

# **Security, Sensors, Surveillance, Smart Machines and Supercomputers**

**Dr. George Poste**

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**Presentation at TASER International  
Scottsdale, Arizona  
6 June 2016**

## Innovation



## Cool Facilities



## Geekiest Offices



## Compelling Mission

**PROTECT LIFE**  
**PROTECT TRUTH**

# **Advisory Roles in US National Security: Dr. George Poste and US Secretary of Defense Dr. Ashton Carter**



- **Defense Science Board**
- **DOD Bioterrorism Task Force**
- **National Academy of Medicine  
Global Forum on Infectious  
Disease**
- **National Blueprint for Biodefense**
- **In-Q-Tel**
- **Defense Threat Reduction Agency**
- **Department of Homeland Security**
- **Council on Foreign Relations**

# Security

- **threat mitigation/elimination**
- **proactive risk assessment and mitigation versus reactive post-incident actions**
- **immediate and long-term protection**
- **channeling events to most desired outcomes**
- **escalating complexities**
- **constant learning and adaptation**

# Rumsfeld's Rules



Hon. D. Rumsfeld  
US Secretary of Defense

- **known, knowns**
  - preparedness
- **known, unknowns**
  - R&D for new capabilities
- **unknown, unknowns**
  - potential for rude surprises



# Global Security Risks: Escalating Diversity and Complexity

**Rise of  
New Powers**



**WMD  
Proliferation**



**Jihadi Terrorism  
and Religious  
Fundamentalism**



**Failed  
States**



**Refugees**



**Homeland  
Security**



**Cybersecurity**



**Biosecurity**



**Robotics,  
Autonomous  
Weapons**

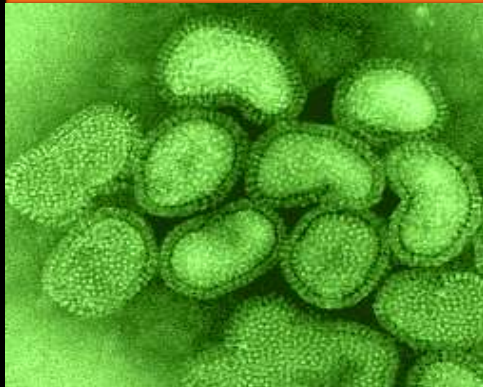


**Asymmetric  
Vulnerabilities**



# Global Security Risks: Escalating Diversity and Complexity

**Pandemic Disease**



**Climate-Change and  
New Vector Range**



**Natural Resources  
Depletion**



**Feeding  
9 Billion**



**Antibiotic  
Resistance**



**Aging Society  
and Health Cost**



**Automation and  
Unemployment**



**Future Workforce  
Education**

# Global Urbanization



- 28 megacities in 2016
- 70% current/projected megacities in countries with Global Conflict Risk Index probability of conflict within 10 years
- unprecedented stresses on infrastructure and services by 2030
  - food (35% ↑), water (40% ↑), energy (50% ↑)
- susceptibility to extreme weather/natural disaster
  - littoral locations, slums



# Global Security Risks: The Impact of Urbanization

## Developing Countries and Failed States

**Megacities  
in DCs**



**Inadequate Health  
Infrastructure**



**Warlords, Gangs and  
No Go Zones**



**MOUT/DUCT  
COIN**



## USA



**Climate  
Change**

**Offshoring and  
Supply Chain Risk**

**Aging  
Infrastructure**

**Disaster  
Management**



# The 'Fog of Disaster': Crisis Standards of Care and Proliferation of Unanticipated Events and Consequences





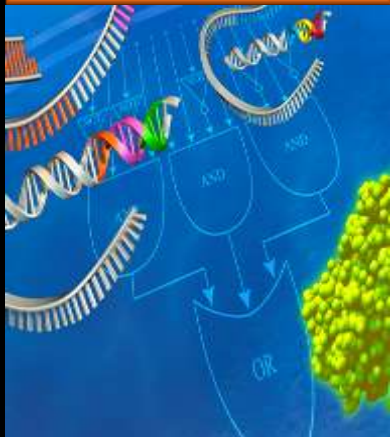
# Domestic Social Issues and Perceived Inequity as Triggers of Resentment, Unrest and Instability



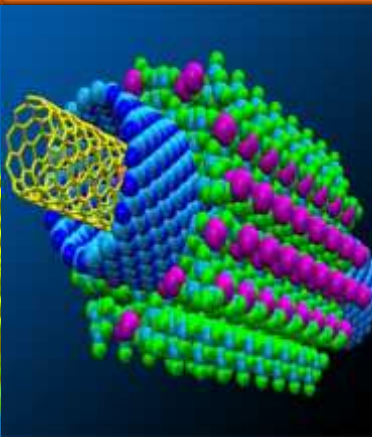


# Security: Sustained Competitiveness in Advanced Technologies

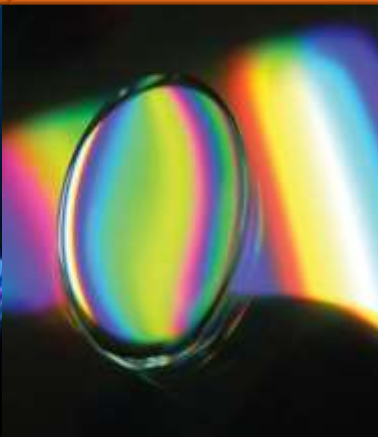
**Genetic and  
Synthetic Biology**



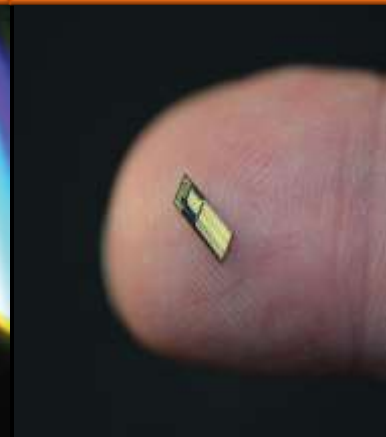
**Nanotechnology  
and Novel  
Materials**



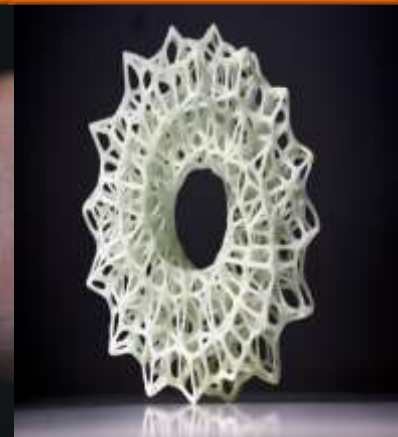
**Photonics  
and Optics**



**Sensors  
and IoT**



**3-D  
Manufacturing**



**Cognitive  
Computing and  
Neurotechnology**



**Robotics and  
Automation**



**Man-Machine  
Interactions**

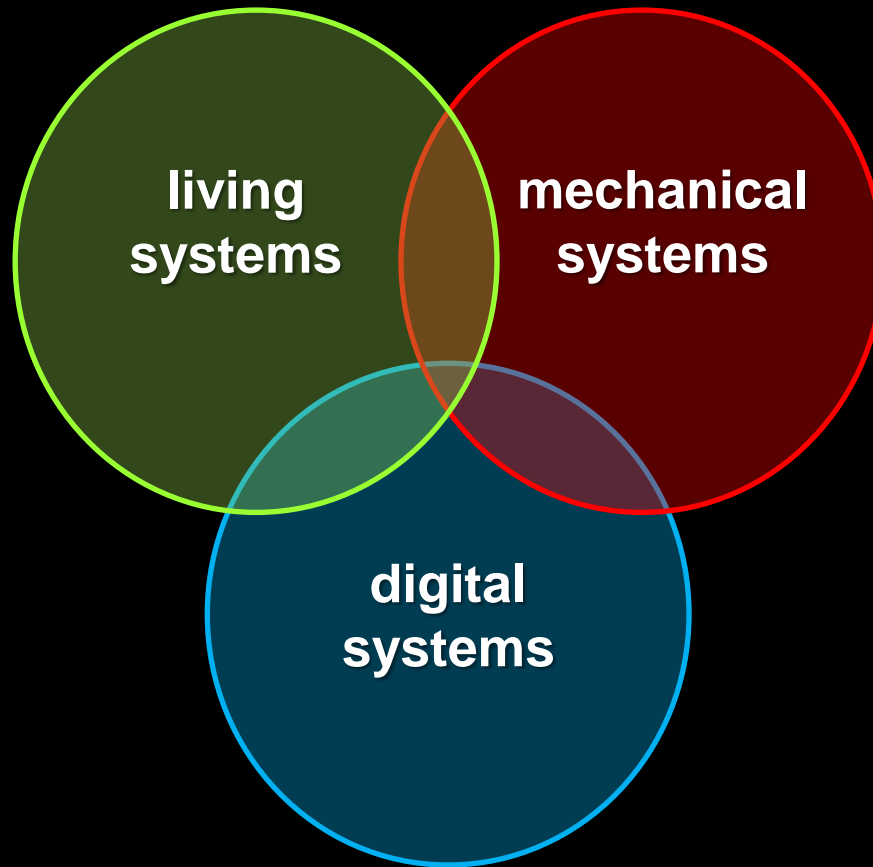


**Machine  
Learning**



**Deep Learning  
and Artificial  
Intelligence**

# Convergence, Connectivity and Complexity



# The Big Data V6 Challenge: The Pending Zettabyte-Brontobyte Worlds



- volume
- velocity
- variety
- veracity
- visualization
- value



# Big Data and Analytics: Integration of Diverse Data Streams for Comprehensive Real Time Situational Awareness



**“Actionable Intelligence Starts at Ingestion”**

# Sensor World

**Ubiquitous Sensing**

**Internet – of – Things (IoT)**

**Biometrics and Surveillance**

**AORTA: Always On, Real Time Awareness**

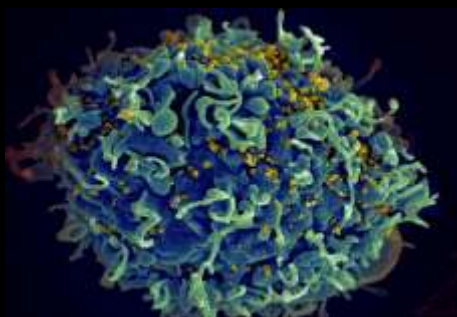
**Faster Data, Smarter Analytics, Better Decisions**

# The Relentless Battle Against Ever Changing Infectious Diseases

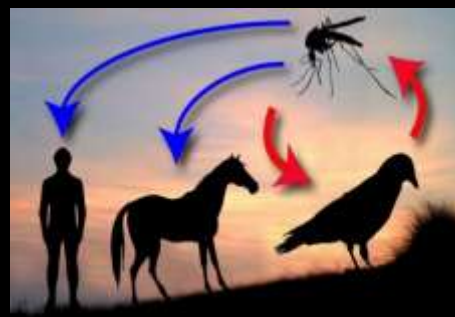
**pandemic (avian)  
influenza**



**HIV**



**West Nile  
virus**



**MERS**



**Ebola  
virus**



**bush meat  
food chain**



**Zika  
virus**



**what's  
out there?**



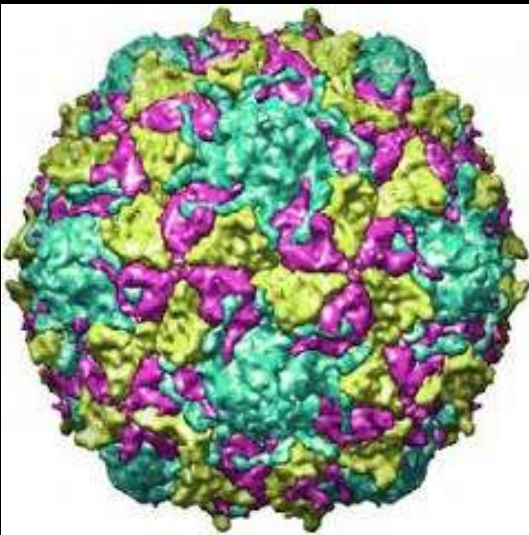
# Geodemographic Information Systems (GIS): Ground Zero Data

## Comprehensive Front Line Sampling of Sentinel Species



## Real-time Intelligence and Faster Preparedness

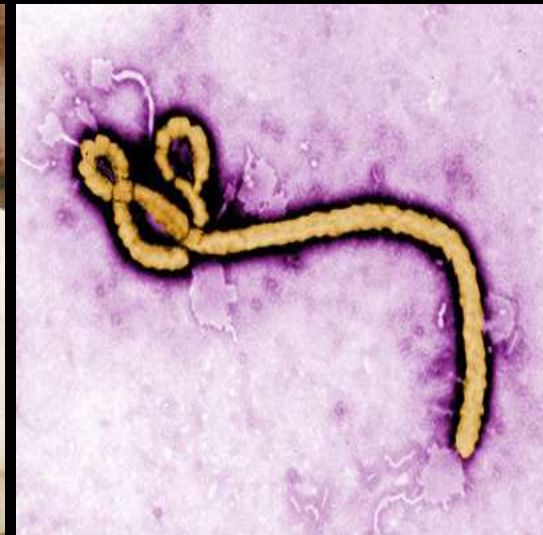
# Engineering Pathogenic Organisms With Increased Virulence and/or Ability to Evade Detection by Body's Immune System



**synthetic  
poliovirus**



**creation of pandemic  
influenza strains**



**Ebola as a  
potential bioweapon**



# Editing Humanity: No Longer An Abstract Question

Research article

## CRISPR/Cas9-mediated gene editing in human trippronuclear zygotes

Puping Liang<sup>1</sup>, Yanwen Xu<sup>1</sup>, Xiya Zhang<sup>1</sup>, Chenhui Ding<sup>1</sup>, Rui Huang<sup>1</sup>, Zhen Zhang<sup>1</sup>, Jie Lv<sup>1</sup>, Xiaowei Xie<sup>1</sup>, Yuxi Chen<sup>1</sup>, Yujing Li<sup>1</sup>, Ying Sun<sup>1</sup>, Yaofu Bai<sup>1</sup>, Zhou Songyang<sup>1</sup>, Wen Ma<sup>1</sup>, Canquan Zhou<sup>1</sup>✉ and Junjiu Huang<sup>1</sup>✉

(1) Guangdong Province Key Laboratory of Reproductive Medicine, the First Affiliated Hospital, and Key Laboratory of Gene Engineering of the Ministry of Education, School of Life Sciences, Sun Yat-sen University, Guangzhou, 510275, China

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Email: [hjunjiu@mail.sysu.edu.cn](mailto:hjunjiu@mail.sysu.edu.cn)





# Gene Editing As One of the Top Six Existential Threats to the USA



Statement for the Record

## Worldwide Threat Assessment of the US Intelligence Community

Senate Select Committee on Intelligence



James R. Clapper

Director of National Intelligence

February 9, 2016

# The Crucial Value of Point-of-Need Multiplex Diagnostic Devices for Real-Time Health Status Monitoring



QUALCOMM  
TRICORDER X PRIZE

# Wearable Devices and Wireless Monitoring of Health Status

## Vital Signs Monitoring



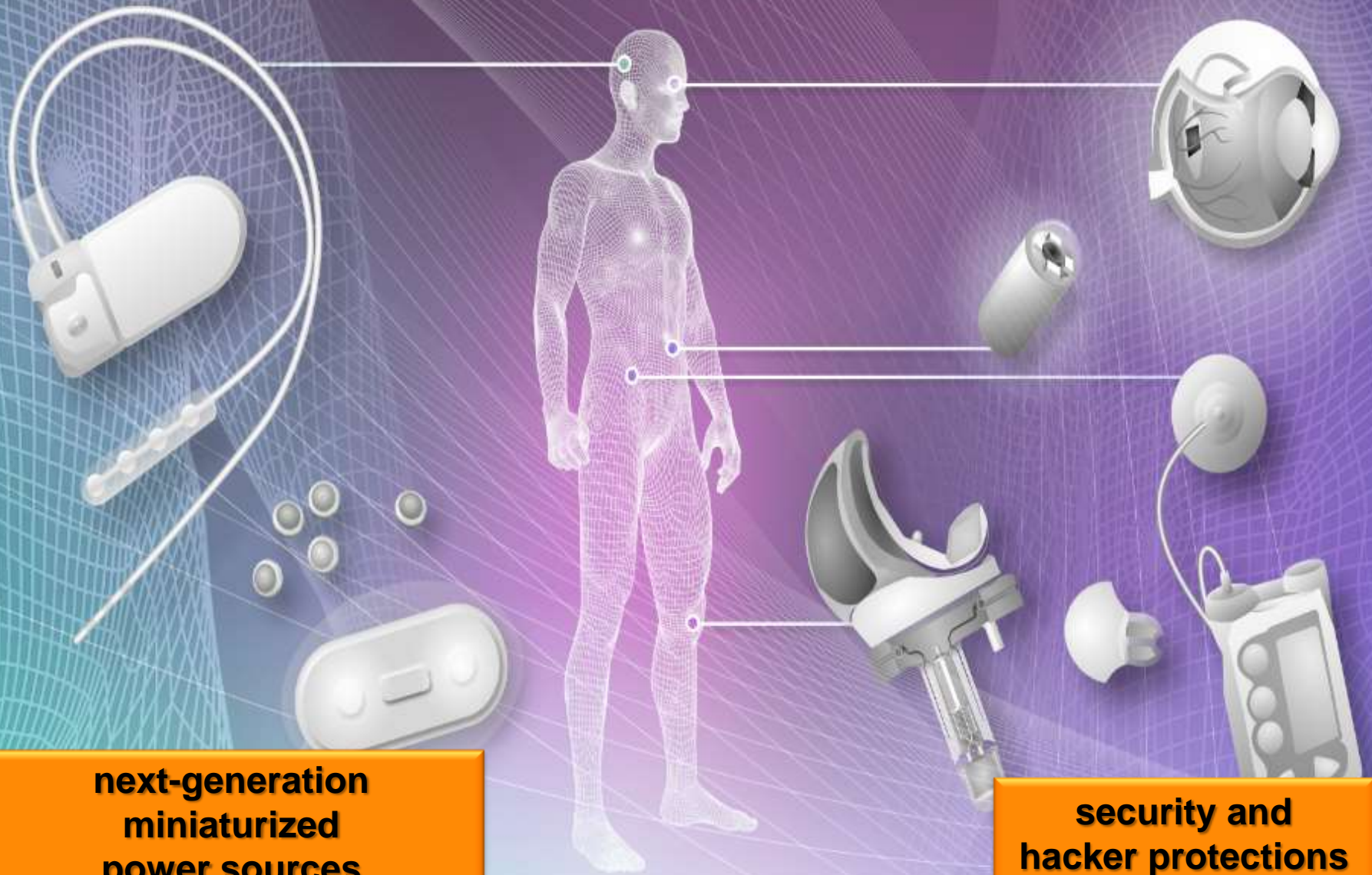
**Gastroenterology Mini-Cam**

**Pills with Chips**

**Glucose Monitoring**



# Implantable Devices and Wireless Monitoring (and Modulation)



**next-generation  
miniaturized  
power sources**

**security and  
hacker protections**

# Invasion of the Body Trackers

## Remote Health Status and Behavior Monitoring



**Meta-Data**

**Consent**

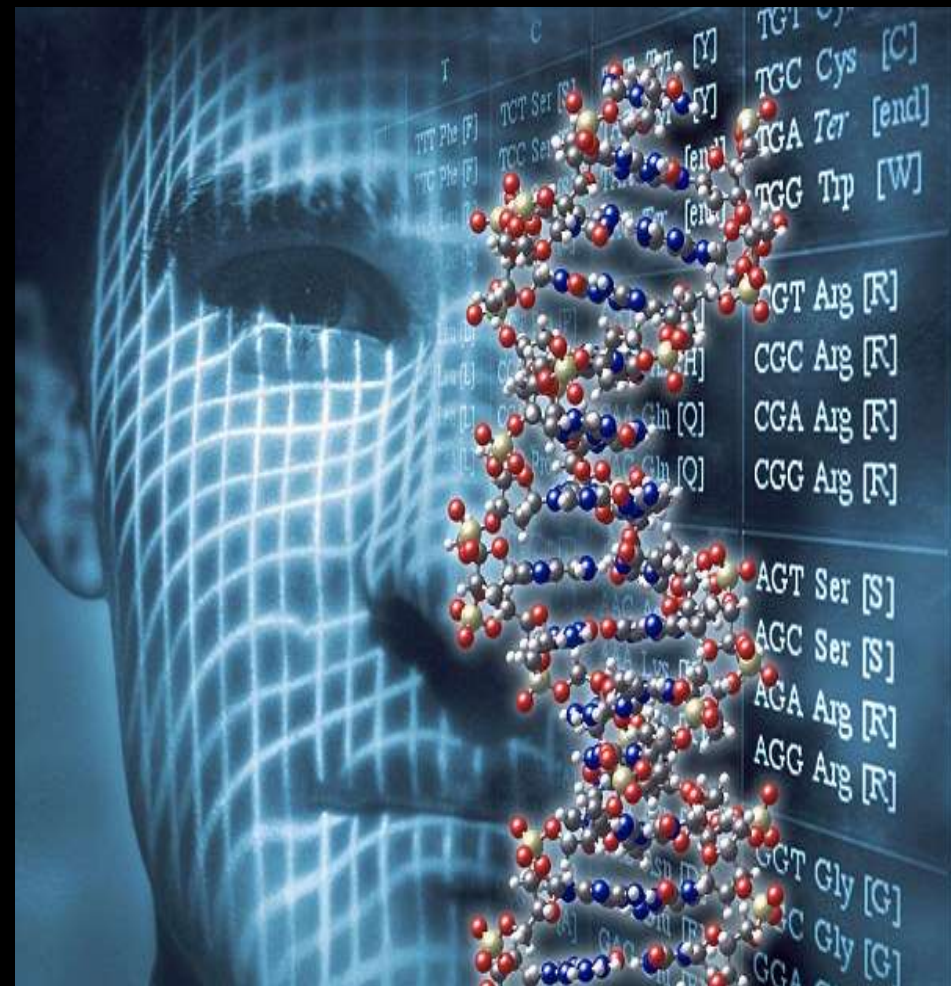
**Privacy  
and Security**







# Your Molecular Uniqueness



**genome**



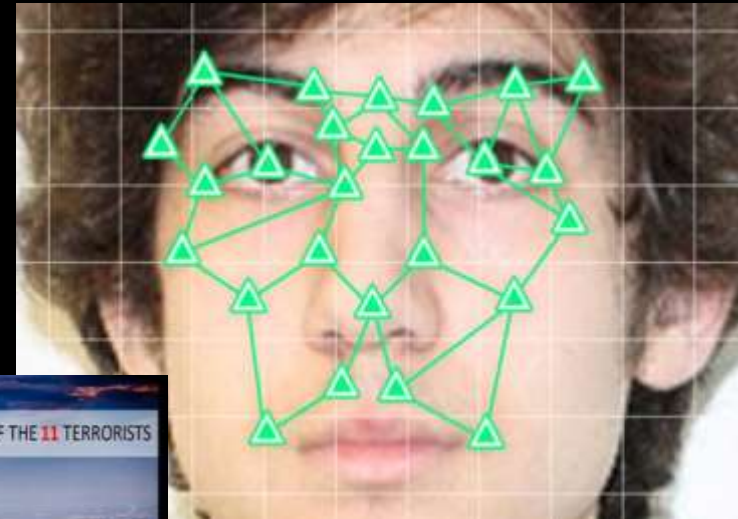
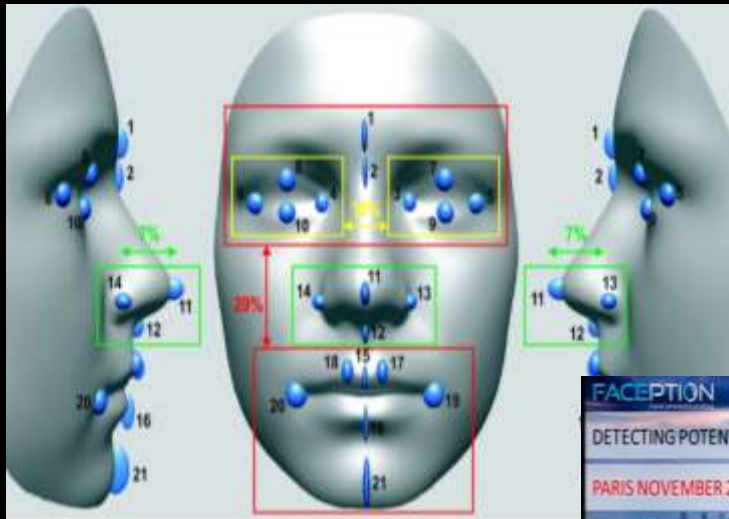
**proteome  
exposome  
immunosignature**

# Construction of Biometric Databases





# Facial Recognition and Identification of Terrorism Suspects



**POLICE NATIONALE**

## APPEL À TÉMOINS

**ABDESLAM SALAH**  
né le 15 septembre 1989  
à Bruxelles (Belgique)

Individu faisant l'objet d'un mandat de recherche.

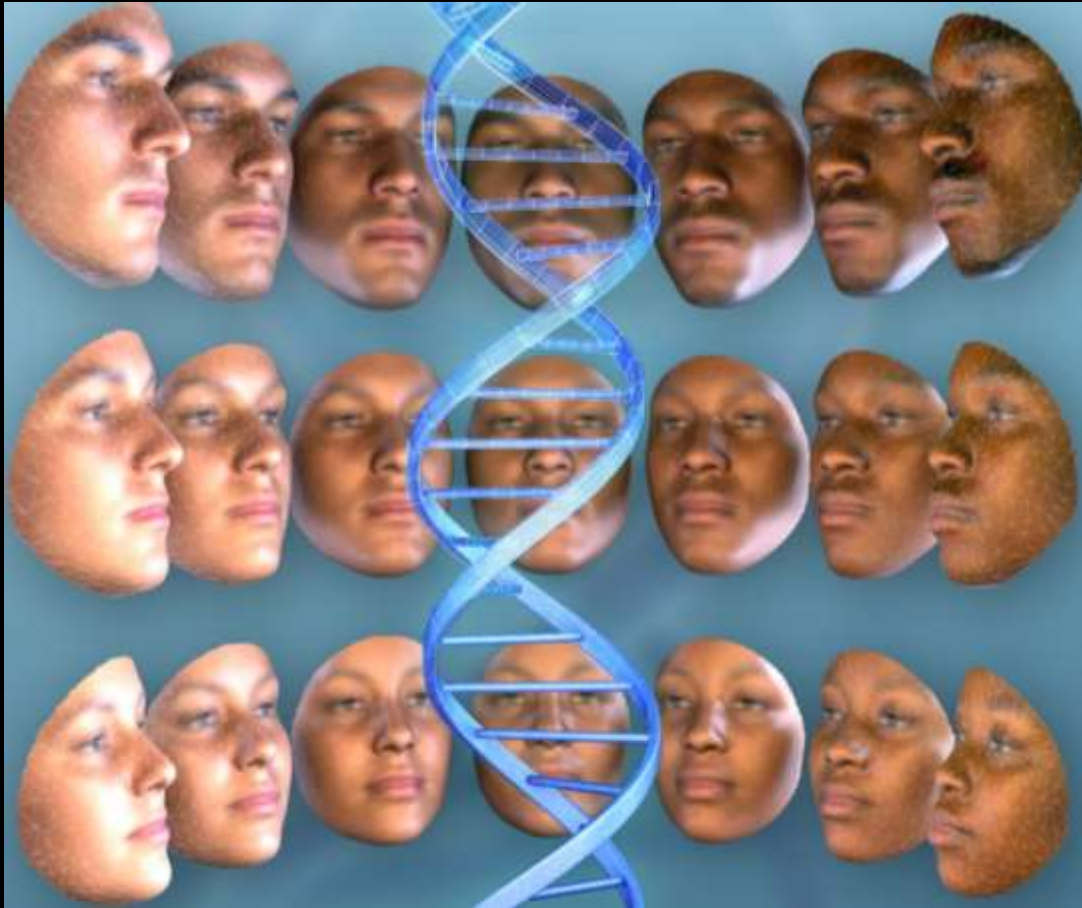
**SIGNALEMENT :**  
1 m 75, yeux marron

**CONTACT :**  
Si vous disposez d'informations permettant  
de le localiser, contactez immédiatement  
le **197 Alerte attentat**.

Individu dangereux, surtout n'intervenez pas vous-même.



# The DNA Identikit: Tracking Genes Coding for Facial Bones, Eye and Hair Color



# **Biometrics of Unknown Person (BUPs)**

- **recovery of DNA and other biological markers from objects seized abroad in military/intelligence operations**
- **bomb casings, keyboards, phones, clothing**
- **matching of recovered papers and electronic materials to other datastreams**

# Computer-Based Facial Recognition Plus Idiosyncratic Patterns of Body Language and Movement





# The Challenge of Real-Time Monitoring and Individual Recognition in Crowded Spaces



# Evolution of Dynamic Interfaces for Computer-Based Individual Recognition and Real Time Decisions



# **Legal and Policy Issues Generated by Use of Body-Worn Cameras (BWC) and other Technologies for Front-Line Police and On-Ground Military**

- **privacy, transparency, accountability**
- **the ‘gotcha’ phenomenon**
  - **every action potentially recorded by third parties**
  - **vital record of the perspective of the front-line operator(s)**
- **integrated end-to-end data ecosystem**



# Integrated Ecosystems for Facile, End-to-End Secure Data Capture, Authentication and Analytics

From Capture to  
Courtroom



- Evidence.com

From Conflict Zone to  
Adaptive CONOPS



- C4ISR

- security
- scalability
- sustainability
- authenticity
- availability
- audit
- speed
- search
- synthesis

**Tracking Personal Behavior and Activities**

**Digital Signatures/Traces/Exhaust/Dust**

**Predictive Analytics**

# Digital Traces

- every move you make
- every twitter feed you update
- every facebook friend you add
- every internet search you log
- every cell phone call you transmit
- every time you use your credit card

**SOMETHING AND/OR SOMEONE IS TRACKING YOU**



# **You're So Predictable!**

## **Social Behavior Becomes Quantifiable**

- **who knows why people do what they do?**
  - **the fact is that they do!**
- **these actions can now be traced and measured with unprecedented precision**
- **with sufficient data, the patterns reveal increasingly predictable behavior and individual risk patterns**
- **new opportunities in multiple business sectors**
- **broad utility in national security, intelligence and military operations**
- **new ethical and legal issues regarding privacy and data security**

# Cell-Phone Based Digital Geo-spatial Information Services





# Individual-Specific Patterns of App Use and Keyboard Use Dynamics





# Avatar Personalities in Gaming Reveal Behavioral Clues to Match With Other Aspects of User Activities



- risk profiling
- predispositions to anti-social actions/susceptibilities
- mapping correlation with real world actions, including law breaking

# **International Mobile Subscriber Identity (IMSI) Catcher Technology (Cell-Site Simulator)**

- **tracking of mobile phones by IMSI signal**
- **police depts., FBI, IRS and IC (restricted)**
  - **Hailstorm**
  - **Stingray, Triggerfish, Kingfish, Amberjack, Harpoon**
- **consumer products**
  - **Snoopsnitch, Cryptophone**
- **legal challenges to privacy invasion**

# Your Car Knows A Lot About You





# Will We Even Call It A Phone In 2020?



**Bendable LED Screens**



**Augmented Reality (AR)**



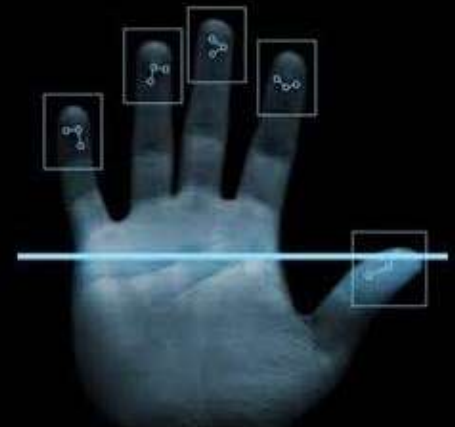
**Wearable Mobile Computing**



**Gesture Based UIs**



**Holographic Imaging**



**Mobile Biometrics**

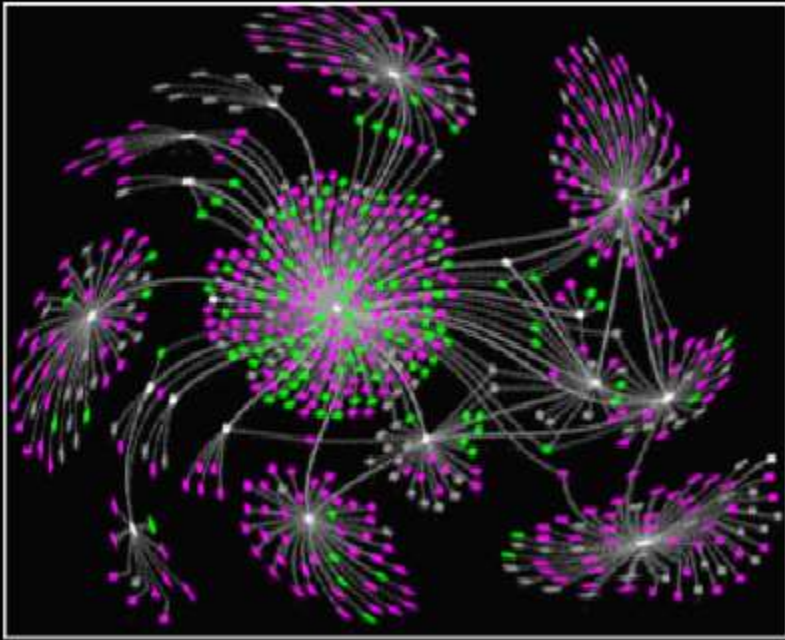
**Facial & Eye Recognition**



**Lots of Little Brothers Create – Big Brother**

**The Democratization of Surveillance**

# Large Scale Probabilistic Analysis of Electronic Traffic Networks to Identify Anomalies and Potential Risk Emergence

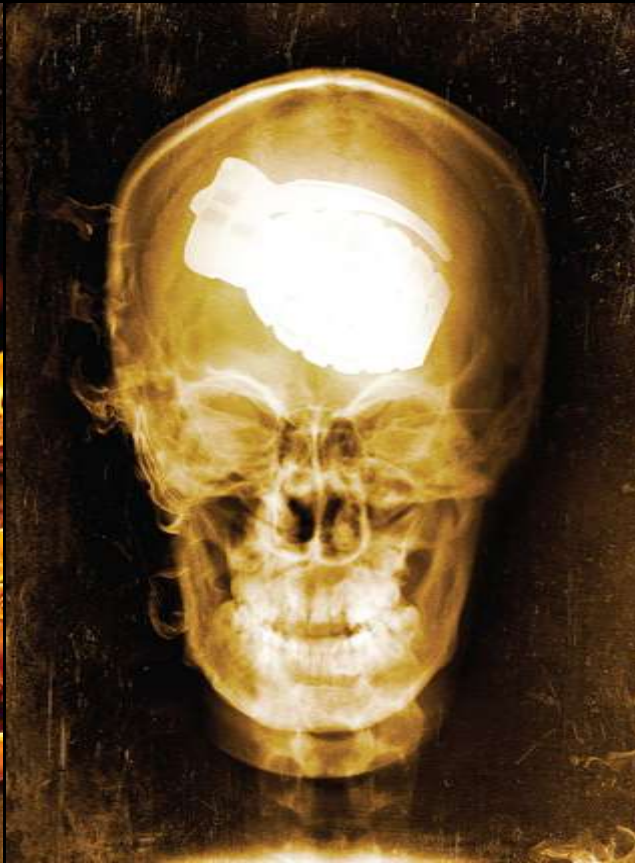




# Real Time Analytics (Mining) of High Volume Social Media Feeds



# Profiling of Militant Islamic Fundamentalists and Terrorism Behavioral Indicators





# Urban Warfare, Counter-Terrorism and Counter-Insurgency Operations

**Mogadishu  
1993**



**Grozny  
1994 and 1999**



**Fallujah  
2004**



**Sadr City  
2008**



**Gaza  
2013**



**Aleppo  
2016**



# Real Time Intelligence for On-Ground, Dismounted Forces

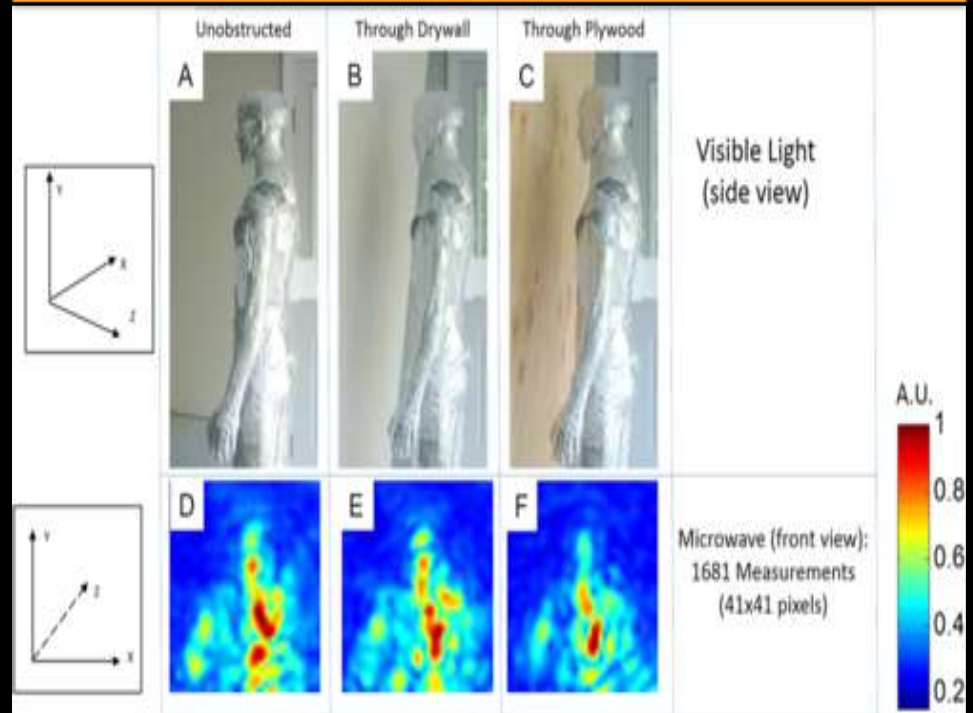


# Electronic Intelligence for On-Ground Dismounted Forces in Urban Settings

## seeing round corners



## seeing through walls





# Everything is a Potential On-Ground Sensor and Signal





**The New Automated Battlefield**

**Satellites, Drones and Robots**

**Semi-Autonomous and Autonomous Weapons**

# Eyes in the Sky: “Persistent Stare”



# The Rise of the Keyboard Warriors: The USAF Now Trains More Drone Pilots Than Conventional Fighter and Transport Pilots

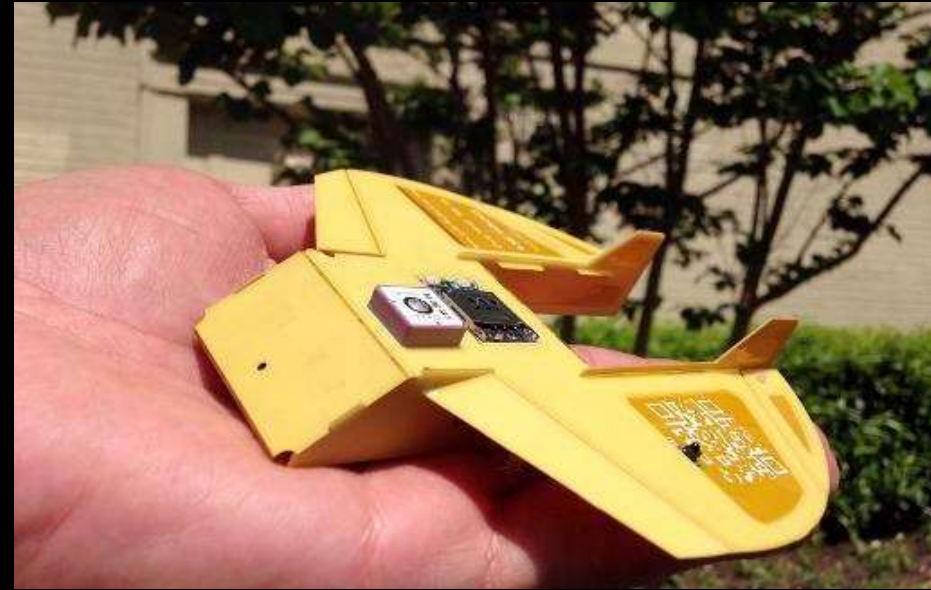




# Diversification of Military and Law Enforcement Drone Platforms



# Cicada: Covert Autonomous Disposable Aircraft



# The Miniaturized Drone That Can Spy From a Leaf





## Drone Paramedics



## Drones to Your Door



## Drones for Your Dog



**Paul Revere Updated**

**The Robots are Coming, The Robots are Coming!**

# The Robots are Coming

## Civilian Sector 4-D Jobs – Dull, Dirty, Dangerous and Digital



## Progressive Redundancy and Replacement of Human Skills



**Submersile - Bots**



**Snake-Bots**

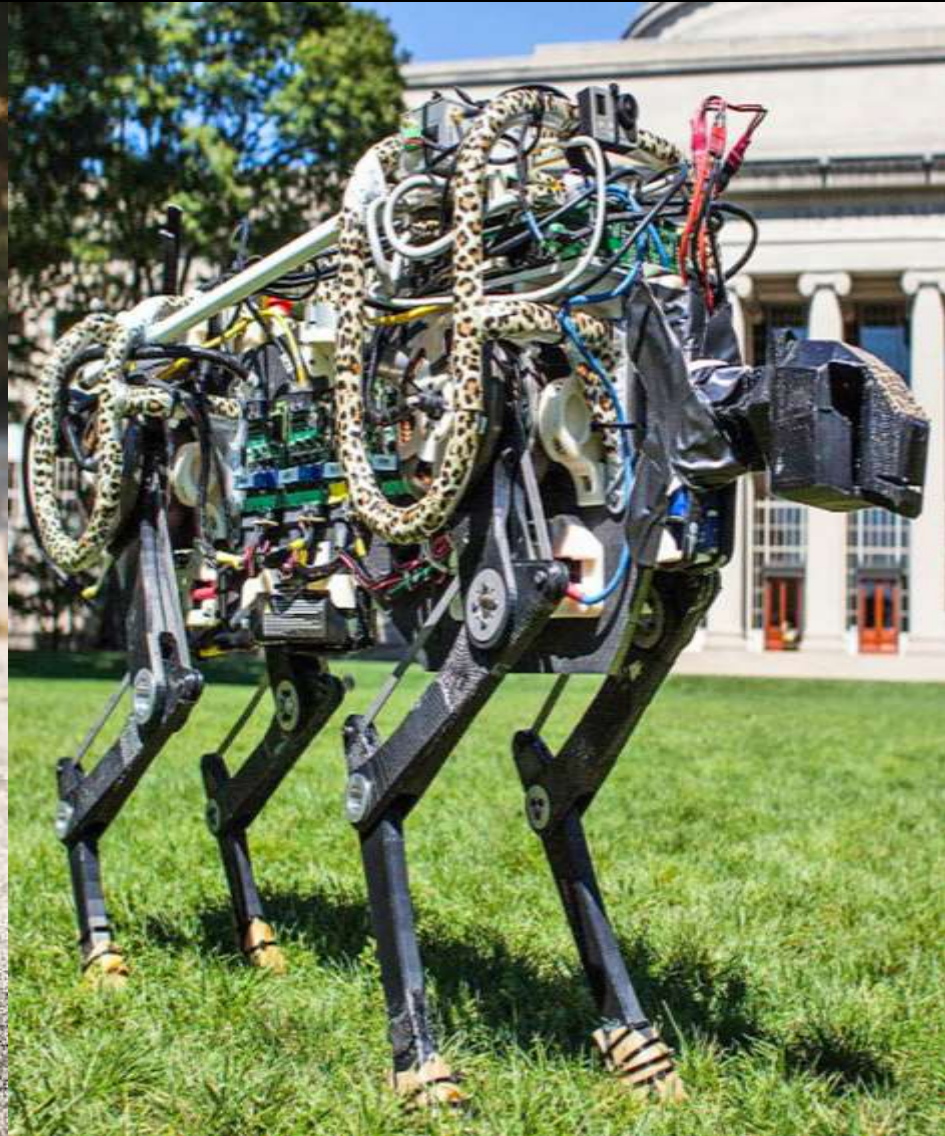


**Buddy-Bots**





# All-Terrain Fast Mobility Robotics: Boston Dynamics





# Armed Robots





# **Robot Wars**

**The Complex Ethical and Legal Landscape of New Classes of Fully Autonomous Battlefield Machines**

**Keeping Humans In-the-Loop**

# Iron Man: The SOCOM-TALOS Project Tactical Assault Light Operator Suit (Ekso Bionics)



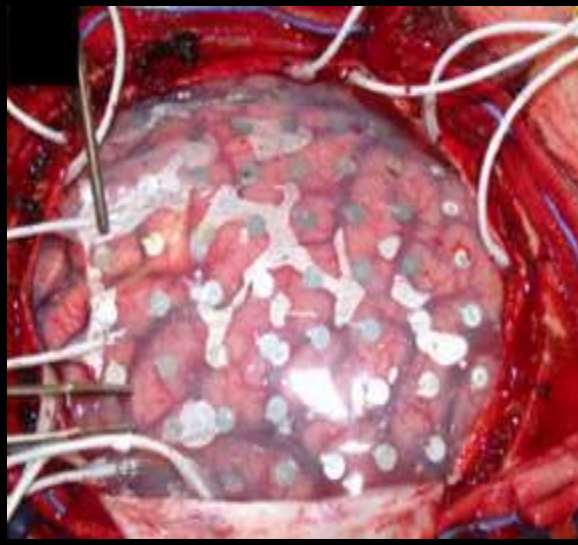
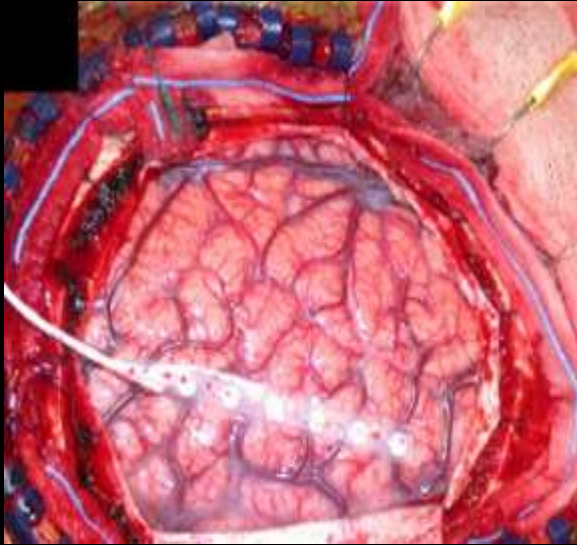
**Human-Machine Interactions**

**Human-Computer Interactions**

**Neurotechnologies and Artificial Intelligence**



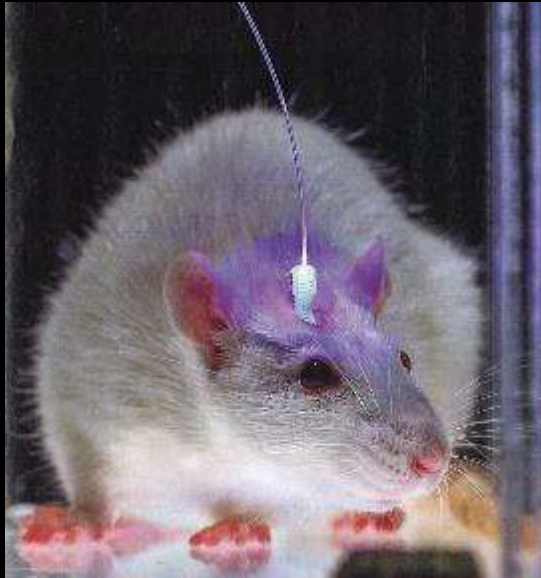
# Implanted Brain Microelectrode Arrays and Mind Control of Prosthetic Arm by Quadriplegic Patient



# Direct Connection of Nervous Control to Prostheses



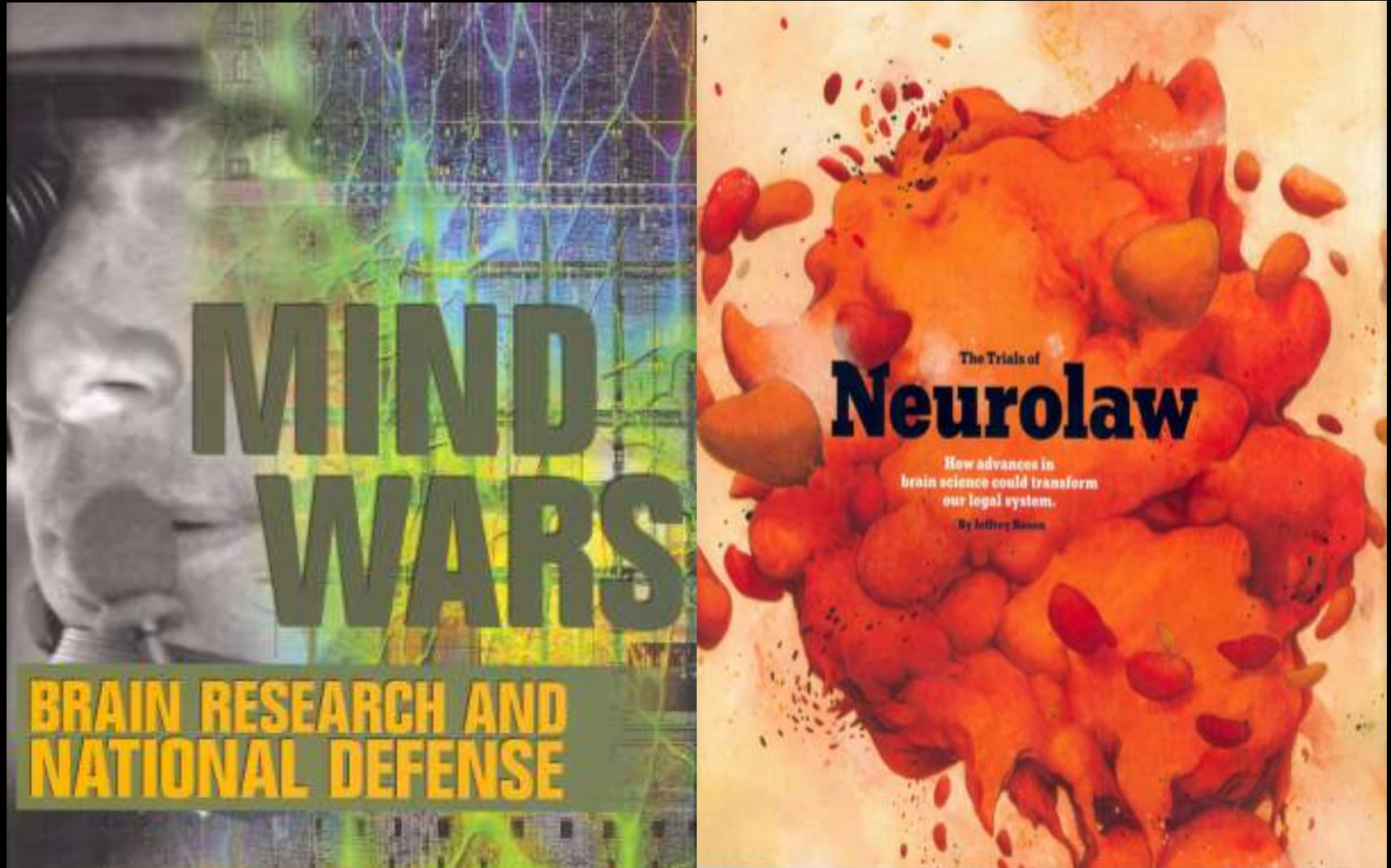
## **“Brain Net”**



- **first brain-to-brain link via remote transfer of encoded brain pattern to decoder animal and triggering of behavioral mimicry**
- **build inventory of codes to elicit specific behavior in target (decoder)**
  - **design of new control systems for robots**
- **legal and ethical implications of extension to elicited behavior (control, modulation) of humans**



# Dual-Use Implications of Advances in Neural Science



**Designing New Ways to Expand Human  
Cognitive, Sensory and Motor Capabilities**

# Heads-up Display Technologies to Optimize Complex Manufacturing Assembly and Reduce Risk





# Virtual Reality and Training for Complex, Dynamic Tasks



# Advances in Cognitive Neurosciences and New Patterns of Cognitive Processing



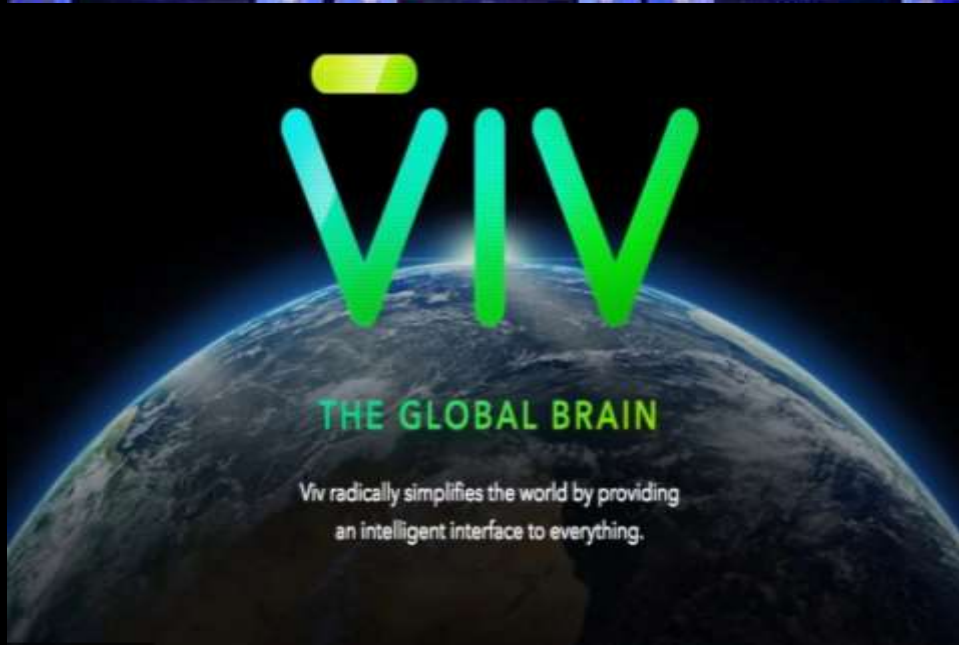
- optimize information representation (perception)
- neuroplasticity and selection of new cognitive mechanisms
- modulation of brain function to optimize comprehension

**Massive Data and the Sophistication of Analytical Algorithms  
is Outpacing Human Cognitive and Sensory Capabilities**

**Why Wait for the Slow Brain to Catchup  
With the Fast Machine**

**Machine Learning and Artificial Intelligence**







## Recent Acquisitions mid-2015 to May 2016



# The Economist

APRIL 8TH-15TH 2014

The parable of Port Talbot

America's Treasury v multinationals

Libya's last chance

Bouncy castles in space

Parsing the Panama papers

## Imperial ambitions





# Automation, Robotics, Machine Intelligence and the Future Workforce



**“I Can’t Let You Do That Dave”**

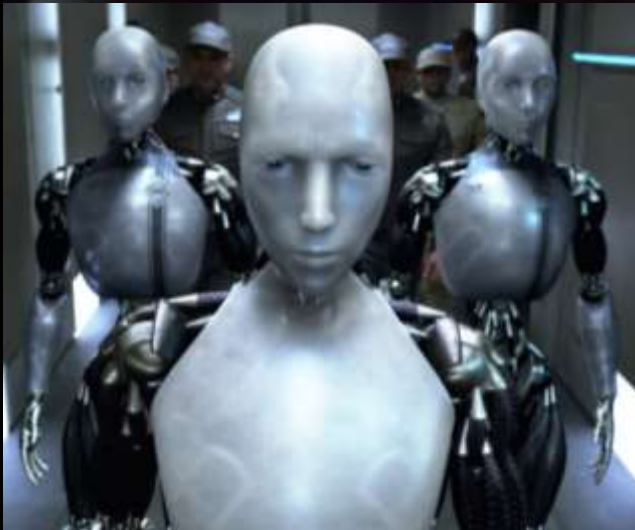


# Robotic Dystopias

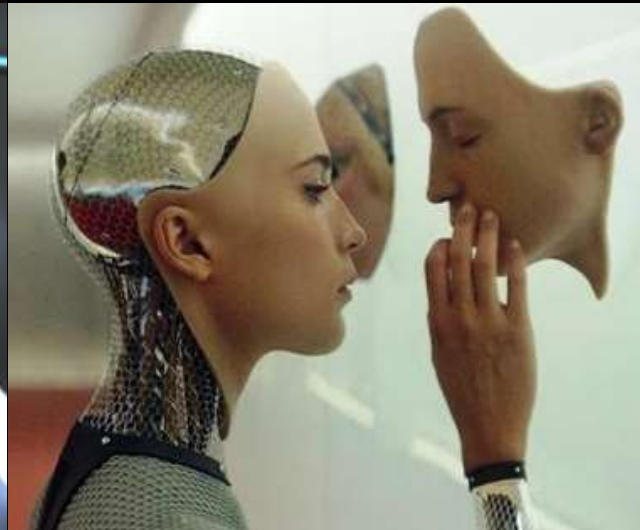
Blade Runner (1982)



Terminator (1984)



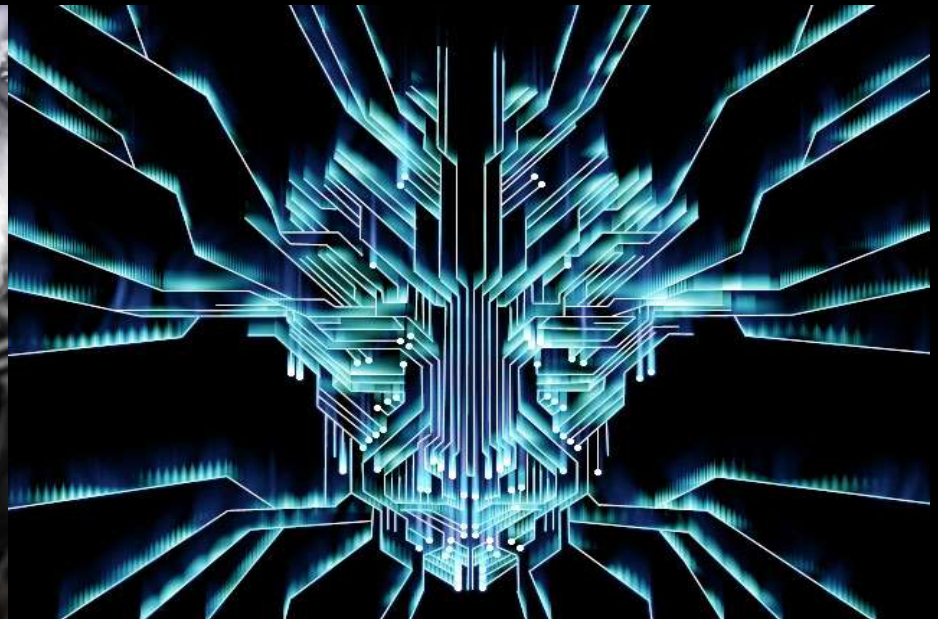
iRobot (2004)



Ex Machina (2015)



# Original Sin Updated? Artificial Intelligence and the Elimination of Mankind?



# Science 20 May 2016

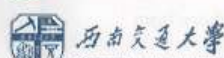
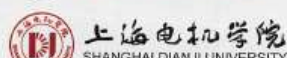
## The 19th Video Recruitment of High-level Overseas Talents for China's Top Universities

The editorial department of CHISA, China Education and Research Network and China Education Online will jointly sponsor this recruitment activity with more than twenty Chinese universities and top disciplines. Those who are intend to participate Chang Jiang Scholars Program and other high-level talents recruitment are warmly invited.

Holding Date : 7:00-24:00 29th May, 2016 (GMT+8)

Recruitment Requirement: Overseas Scholars and Doctors

### Participating Universities :



### ► Position Requirements :

Mechanical Engineering, Information and Communication Engineering, Power System and Automation, Environmental Science and Engineering, New Energy Materials, Traffic Engineering, Electronic Science, Biology, Cytobiology, Clinical Medicine, Thermal Energy and Power Engineering, Civil Engineering, Instrument Science and Technology, Food Science and Engineering, Mathematics, Geography, Economics, Psychology, The Science of Law, Foreign Linguistics and Applied linguistics, Pedagogy, Art, Management Science, Marxist Philosophy.

### ► Participation Approaches:

1. Please send your resume to [wubh@col.cn](mailto:wubh@col.cn)
2. Visit the website <http://www.edu.cn/cv>. Each university has his own chat room and you can communicate with recruiter face to face. [7:00-24:00 29th May, 2016 (GMT+8)]

For more information, Please contact : 86-10-62603770 , 86-15300215485



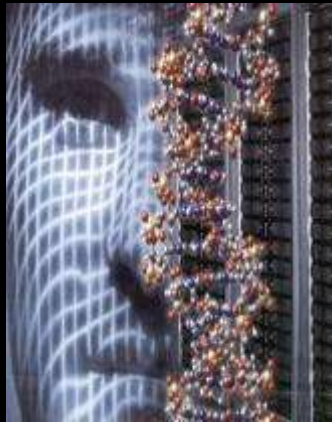
# China's Military Aspirations





# Technology Acceleration and Convergence: Escalating Complexities

**Genetics,  
Biotechnology,  
Synthetic  
Biology**



**“Bio-Space”**

**Ubiquitous  
Sensing/  
Devices &  
Social Networks**



**“Connected  
Space”**

**Advanced  
Computing  
Mega- &  
Meta- Data**



**“Analytics Space”  
and  
“Surveillance Space”**

**Robotics and  
Advanced  
Autonomous  
Systems**



**“Design Control  
Space”**

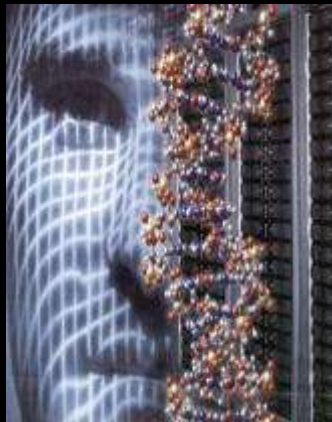
**Neurosciences  
and  
Human-Machine  
Interactions**



**“Cognitive  
Space”**

# Technology Acceleration and Convergence: Escalating Complexities

Genetics,  
Biotechnology,  
Synthetic  
Biology



“Bio-Space”

Ubiquitous  
Sensing/  
Devices &  
Social Networks



“Connected  
Space”

Advanced  
Computing  
Mega- &  
Meta- Data



“Analytics Space”  
and  
“Surveillance Space”

Robotics and  
Advanced  
Autonomous  
Systems



“Design Control  
Space”

Neurosciences  
and  
Human-Machine  
Interactions



“Cognitive  
Space”

New Patterns of Technology Fusion,  
Evolution and Adoption

New Knowledge  
Networks

New  
Participants

New Markets  
and  
Business Models



**Slides available @ <http://casi.asu.edu/>**

