Re-engineering Collaborative Mechanisms and Knowledge Networks to Accelerate Innovation for Alzheimer’s

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Unlocking Global Collaboration to Accelerate Innovation for Alzheimer’s
Oxford, 20-21 June 2013
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Drivers of Key Inflection Points for AD Research, Accelerated Innovation, & Care Models Require Policy Shifts

- Re-engineering Clinical Research Ecosystem
- Convergence and the “New Biology”
- Next-generation “Enabling Tools Revolution and Platforms”
- Aligning Science and Biomedicine with “Challenge-driven Innovation” and the “Knowledge Triangle” : Problem-driven, Tool-based, and Solutions-oriented
- Big Data and Knowledge Networks and Markets
- Patient-centered Approaches from the Outset
- Global Solutions & Local Knowledge
Re-Engineering the Clinical Research Ecosystem (10 years on) (Grady 2004)
Convergence of the “New Biology” with Physical Sciences & Engineering + Redrawing the Boundaries for Accelerating Research and Translation = Foundational Shift for AD and Biomedicine over next 20 years
New Enabling Tools and Platforms Required to Traverse the Scales (and Complexity) of the Brain – not to mention Innovative Care Models

(Donoghue, Brown Institute for Brain Science, 2013)
Aligning AD Research and National AD Strategies with National Innovation Strategies and new Business Models: New AD Initiatives Build on Open Innovation, Multi-directional S&T, University-Industry Partnering, Pre-competitive Consortia, Forward-looking IPR, and New Public-Private Collaborative Mechanisms to Enable Cutting-edge Research, Innovation, and Care Models
Challenge-driven Innovation: AD Research as a Foundation for *The Creative Destruction of Medicine* [in a good way] and Innovative Care Models

Eric Topol (2012)

**Transformation of Medicine**

Patient-driven needs require innovative research beyond traditional research paradigms

- **Expand the Research Agenda**
  - Social Science research matters
  - Risk Reduction strategies
  - Understanding support communities
  - Behavioral and lifestyle research

- **Non-technological innovation matters:** Risk reduction strategies, Best practices for Innovative Care, Innovation Models of support services
Big Data Changes (Almost) Everything --
The Fourth Paradigm (Gray 2009), the Internet of Things/M2M, Big Data Analytics, and Patient-centered Data Come Together in New AD Research, Collaborative Mechanisms, Patient Choice Options, and Healthcare Initiatives

The Age of Data:
From Data to Knowledge to Action

- Data-driven discovery is revolutionizing scientific exploration and engineering innovations
- Automatic extraction of new knowledge about the physical, biological, and cyber world continues to accelerate
- Multi-cores, concurrent and parallel algorithms, virtualization, and advanced server architectures will enable data mining and machine learning, and discovery and visualization of Big Data

Science Paradigms

- Thousand years ago: science was empirical describing natural phenomena
- Last few hundred years: theoretical branch using models, generalizations
- Last few decades: a computational branch simulating complex phenomena
- Today: data exploration (eScience) unifying theory, experiment, and simulation
  - Data captured by instruments or generated by simulator
  - Processed by software
  - Information/knowledge stored in computer
  - Scientist analyzes database/files using data management and statistics
Big Data: New Sets of Access, Diffusion, Ownership, and Re-Use Policy Issues

Range of Inter-related Issues

- Data Silos
- Governance
- Curation, management, and quality
- Privacy and confidentiality
- Data linkages
- Lack of standards, interoperability, data exchanges, common nomenclature
- Patient consent and research re-use
- Data, samples, and material transfers

The eMERGE Network = DNA biorepositories + Electronic Medical Records + GWAS studies + Results in Clinical Care Settings
Rapid Growth of Knowledge Networks and Markets

OECD Knowledge Networks and Markets (2012)

Table 6. A proposed typology for Knowledge Networks and Markets

<table>
<thead>
<tr>
<th>Defining feature</th>
<th>Knowledge object</th>
<th>Core/salient types of KNMs</th>
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<tbody>
<tr>
<td>Sourcing / providing knowledge</td>
<td>Existing knowledge</td>
<td>(1) Searchable registers and data repositories</td>
</tr>
<tr>
<td></td>
<td>Create and co-create new knowledge</td>
<td>(2) Platforms for sourcing solutions</td>
</tr>
<tr>
<td>Sourcing / providing rights to knowledge</td>
<td>Existing knowledge</td>
<td>(3) IP-based marketplaces and intermediaries (E.g., patent market intermediaries, digital rights collecting societies)</td>
</tr>
<tr>
<td></td>
<td>Create and co-create new knowledge</td>
<td>(4) Standard setting bodies and consortia, accreditation bodies, etc...</td>
</tr>
<tr>
<td>Making knowledge transferable</td>
<td>All</td>
<td>(5) Infrastructures and intermediaries in the market for embodied knowledge</td>
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Source: OECD.
Building a Biomedical Knowledge Network for Basic Discovery and Medicine

Knowledge Network

- Molecular Characterization
- Electronic Health Records
- Clinical Discovery
- Observational Studies During Normal Course of Clinical Care

Basic Sciences Discovery

Informed Mechanistic Studies

Information Commons

- Expose
- Signs and Symptoms
- Microbes
- Genes
- Metabolites
- Other Types of Patient Data
- Individual Patients

Biomedical Research

- Target Identification
- Marker Identification
- Molecular Mechanisms

Taxonomic Classification

Validation

Clinical Medicine

Diagnosis

Health Outcomes

Treatment
Patient-centered from the Outset: Re-coupling Research and Technology with Patients, Families, and Support Communities

Banner Alzheimer’s Institute/NIA Experiment

New Alzheimer’s Prevention Registry recruiting 250,000 volunteers

March 28, 2013

People who have been touched by Alzheimer’s—in a parent, partner, grandparent, or friend—know the challenges and sadness of this devastating disease. Many also wish to take action in the fight against the disease. Now, a new initiative offers a way for this group of family members, friends, and others to help combat Alzheimer’s in a direct and meaningful way.

The Alzheimer’s Prevention Registry (www.endalznow.org), launched in October 2012 by the Banner Alzheimer’s Institute, is a new online community of people who want to help scientists find treatments to slow, halt, or prevent the memory-robbing disorder.

Reintegrating Technology Innovation, Social Needs, and Patients (Maynard 2013)
AD is a Global Crisis: Addressing the Growing Burden in Low- and Middle-Income Countries

The growth in numbers of people with dementia in high income countries and low and middle income countries

10/66 Dementia Research Group: more than 2/3 of dementia patients but < 10% of the population-based funding
But New Global Opportunities to Leverage Global Solutions & Local Knowledge/Contexts

G8 dementia summit

Press release

UK to use G8 to target global effort on dementia

AD Innovation, Financial Infrastructure, Portfolio Theory, and Global Securitization (Andrew Lo, MIT - 2013)

Innovation Requires Financial Infrastructure!
- Private investment
- Accounting, legal, regulatory structures
- Systemic stability
- Well-functioning capital markets
- Proper design of securities

⇒ Incentives to Motivate Action

Fear Works Faster; Greed Is More Sustainable
Research Collaborations Broaden and Deepen

- Industry partners (20)
- Philanthropic partners
- Foundation of the NIH
- National Institute on Aging
- Acquisitions Sites (59)

Data Sharing, Disease Modeling and Biomarkers to Accelerate the Development

COALITION AGAINST MAJOR DISEASES
Public Announcement June 11, 2010

Embargoed for
12:01 a.m.
Friday, June 11, 2010

Contact:
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PUBLIC RELEASE OF ALZHEIMER’S CLINICAL TRIAL DATA BY PHARMACEUTICAL RESEARCHERS
First Combined Pharmaceutical Trial Data on Neuro-degenerative Diseases;
Shared Resource from Unique Public-Private Partnership Will Help Accelerate Alzheimer’s, Parkinson’s, and Other Brain Disease Research

Washington, DC – A new database of more than 4,000 Alzheimer’s disease patients who have participated in 11 industry-sponsored clinical trials will be released today by the Coalition Against Major Diseases (CAMD). This is
Global Business Becomes a Major Player and Partner
Comprehensive Regional Initiatives – e.g., Europe

European Innovation Partnership on Active and Healthy Ageing

About the Partnership
The Partnership brings together a wide array of stakeholders to work in a collaborative way on shared interests and projects geared towards achieving common goals and promoting successful technological, social and organisational innovation.

Innovative actions
The Partnership’s Strategic Implementation Plan identifies 14 priority areas. Six actions have now started.

Horizon 2020
The Framework Programme for Research and Innovation

JPND Research
EU Joint Programme – Neurodegenerative Disease Research

The Dementia Challenge
Fighting back against dementia
Patient-driven Strategies and Venture Philanthropy

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<th>Key private sector partners have made important commitments to support the BRAIN Initiative. We encourage companies, universities, and philanthropists to get involved.</th>
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**PARTNERS**

- **$60 MILLION ANNUALLY**
  - The Allen Institute for Brain Science
- **$30 MILLION ANNUALLY**
  - Howard Hughes Medical Institute
- **$4 MILLION ANNUALLY FOR 10 YRS**
  - Kavli Foundation
- **$28 MILLION**
  - Salk Institute for Biological Studies

**GOALS**

- Understand how brain activity leads to perception, decision making and ultimately action
- Develop new imaging technologies and understand how information is stored and processed in neural networks
- Provide the knowledge for addressing debilitating diseases and conditions
- Produce a sophisticated understanding of the brain, from individual genes to neuronal circuits to behavior
1. Maximize OECD’s Role as the “Gold standard” Think Tank and Economic Bridge to Economics/Finance/Budget Ministries

The Reality of Alzheimer’s: Fiscal Nightmare and Barrier to Sustainable Economic Growth: If Dementia Were a Country, It Would be the World’s 18th Largest Economy

Developing the Economic Case for Investing in AD and the Need for a Global Financing Mechanism

Cumulative Costs of AD ~ €460 billion;
>1% of global GDP (and rising)

$20 Trillion
$15 Trillion
$10 Trillion
$5 Trillion

Source: Lewin Trajectory Report, Alzheimer’s Association
2. Create an OECD Global Policy Forum on National/Regional/Subnational Plans – leverage the OECD’s convening power on a global scale by creating a global policy hub

13 National Plans +

Complement Core Building Blocks such as JPND (Europe/Canada) and NAPA (U.S.)

- Best Practices, Infrastructure, Governance and Accountability
- Whole-of-government Policies (beyond Research only)
- Financing Mechanisms
- Multi-stakeholder Strategies
- Comprehensive Collaborations
Develop a Global “Network of Networks” to Enable Comprehensive Collaboration and Policy Coherence

Leverage extensive OECD expertise on new Innovation Modes, Knowledge Networks, Business Models, and Virtual Organizations

• Scaling for optimal impact
• Compression of time scales/cycle times (“Silicon Valley time” rather than academic/government ministry time cycles)
• Optimization
• Prioritization
• Impact assessments and metrics

Combined with OECD-facilitated Global Databases

• International Database of Shared Research Infrastructures for AD
• Network of Global AD Database Linkages
• Database of International R&D Collaborations in AD
3. Focus on Innovating Regulatory Governance and Regulatory Science: an OECD “Berlin 2.0” Process

Intervention for Alzheimer’s Patients with Clear Symptoms is Too Late to Get Clinical Benefit?

- Target population for future trials
- Patients enrolled in clinical trials

Symptoms
- Preclinical
- MCI
- AD

Neuronal injury

Amyloid deposition

10~20 years

Pairing Clinical Trial Design; End-Point Selection; and Genomics/Biomarkers

Disease Stage
- Subtle cognitive deficits alone
- Detectable functional deficits
- Increasing cognitive deficits
- Dementia

FDA Approval
- Accelerated, based on an effect on cognition
- Standard, based on a single combined measure of cognition and function (e.g., CDR-SB)
- Standard, based on coprimary measures of cognition and function or global rating

Potential Regulatory Pathways in Early Alzheimer’s Disease.
4. Develop Financing Toolkits and Mechanisms to Leverage Public-Private Funding, to Attract Risk Capital, and to “De-Risk” Research & Innovative Care Models
5. AD and Big Data Technical Roadmap: Standards, Validation, Measurement, Interoperability, Data Transfer Protocols

Why a Standards-driven Roadmap? Proven Approach in other Complex, Cumulative, Integrated Domains

- Standardized Information Commons
- Global-scale patient registries
- Facilitating trans-border data flows and database linkage technical policy issues
- Best practices for pre-competitive data sharing, access & diffusion

Biomarkers as a Case Study building on OECD 2010-2012 work programs and analysis

Technology Roadmap

- Program design and metrics
- Governance structures
- Interoperability and collaboration
- Financing Modes
- Strategic Policy Mix for PPPs
- Globalization of PPPs

Diagnostics

- Establishment of biomarkers

Academia

Government

Pharma Industries

Medical Institution

Payer

Patients

Policy

- Social implementation of preemptive intervention

Healthcare Budget

- Assure access for care

Treatments

- Develop disease modifying drugs

Social Acceptance

- Ethical issues of early diagnosis
Thank You!

“Knowing is not enough; we must apply.
Willing is not enough; we must do.”

—Goethe

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