Big Data and Big Implications for Bio-cybersecurity

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Neuroscience…

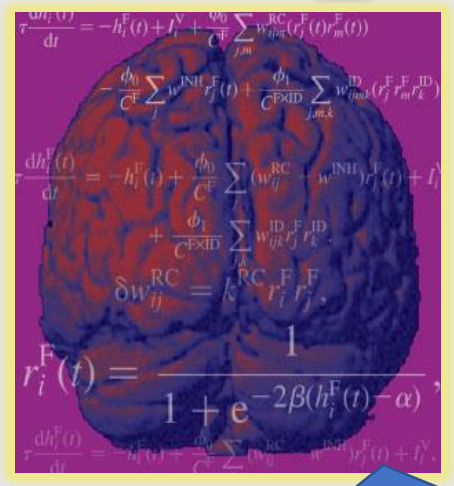
puts the brain at our fingertips

Progress in Neuroscience

Heuristic Reciprocity

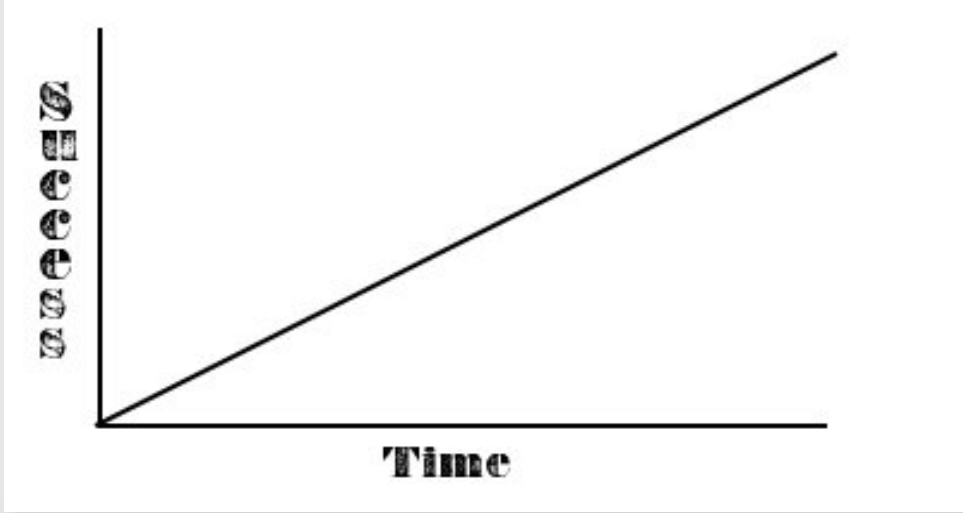
Tools-to-Theory

Theory-to-Tools



Advances in Neuroscience

- **<u>Translationally viable</u>**
  - **Anatamo-physiological correlation**
  - **Individual trajectories of expression**
  - **Populational variation and pre-dispositional assessment**



Integrative Scientific Convergence (ISC) in Neuroscience

Conjoins:

- **Natural sciences**
- **Biotechnology**
- **Anthro/social science(s)**

Focus upon assessment, access and manipulation of neural structure and cognitive, emotional and behavioral function(s):

-Individuals

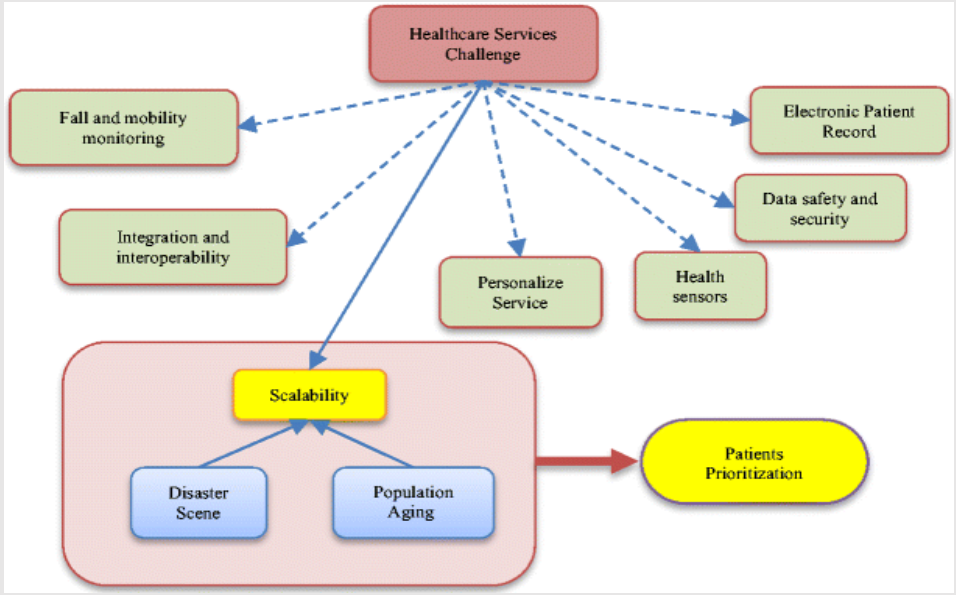
-Groups

RELIANT UPON DATA INTEGRATION, SHARING AND USE...

BIG DATA

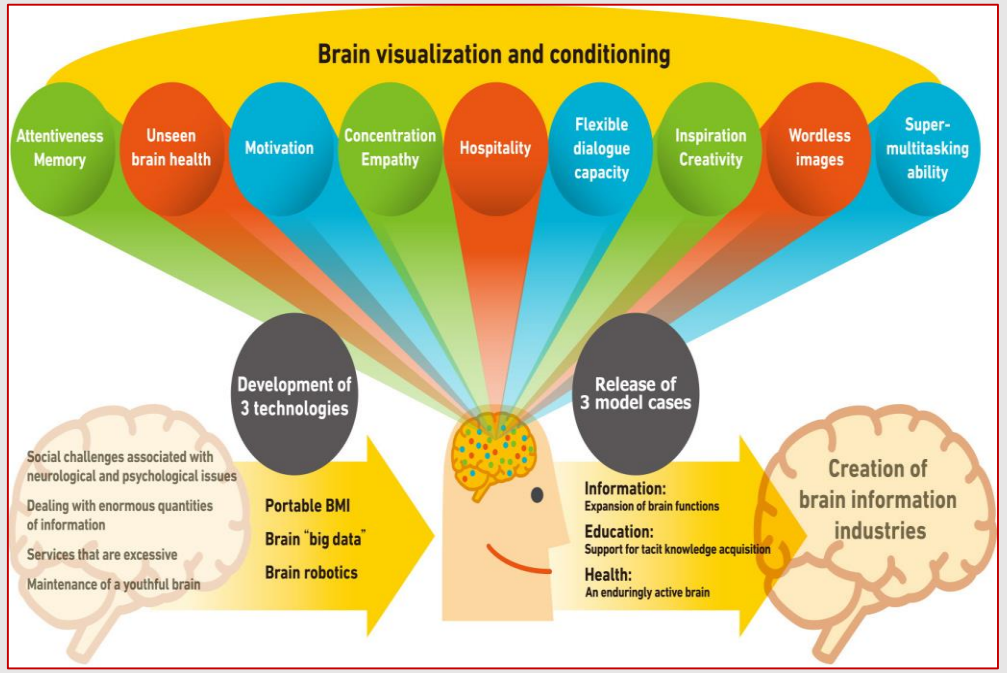
Validity-Reliability-Utility Issues

- Need for large volume data banks
- Individual, cohort and population data tiers
- Intra- and inter-tier integration potential
- Longitudinal input requirement
- Rapid (real-time) access requirement
- Non-anonymity



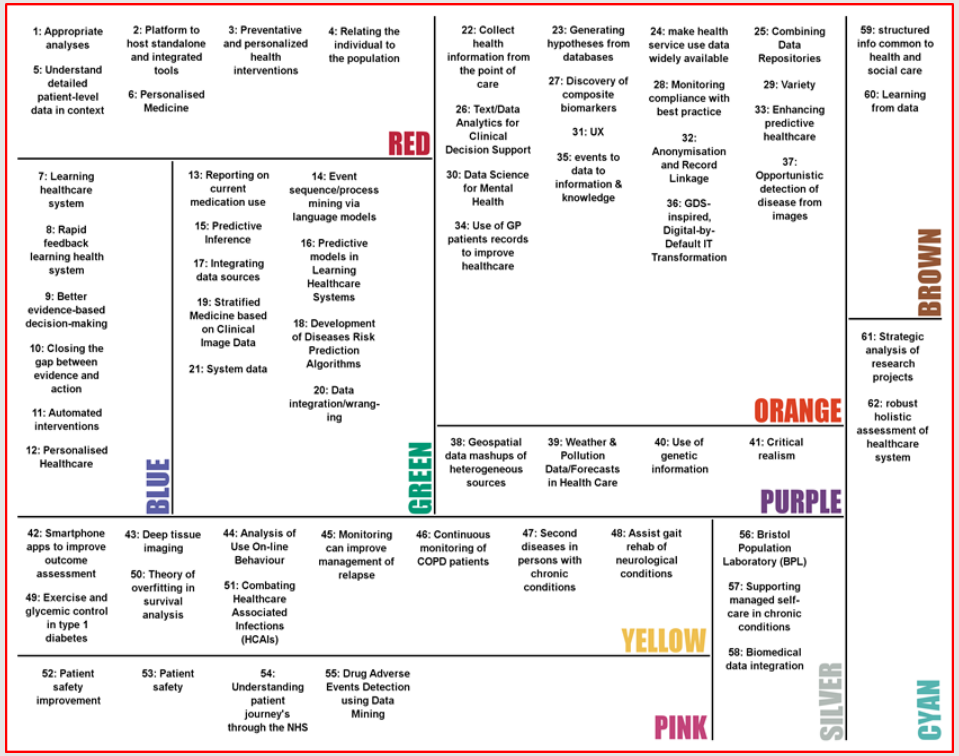
NeuroCyber/Big Data Approaches

- Maximize storage and retrieval
- Parallel computing
- Scalable, customizable
- Accessible and sharable

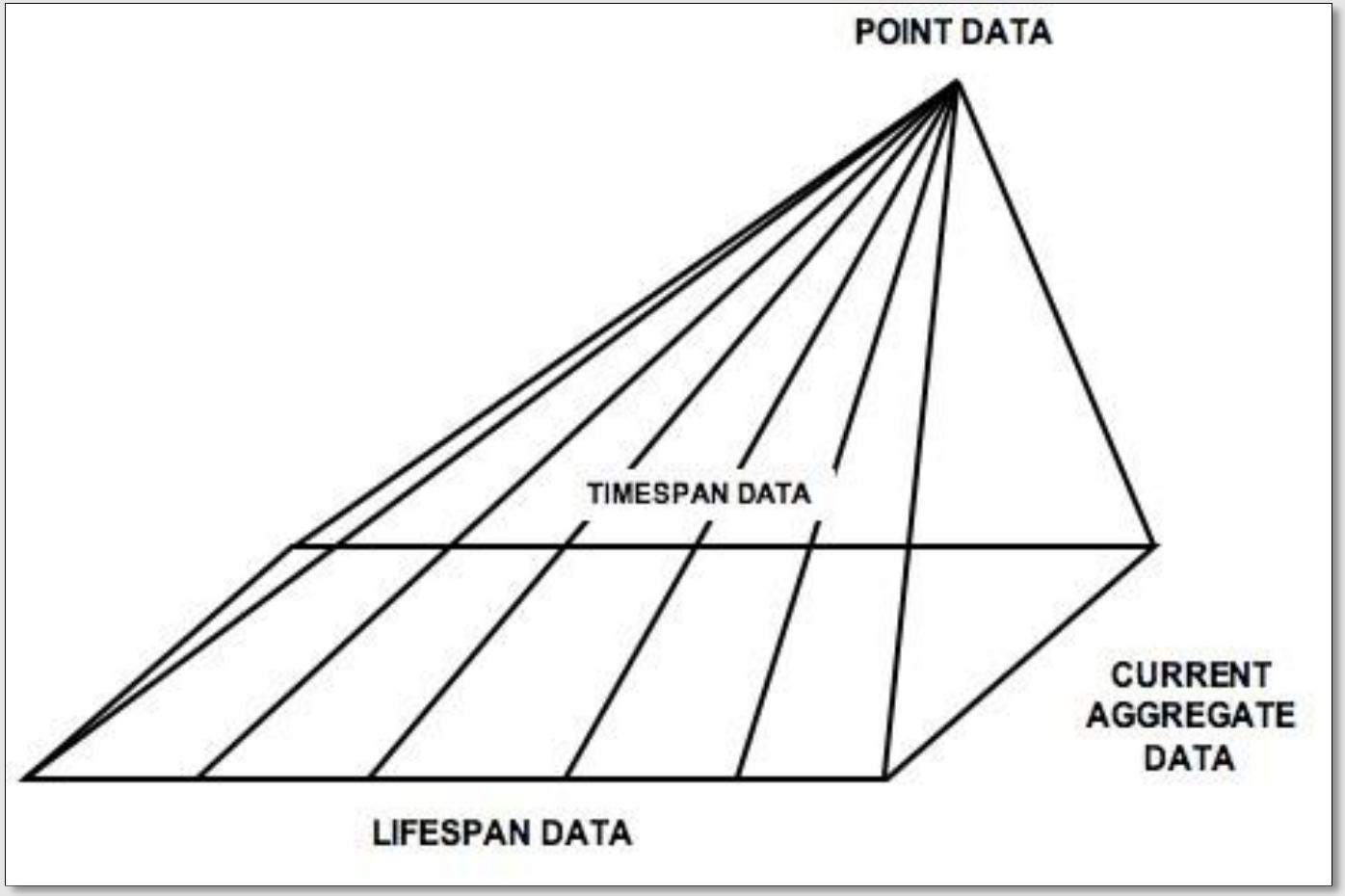


Data Acquisition and Tracking

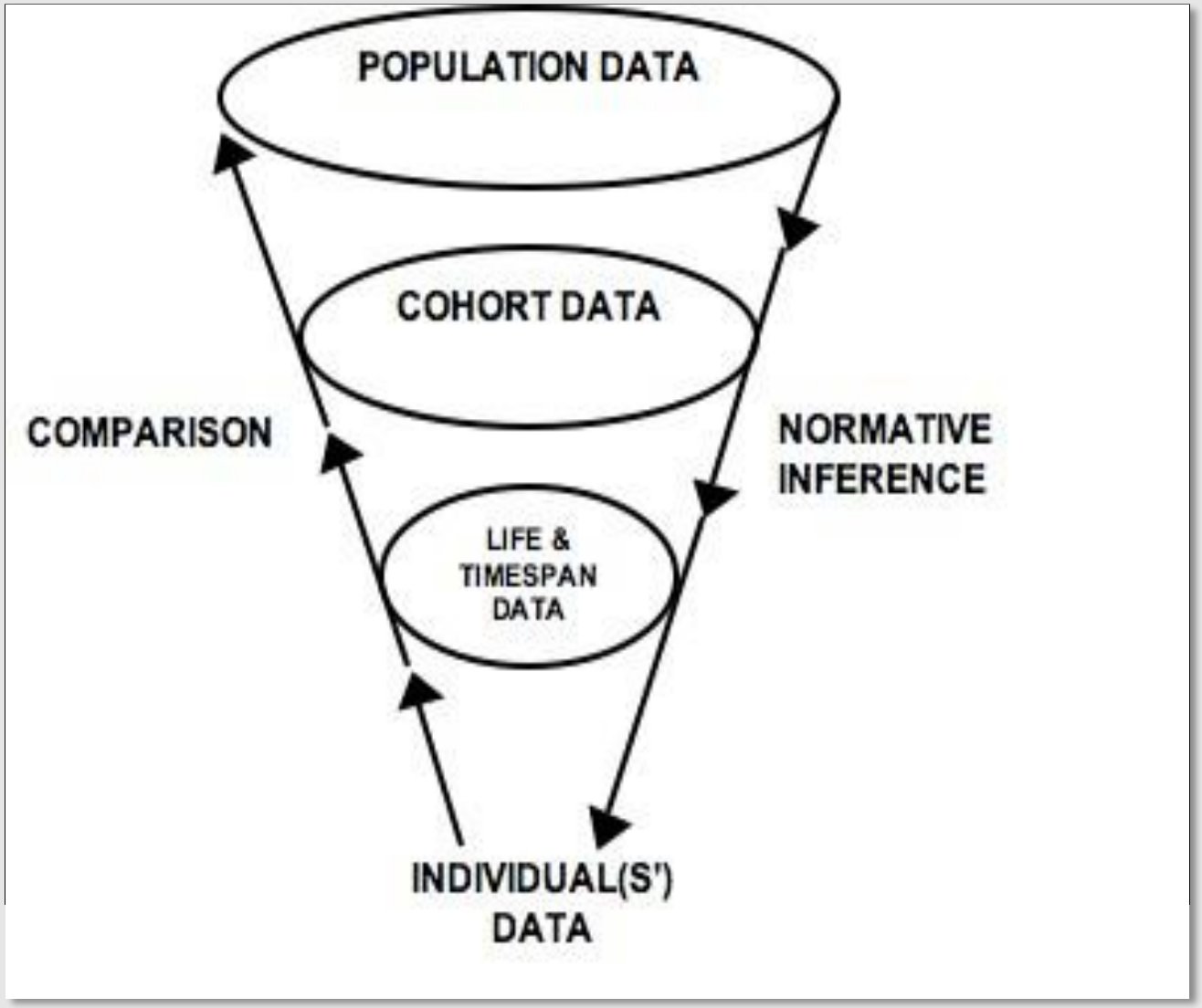
- Across domains
  - Cellular-to-social
- Across levels
  - Individual, cohorts, groups, populations
- Across geographic locales
  - Complete geo-spatial access
- Across time
  - Individual and historical timespans
- Across groups
  - Comparatively and normatively

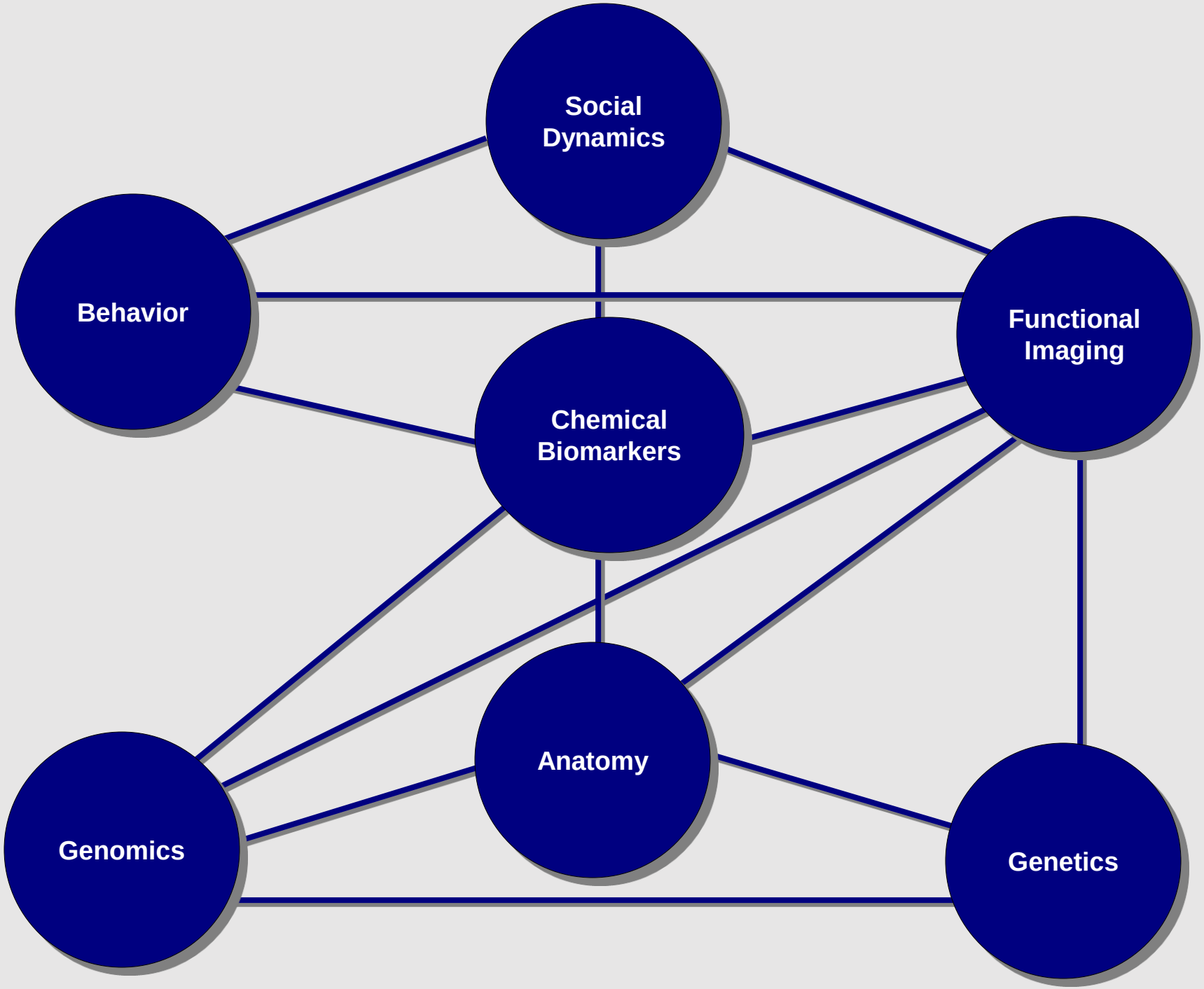


Individual Data

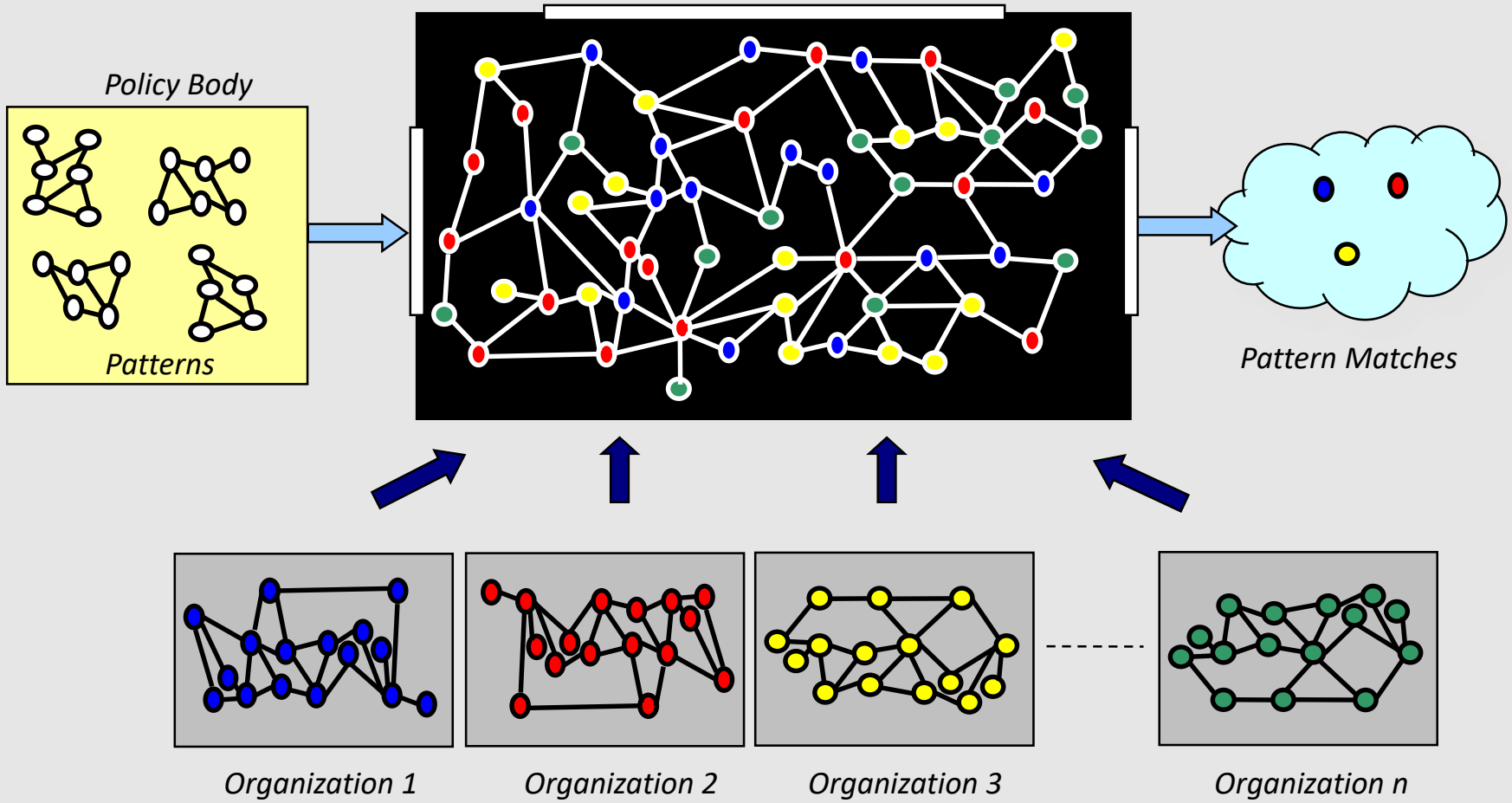


Group-analytic Data




Social Dynamics
Behavior
Functional Imaging
Chemical Biomarkers
Anatomy
Genomics
Genetics

The “Black Box” approach



Caveats

- If it’s assessable, it’s accessible
- If it’s tagged, it’s targetable
- *If it’s stackable, it’s hackable*
- What’s hackable is manipulable
- What’s controllable is corruptible

Engaging NeuroCyberS/T as a "Weapon"…

A.) *n*. (Old English) 1) "a means of contending against another " and 2) "…something used to injure, defeat, or destroy"

and

B.) An agent that…

1) *mitigates aggression and fosters thoughts and feelings of affiliation or passivity*; 2) incurs burdens of morbidity, disability or suffering and in this way "neutralizes" potential opponents, or 3) induces mortality

Weaponized NeuroCyberS/T

Tactical and Strategic Impact(s)

Effects

- **Proximate (Tactical)**
  - **Accessibility and use/misuse of data**
    - **Development of "precision pathologies"**

- **Intermediate (Tactical-Strategic)**
  - **Data modification**
  - **Public life effect(s)**

- **Distal (Strategic)**
  - **Economic impacts**
  - **Social impacts**
  - **Net impact on "New Global"milieu**

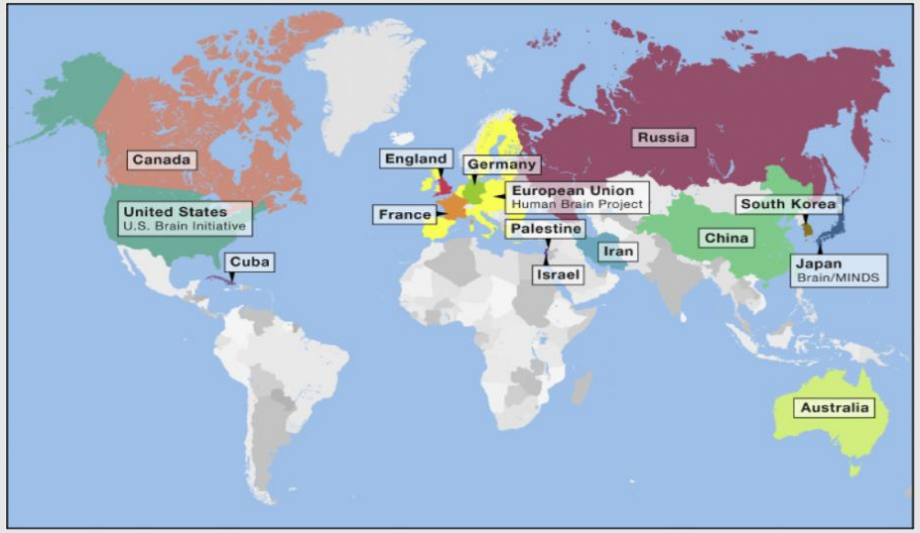
NeuroCyberS/T to Affect Opposing Elements

- **Weapon of Mass Destruction possible...**
  - **RDTE/Use in ways (e.g.- "precision pathologies")that "side-step" current BTWC, CWC**
- **<u>Weapon of Mass *DISRUPTION*</u>...**
  - **RDTE not necessarily bounded by BTWC/CWC**
  - **Highly effective; both non-kinetic and kinetic**
  - **Can be covert/non-attributable in use**
  - **Incurs "ripple effects" on/across scales and levels**

<u>See:</u> Giordano J, *Nat Def* , 2017; Giordano J, 'Neurotechnology, global relations and national security: Shifting contexts and neuroethical demands'; and: Wurzman R, Giordano, J. 'NEURINT and neuroweapons' ; In: Giordano J (ed.) *Neurotechnology in National Security and Defense*, CRC Press (2015).

NeuroCyberS/T on World Stage

- **Global NeuroS/T Economic Predictions 2020**
  - **China (on pace to out spend U.S. by an order of magnitude over the next 10 years)**
    - **Predicted 60-68% increase in RDTE by 2025**
    - **Predicted 50-53% market share by 2025**
  - **Russia**
  - **Iran**
  - **North Korea**
  - **Virtual nations**
  - **Non-state actors**



Lack of focus and commitment on our part provides exponential growth opportunities for others

Core Questions and Issues

- **What do we do *with* the information and capability we have?**
- **What do we do *about* the information and capability we don't?**
- **Given what *can* be done, how do we (and who will) decide upon what *should* be done?**
- **Will be able to do what we decide we should?**

“Preparedness Process”

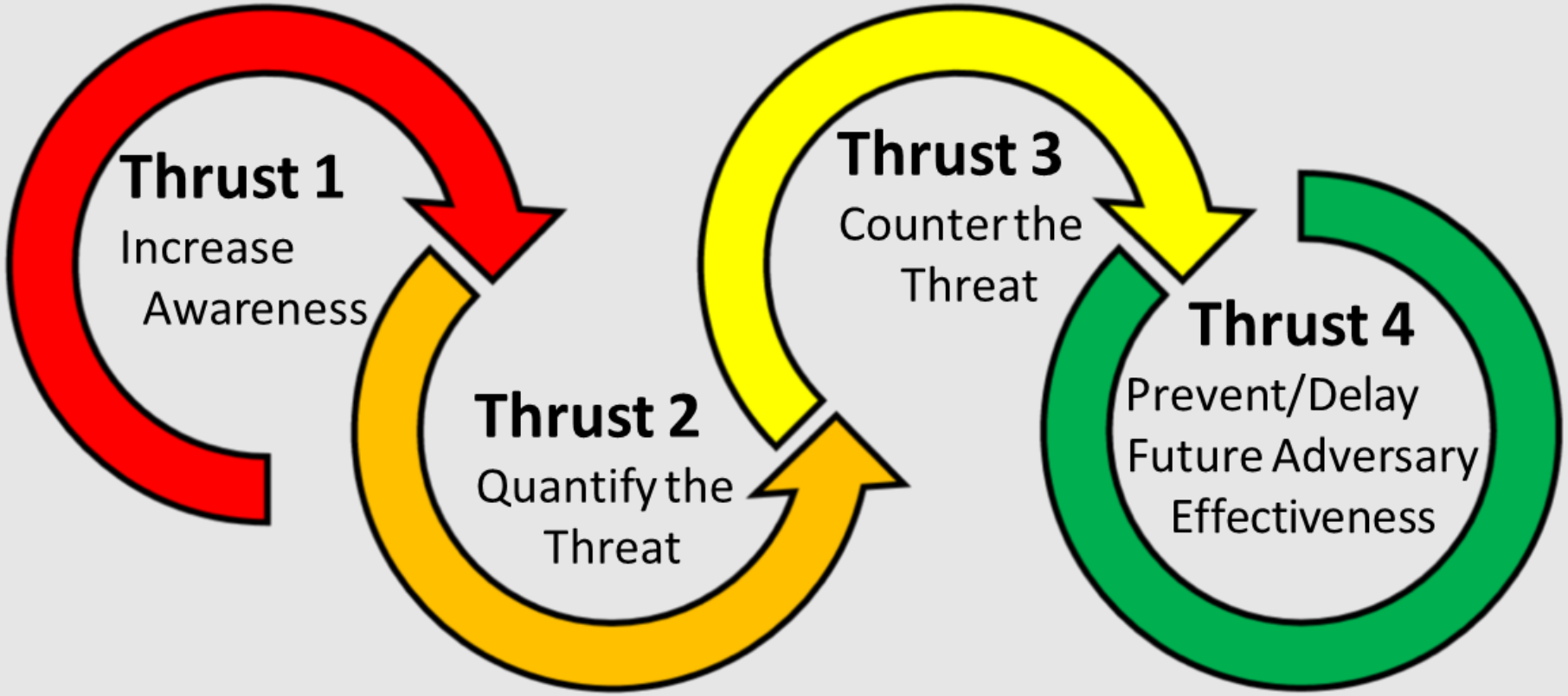
- **Identify risk scenarios that evolve from specified events**
- **Craft strategies for preemption, preparation, response, and amelioration**
- **Examine (setting, exploring, and exploiting) conditions at the operational level, across all elements, and the physical, cognitive and informational domains**
- **Create strategies that are relevant, durable, and can be targeted for demographics and psychographics in the face of severe cultural impact**
- **Identify/plan a robust framework to remain effective and adaptive to a changing environment as risks and society (co-)evolve**.

Key Steps

Core premise: Need for NeuroCyber Tools & Methods

- **Need for NINA now (see Kostiuk, 2012)**
- **Need for programmatic neurobiocyber-security**
- **Need for ongoing surveillance (of field and RDTEU loci/foci)**
- **Need for discourse/dialog**
- **Need for communication**

Four Thrust Strategy



Necessity of a Whole of Nation approach to identify, characterize, counter, and exploit/prevent emerging technologies that threaten or erode United States' security and stability

Thrust 1
Increase Awareness

Thrust 2
Quantify the Threat

Thrust 3
Counter the Threat

Thrust 4
Prevent/Delay Future Adversary Effectiveness

Academic Institutions

Law Enforcement

Department of Defense

Research Centers

DHS

DHS

National Labs

State Department

Intelligence Community

Industry

Intelligence Community

Summary

- **Current NeuroCyberS/T growing exponentially: clear and present danger to U.S. national security and stability**
- **Identified risk/threat should prompt:**
  - **Funded research in technologies, innovations, countermeasures, and solutions**
  - **Capabilities to address and defeat evolving kinetic and non-kinetic threats**
  - **Remaining ahead of competitors'/adversaries' abilities to exploit U.S.**
  - **Whole of Nation approach for leveraging all sectors of national power**

"Victorious warriors win first then go to war, while defeated warriors go to war first then seek to win."

Sun Tzu

Additional Information

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