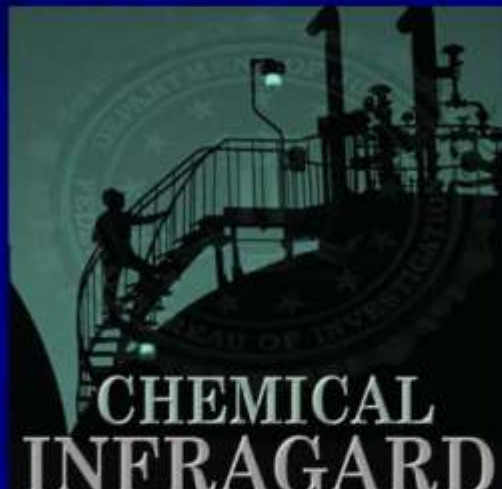
# Special Interest Groups



The Food/Agriculture InfraGard Special Interest Group (SIG) is a resource dedicated to the safeguarding of the food and agriculture sectors of both private industry and government through information-sharing networks and a private secure portal of communication. It is a collaborative effort of the Counterterrorism and Cyber Divisions of the FBI. The Food/Agriculture InfraGard SIG is intended to enhance the sharing of information among private sector stakeholders who can be called on to assist the FBI in detecting, deterring, assessing, and preventing threats and attacks targeting the food and agriculture sectors of our nation's critical infrastructures. It aims to be a consortium of agriculture security professionals and law enforcement officials with the common goal of protecting America's farmland, food products, animals, and industry.

Participation in the Food/Agriculture InfraGard SIG requires membership in the national InfraGard Program and affiliation with the agriculture industry. Visit [www.infragard.net](http://www.infragard.net) for national membership. Once a participant in the national program, a member may request access to the Food/Agriculture InfraGard SIG by submitting an e-mail containing answers to questions about his/her association with the agriculture industry.

Assessments, news, relevant links, and up-to-date information on protection issues related to the agriculture community are available to Food/Agriculture InfraGard SIG members. Members may submit articles for posting on the site, and communicate on the message board about food and agriculture sector issues in a secure environment. The site is also broken into areas specific to law enforcement, industry, food/agriculture agencies, animal/human health organizations and academia. The Food/Agriculture InfraGard SIG is a unique opportunity for you to belong to the fastest growing network dedicated to agriculture-specific information sharing, driven to protect the food and agriculture infrastructure of the United States. To belong to the Food/Agriculture InfraGard SIG, visit [www.infragard.net](http://www.infragard.net). For questions, please contact [infragardteam@infragard.org](mailto:infragardteam@infragard.org).



The Chemical InfraGard Special Interest Group (SIG) is a resource directed to the safeguarding of the chemical sector of both private industry and government through information-sharing networks and a private secure portal of communication. It is a collaborative effort of the Counterterrorism and Cyber Divisions of the FBI. The Chemical InfraGard SIG is intended to enhance the sharing of information among private sector stakeholders who may be called upon to assist the FBI in detecting, deterring, assessing, and preventing threats and attacks targeting the chemical sector of our nation's critical infrastructures. It aims to be a consortium of chemical security professionals and law enforcement officials with the common goal of protecting America's chemical plants and industry.

Participation in the Chemical InfraGard SIG requires membership in the national InfraGard Program and affiliation with the chemical industry. Visit [www.infragard.net](http://www.infragard.net) for national membership. Once a participant in the national program, a member may request access to the Chemical InfraGard SIG by submitting an e-mail containing answers to questions about his/her association with the chemical industry.

Assessments, news, relevant links, and up-to-date information on protection issues related to the chemical community are available to Chemical InfraGard SIG members. Members may submit articles for posting on the site, and communicate on the message board about chemical sector issues in a secure environment. There is also a Chemical InfraGard SIG listserv which allows SIG moderators the ability to correspond upcoming events and important announcements directly to SIG members via secure e-mail. The Chemical InfraGard SIG is a unique opportunity for you to belong to the fastest growing network dedicated to chemical-specific information sharing, driven to protect the chemical infrastructure of the United States. To belong to the Chemical InfraGard SIG, visit [www.infragard.net](http://www.infragard.net). For questions, please contact [infragardteam@infragard.org](mailto:infragardteam@infragard.org).



# Dark Visitors

## ROGUES GALLERY

### GOODWELL

Founder of the Green Army, with a membership of as many as 3,000, Goodwell is perhaps China's most famous hacker, directly or indirectly responsible for hacking countless foreign Web sites.



### WITHERED ROSE

His group, NCPH, built viruses that may have stolen classified U.S. documents. Withered Rose represented the Sichuan Military Command in a hacker competition against other provinces—and won.



**XIAO TIAN** In the male-dominated world of hacking, Xiao Tian, leader of a female hacker group called the China Girl Security Team, is a rarity. Her 2,200-plus-member group is responsible for several defacements.



## ==菜黑联盟==

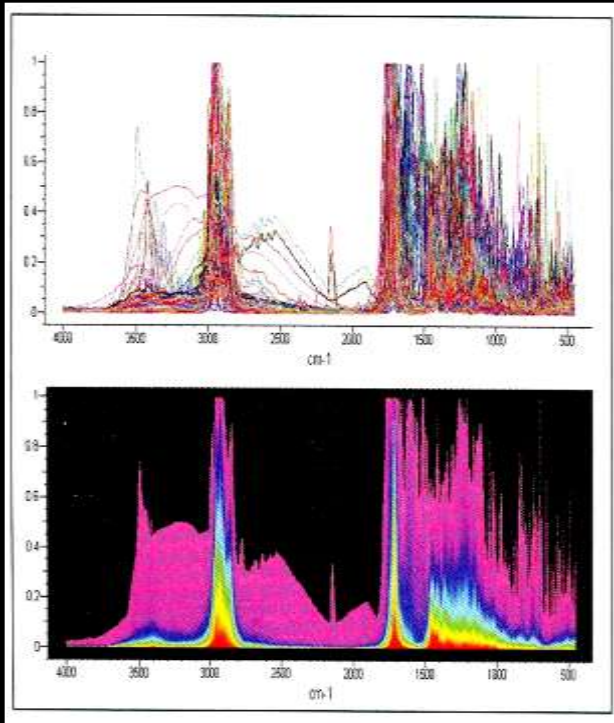
坚决反对“公投”台独，台湾是中国不可分割的一部分，任何企图将台湾从分裂中国分裂出去，阻碍海峡统一的妄想都必将覆灭！！我们只有一个中国！！！！

hack by oNe's wAr(550659)

ONE THIRD  
OF CHINESE  
ELEMENTARY-  
SCHOOL STUDENTS  
CLAIM THEY ASPIRE  
TO BE HACKERS.

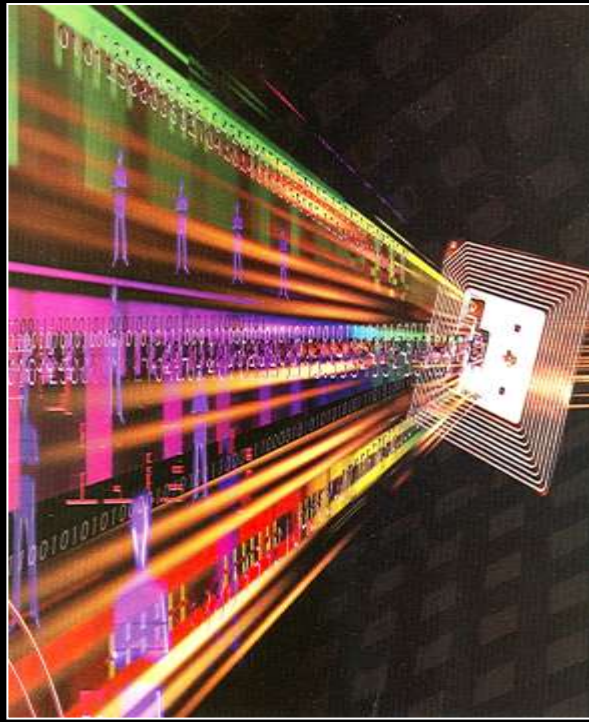


# Ubiquitous Sensing: (Ambient Intelligence) Using Very Small Things to Solve Big Problems



defining robust  
signatures

**Profile**



Complex Signal  
deconvolution and  
wireless networks

**Sense**



actionable  
information

**Act**



# “Hell is the Place Where Nothing Connects”

## T. S. Eliot



# The Fragmented Silos of USG: A Dangerous Vulnerability









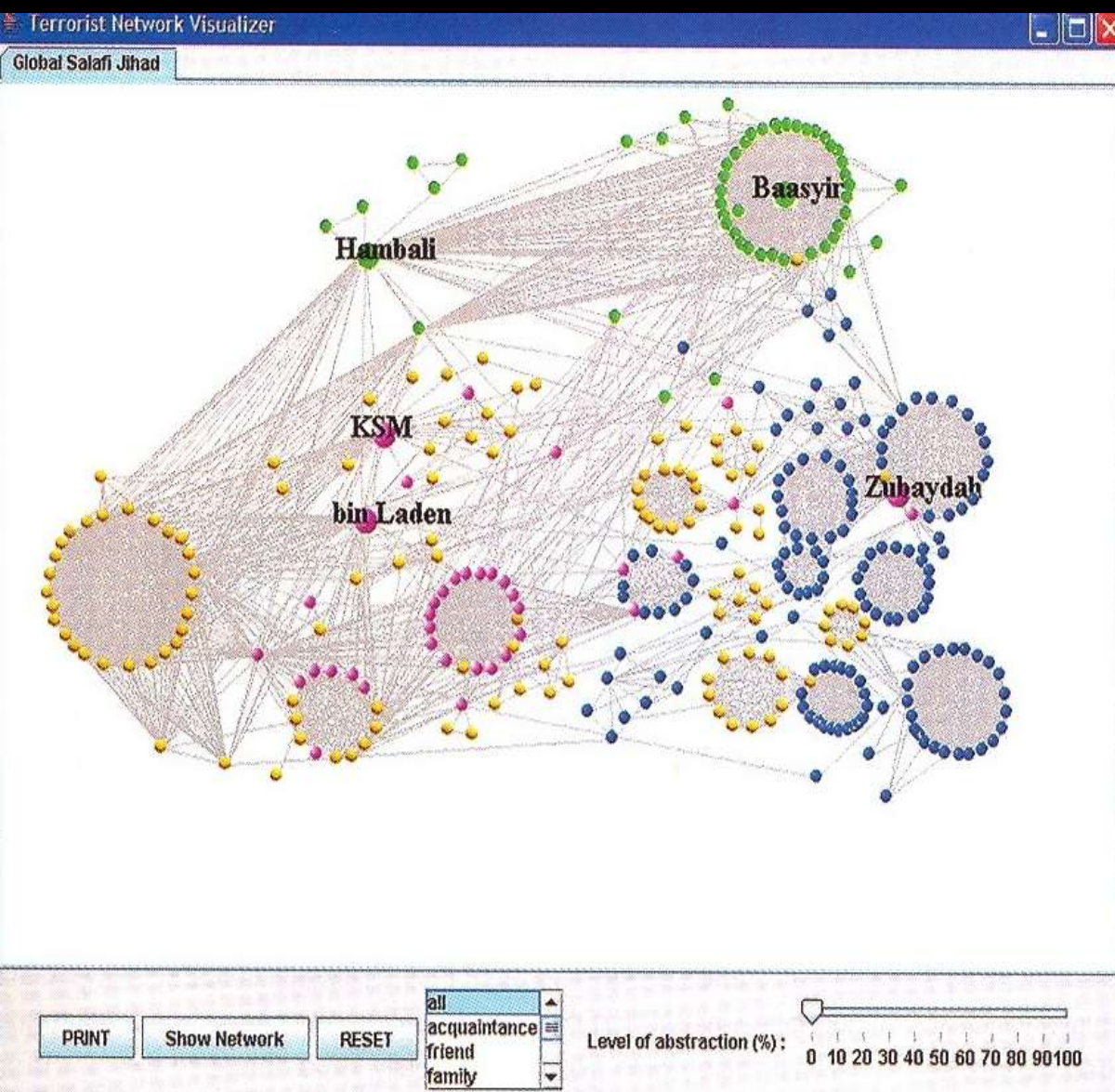
# **Great Expectations: Intelligent Monitoring Systems for Improved Analysis of National Security Threats and Their Implications**



- **dramatic expansion in ‘signatures for interest’**
- **formidable data mining and context analytics**
- **new tradecraft**
- **new open sources (OSINT)**
- **new ways to validate sources**
- **new technical competencies**
- **new knowledge integration tools**
- **new behaviors**



# Social Network Analysis of al-Qaeda Cells

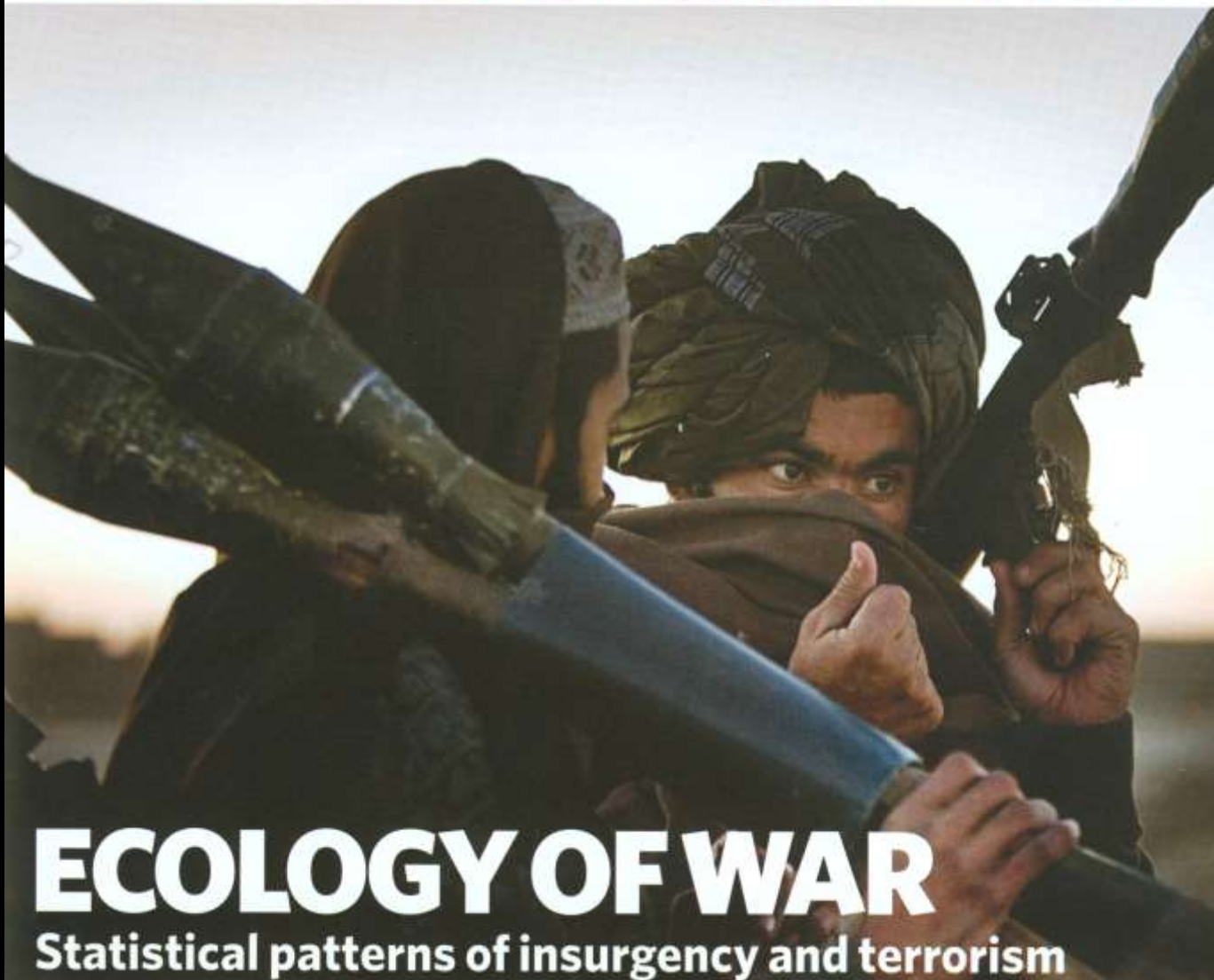




17 December 2009 | www.nature.com/nature | \$10

THE INTERNATIONAL WEEKLY JOURNAL OF SCIENCE

# nature

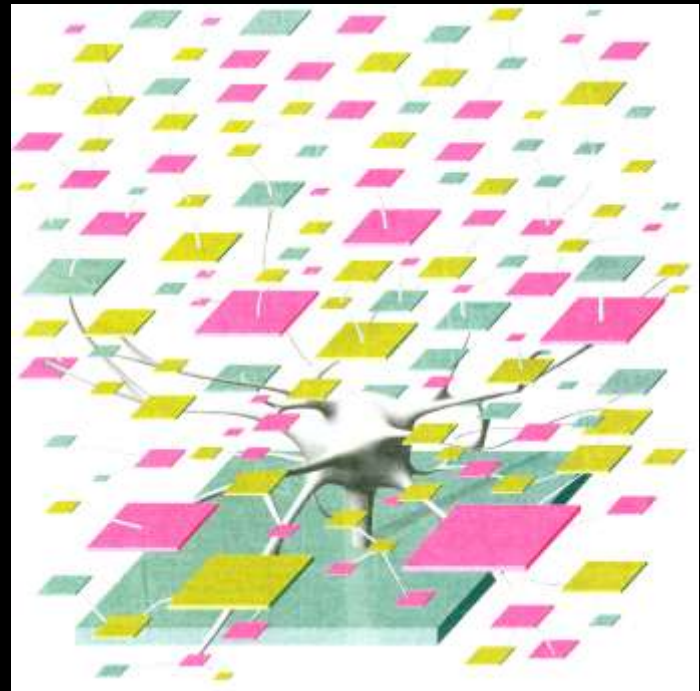


## ECOLOGY OF WAR

Statistical patterns of insurgency and terrorism



# Big SIS is Watching You



# **SIS: Societal Information Systems**

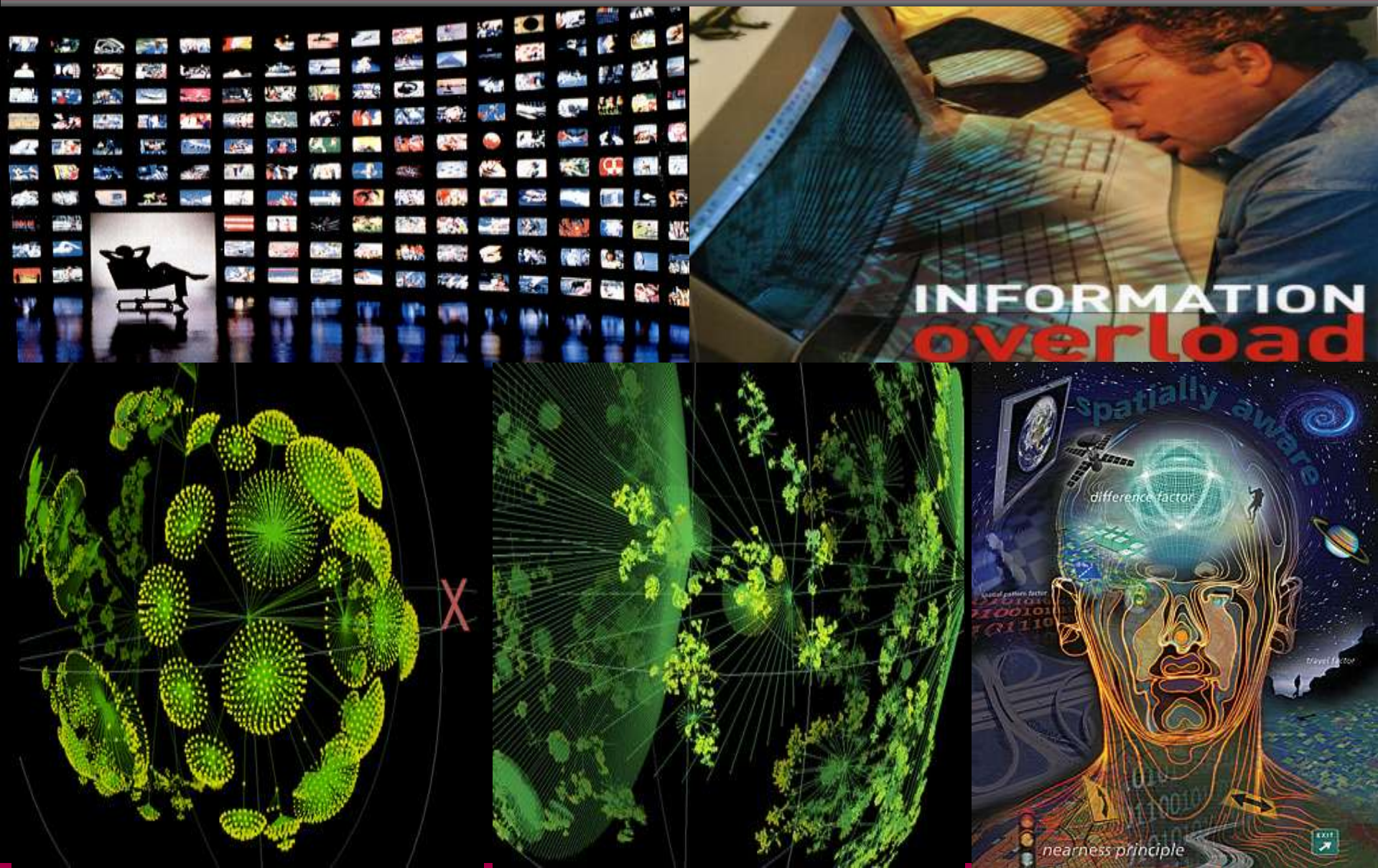
## **Ubiquitous Sensing in a Wireless World**

- **estimated 7 trillion wirelessly connected devices and objects by 2017 (c.1000/person)**
- **mobile devices and monitoring consumer habits**
  - **behavioral targeting**
  - **contextual targeting**
  - **social network profiling**
- **the politics of privacy**
  - **growing pressure for legislative oversight**
  - **US Energy and Commerce Internet Subcommittee**
  - **EU Article 29 Working Party**
- **two-thirds of new products now come with some electronic component or tracking potential**





# Enhancing Human Capabilities to Use the Increased Volume, Diversity and Complexity of Information Flows





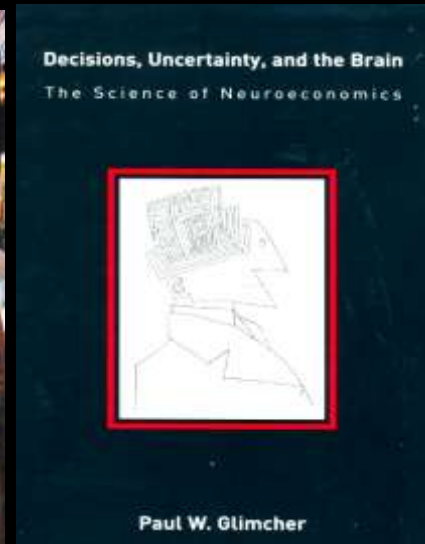
# The Neurobiology of Decision



**choice**



**risk reward**

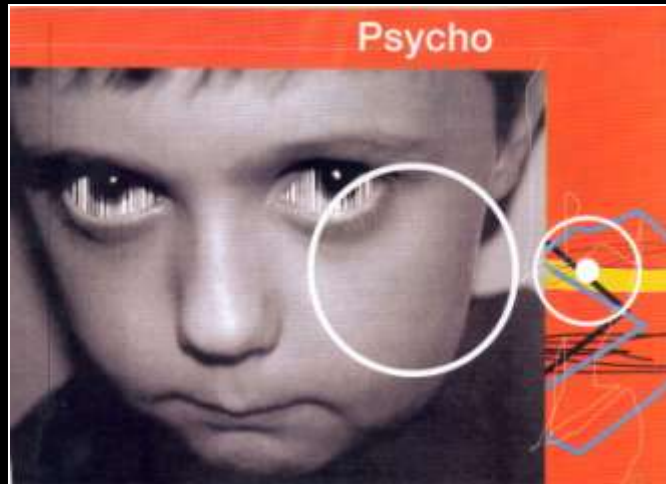


**rational (?)  
economics**



**religion**

# Behavioral Genetics: A Non-PC But Unavoidable Domain of Cognitive Neurosciences





# Getting Inside the Mind of Terrorists



**“The problem is religion.**

**Our Islamist enemies are inspired by it,  
while we are terrified to talk about it.**

**We are in the unique position of denying  
that our enemies know what  
they themselves are up to.”**

**Ralph Peters**

**J. Int. Sec. Affairs (2009) 16, 7**





# SCIENCE AND SECURITY IN A POST 9/11 WORLD

A Report Based on Regional  
Discussions Between the  
Science and Security  
Communities

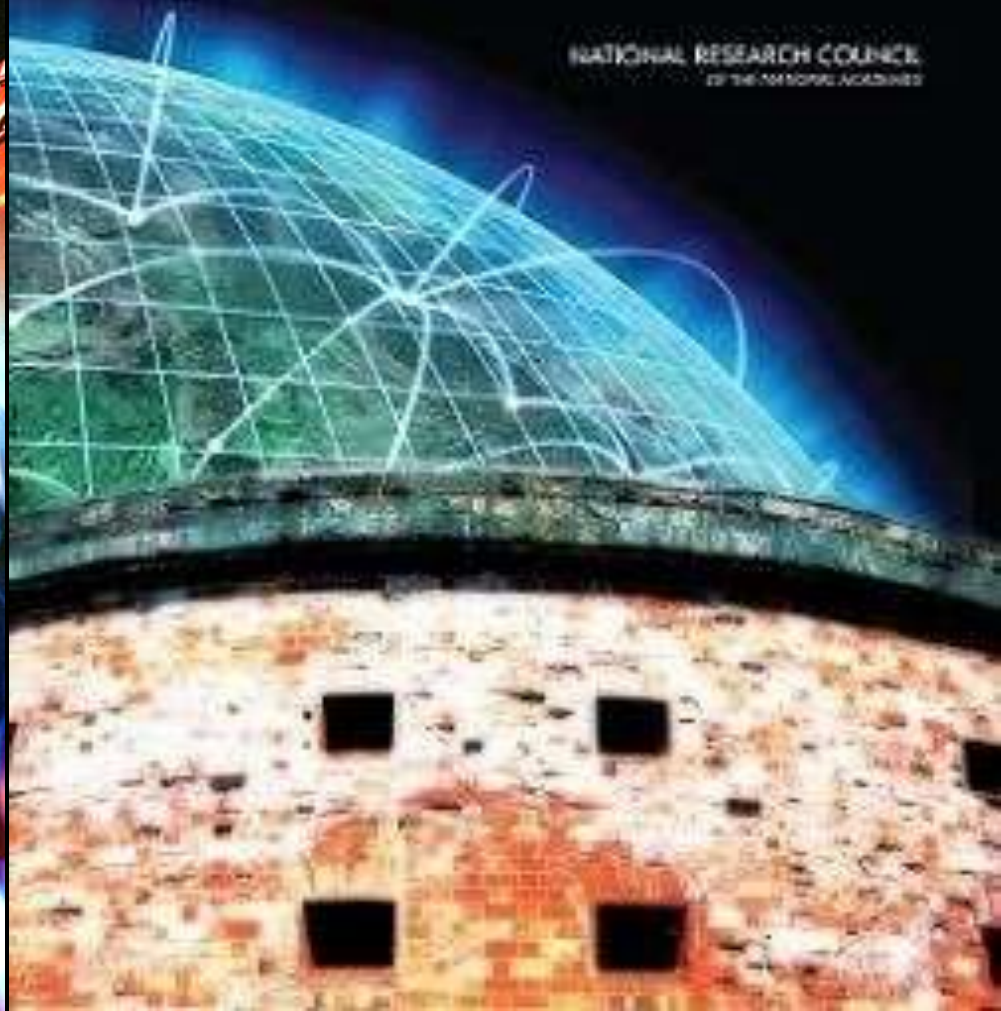
NATIONAL RESEARCH COUNCIL  
OF THE NATIONAL ACADEMIES



# B E Y O N D “FORTRESS AMERICA”

National Security Controls on Science and  
Technology in a Globalized World

NATIONAL RESEARCH COUNCIL  
OF THE NATIONAL ACADEMIES



# Economic Espionage



- **national initiatives**
- **targeted espionage**
- **universities**



# Capability of the People's Republic of China to Conduct Cyber Warfare and Computer Network Exploitation

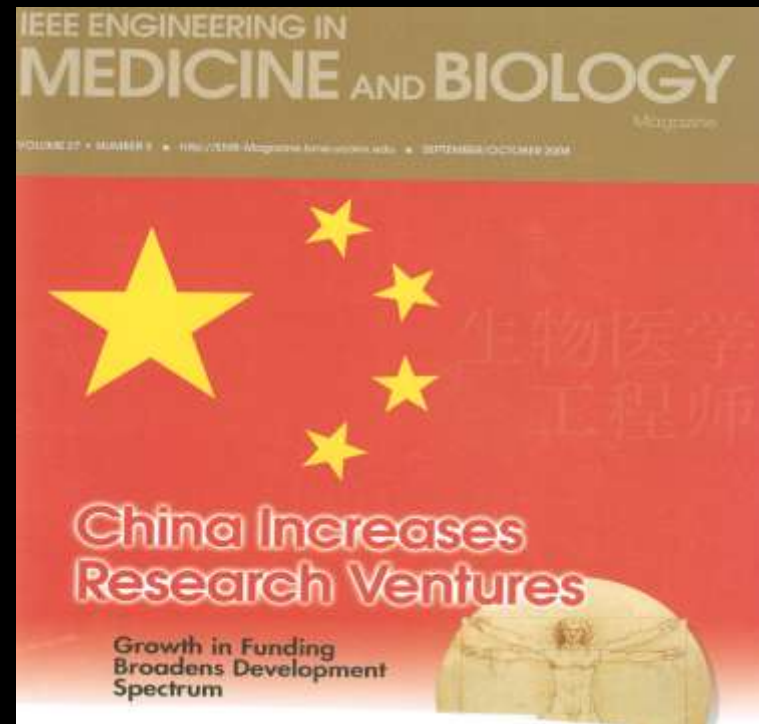
Prepared for

The US-China Economic and Security Review Commission



Information Systems Sector  
7575 Colshire Drive  
McLean, VA 22102  
October 9, 2009

**NORTHROP GRUMMAN**



## Biotech in China

February 2010



中国  
生物  
科技  
专辑

**SAIC**  
From Science to Solutions

## China's Use of Perception Management and Strategic Deception



Prepared for the U.S.-China Economic and Security Review Commission

by  
Dr. Eric C. Anderson with Mr. Jeffrey G. Engstrom  
Science Applications International Corporation

Revised November 2009

## Criminal Justice Information Services (CJIS)

**Provides timely and relevant information to intelligence, law enforcement, civilian, academic, employment, and licensing agencies**



# **“Fortress America”: NRC Report**

- **unilateral US control efforts outdated**
- **origins in effective Cold War policies but now eclipsed by rapid diffusion of technologies OCONUS**
- **USG maintains long list of controlled obsolescent technologies and export bans on products freely available OCONUS**
- **lack of USG staff with advanced training to revise controlled technologies lists**
- **adverse impact on competitiveness of US high-tech companies/universities**



# RISE ABOVE THE GATHERING STORM

*Energizing and  
Employing America  
for a Brighter  
Economic Future*

NATIONAL ACADEMY OF SCIENCES,  
NATIONAL ACADEMY OF ENGINEERING, AND  
INSTITUTE OF MEDICINE  
OF THE NATIONAL ACADEMIES



REPORT TO THE PRESIDENT  
JUNE 2005

## COMPUTATIONAL SCIENCE: ENSURING AMERICA'S COMPETITIVENESS

PRESIDENT'S  
INFORMATION TECHNOLOGY  
ADVISORY COMMITTEE



One Hundred  
Thirty-Three  
Thousand  
H-1B Visa  
Applications Submitted  
In Two Days

# The Gathering Storm: The USA is Losing Scientific and Technical Leadership



- Annual Competition in algorithm coding
- 4200 competitors (2009)
- finalists
  - China (20)
  - Russia (10)
  - USA (2)



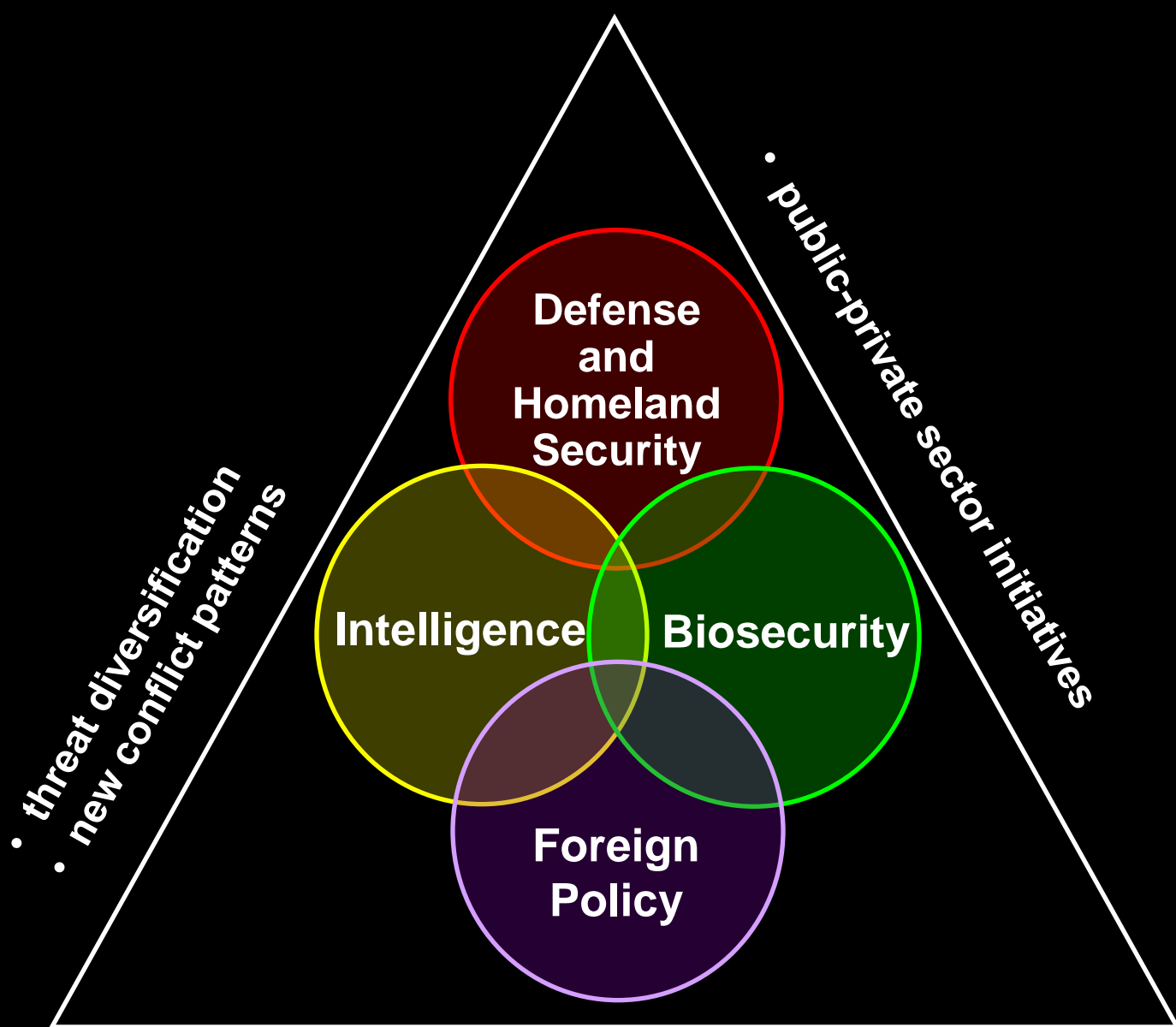
- rapid growth in number and nationalities competing
- major presence of PRC teams
- contest winners now largely non-US



# “Tracking Expertise”







- strategic communication and projection of non-military dimensions of US influence
- new international mechanisms for oversight/governance of dual-use technologies

**“Politics is the art of the possible,  
the calculated science of survival”**

**Prince Otto von Bismarck**



**“Survival owes little to the art of politics,  
but everything to the calculated application  
of science”.**

**Professor Rudolph Virchow  
(in reply)**

