Global Alliance
for Genomics & Health

Collaborate. Innovate. Accelerate.

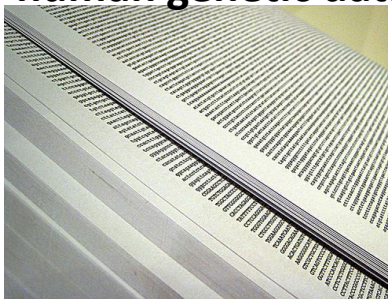
Lessons learned from GA4GH

Peter Goodhand
Executive Director, GA4GH
President (Interim), OICR

The Challenge

Global Alliance for Genomics & Health

Unparalleled generation of human genetic data



In a way that allows data to be shared on a global level

How do we unlock its potential?

Thus empowering new knowledge, new diagnostics and new therapeutics for patients and populations

Courtesy of Mark Lawler

The Challenge

Global Alliance for Genomics & Health

Data from **millions of samples** may be needed to achieve results and progress - showing patterns that would otherwise remain obscure.

That will take new methods and organizational models.

Historically:

- Data is typically in silos: by type, by disease, by country, by institution
- Analysis methods are non-standardized, few at scale
- Approaches to regulation, consent and data sharing limit interoperability

Don't act: an overwhelming mass of fragmented data, such as electronic medical records in many countries

Collective Action: achieve the interoperability of the www or global telecommunications – Smart phones.

LAUNCH A GLOBAL ALLIANCE – 2013

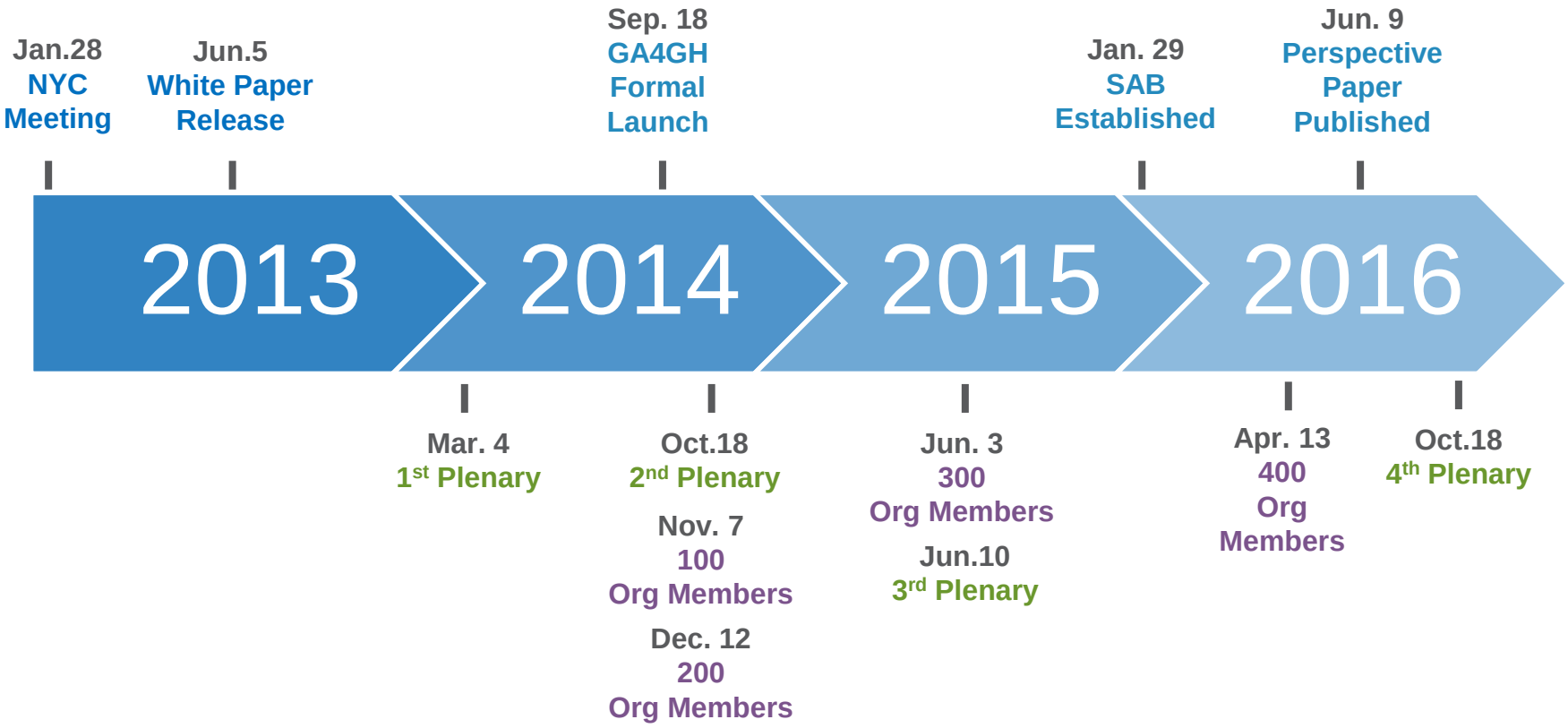
Mission

Global Alliance for Genomics & Health

To accelerate progress in human health by helping to establish a common framework of harmonized approaches to enable effective and responsible sharing of genomic and clinical data, and by catalyzing data sharing projects that drive and demonstrate the value of data sharing

Organizational Milestones

Global Alliance for Genomics & Health



Role

Global Alliance for Genomics & Health

Convene stakeholders

Catalyze sharing of data

Create harmonized approaches

Act as a clearinghouse

Foster innovation

Commit to responsible data sharing

GA4GH does not *directly*:

Generate or store data

Perform research or care for patients

Interpret genomes

Be exclusive to entities that have and share data

Overall approach

Global Alliance for Genomics & Health

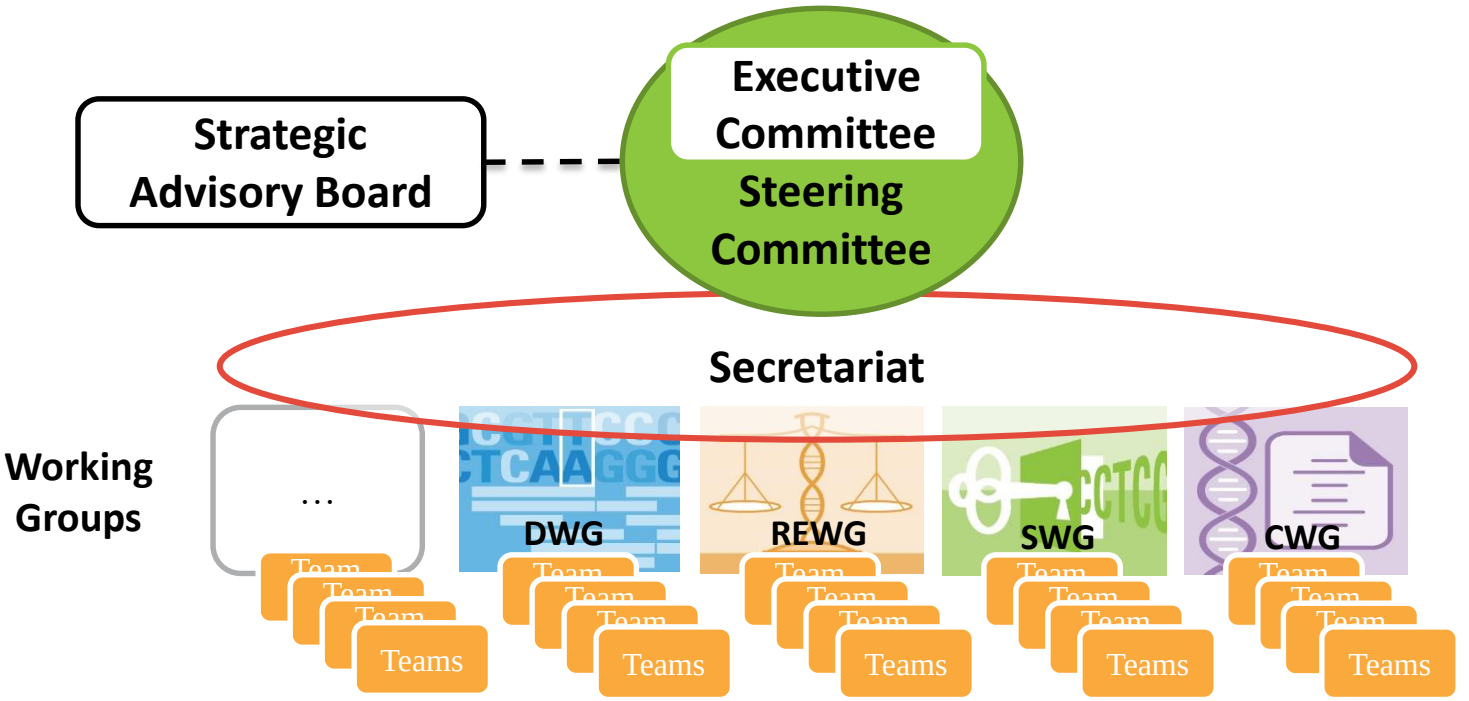
Work together **internationally** to ensure **interoperability** of data and of methods, to **harmonize** approaches to ethics and regulation, and to promote **participant** autonomy

Support pilots, reference implementations and data sharing **projects** that responsibly and effectively harmonize, analyze and share genomic and clinical data

Engage professional communities and the public; build **trust** and encourage appropriate sharing and learning

Organizational Model

Global Alliance for Genomics & Health




Beacon Project


Matchmaker Exchange


BRCA CHALLENGE


Cancer Gene Trust

Future Initiatives …

Demonstration Projects

GA4GH Strategic Advisory Board

Global Alliance for Genomics & Health

Harold Varmus
Weill Cornell Medicine
New York City, United States

Chair, Strategic Advisory Board

Agnès Buzyn
Haute Autorité de Santé
Paris, France

Member, Strategic Advisory Board

Francis Collins
National Institutes of Health
Bethesda, United States

Member, Strategic Advisory Board

Susan Desmond-Hellmann
Bill & Melinda Gates Foundation
Seattle, United States

Member, Strategic Advisory Board

Jeremy Farrar
Wellcome Trust
London, United Kingdom

Member, Strategic Advisory Board

Eric Lander
Broad Institute
Boston, United States

Member, Strategic Advisory Board

Michael Stratton
Wellcome Trust Sanger Institute
Hinxton, United Kingdom

Member, Strategic Advisory Board

Sharon Terry
Genetic Alliance
Washington D.C., United States

Member, Regulatory and Ethics Working Group
Member, Strategic Advisory Board

Membership

400+
Organizational Members

900+
Individual Members

70+
Countries

Global Alliance members include:

1. Universities and research institutes (32%)
2. Academic medical centers and health systems (10%)
3. Disease advocacy organizations and patient groups (5%)
4. Consortia and professional societies (6%)
5. Funders and agencies (6%)
6. Life science and information technology companies (41%)

Operations and funding

Global Alliance for Genomics & Health

- **Host institutions**
  - Ontario Institute for Cancer Research
  - Wellcome Trust Sanger Institute
  - Broad Institute of MIT and Harvard

- **Funding**
  - Working with major international funders (NIH, Wellcome Trust, Genome Canada/CIHR) to support and expand core funding
  - Outreach to other public and philanthropic funders to support reference implementations, pilots, and global reach

Funding

Global Alliance for Genomics & Health

Core

Three hosts – start up costs in 2012/13 and then ~$400K per year in 2014, 15, 16 - staff secondment.

Significant support from NIH in 2015 and 16 for plenary meetings and key activities at the Broad and OICR; WT support for Participant Engagement and Communications; Genome Canada/CIHR for regulatory and ethics and web.

Implementation and demonstration projects

BD2K support of UCSC (Haussler) including BRCA challenge; WT collaborative Grant to EBI; CIHR/GC CanShare grant to researchers on several projects; AZ/HVP; ELIXIR - Beacons (and tiered access)

Different mechanisms/timing, different OH, primarily national - **sustainability**

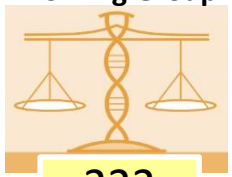
Volunteer Contributors

Global Alliance for Genomics & Health

Data Working Group

444

Regulatory and Ethics Working Group



222

Security Working Group

89

Clinical Working Group

117

Working Groups

Beacon Project — 82

Matchmaker Exchange — 49

BRCA CHALLENGE — 56

Cancer Gene Trust — 15

Demonstration Projects

GA4GH Tools and Solutions Deliverables

Global Alliance for Genomics & Health

Total GA4GH Deliverables: 55

Key Deliverables

Global Alliance for Genomics & Health

DWG

- Genomics API
- File Formats Standard
- Standard for DNA sequence reads

REWG

- Framework for Responsible Sharing of Genomic and Health Related Data
- Accountability Policy
- Privacy and Security Policy
- Data Sharing Lexicon
- Consent Policy

SWG

- Security Infrastructure
- Data Safe Havens

CWG

- Catalogue of Global Activities
  - eHealth
  - International Genomic Data Initiatives
  - Mendelian
  - Family History Tools
- Clinical Cancer Genome - Cancer Data Sharing
- eHealth Family History Tools Statement of Best Practice

Framework for Responsible Sharing of Genomic and Health-Related Data

Global Alliance for Genomics & Health

The *Framework* is currently available in 12 languages. Thank you to all the volunteers!

• Arabic	إطار لتبادل مسؤول للمعلومات الجينومية والمتصلة بالصحة
• Chinese	基因组学与健康相关数据负责任的共享框架
• French	Cadre pour un partage responsable des données génomiques et des données de santé
• German	Rahmenkonzept für die verantwortungsvolle Datenweitergabe genomischer und gesundheitsbezogener Daten
• Greek	Πλαίσιο για την Υπεύθυνη Κοινοχρησία Γονιδιωματικών και άλλων Ιατρικών Δεδομένων
• Hindi	जीनोमिकी और स्वास्थ्य संबंधी डेटा को उत्तरदायित्वपूर्ण रूप से साझा करने के लिए रूपरेखा
• Italian	Framework per la condivisione responsabile di dati genomici e relativi alla salute
• Japanese	ゲノム及び健康関連データの責任ある共有に関する枠組み
• Portuguese	Framework para Compartilhamento Responsável de Dados Genômicos e Relacionados à Saúde
• Russian	Концепция ответственного обмена данными и данными, связанными со здоровьем человека
• Spanish	Marco de actuación para el uso compartido responsable de datos genómicos y relativos a la salud

Catalogues of Global Activities

Global Alliance for Genomics & Health

eHealth: a catalogue to identify and aggregate global resources for sharing clinical and genomic eHealth data.	**86 Initiatives**
Family History Tool: a catalogue of family history tools currently available for documenting family health history information.	**23 Tools**
Mendelian: a catalogue of current activities for sharing data on Mendelian Genetic Disorders.	**39 Initiatives**
International Genomics Data Initiative: provides information on world-wide genomic data initiatives, including national precision medicine initiatives, data-sharing initiatives, databases and repositories, international genomics research consortia and projects, and other genomics data resources.	**89 Initiatives**

Current demonstration projects

Global Alliance for Genomics & Health

Through a series of **Demonstration Projects**, GA4GH is putting these tools to use in real-world settings to demonstrate the value of data sharing.

BRCA Challenge: aims to advance understanding of the genetic basis of breast cancer and other cancers by pooling data on BRCA genetic variants from around the world and expert-classifying variants in BRCA1 & BRCA2.
→ **www.brcaexchange.org**

Matchmaker Exchange: a federated network of databases whose goal is to find genetic causes of rare diseases by matching similar phenotypic and genotypic profiles.
→ **www.matchmakerexchange.org**

Beacon Project: open web service that tests the willingness of international sites to share genetic data.
→ **www.beacon-network.org**

Cancer Gene Trust: an online network for sharing somatic cancer genomic and clinical data from around the world.
→ **genomicsandhealth.org > Products & Projects > Demonstration Projects**

Goals of the Challenge

To improve the care of patients at risk of breast and ovarian cancer using global data sharing and collaboration in the analysis of *BRCA1* and *BRCA2*

1. Share *BRCA1* and *BRCA2* variants publically via a web portal
    1. Displays a curated list of BRCA variants, interpreted by expert consensus, to enable, without dictating, accurate clinical care
    2. Includes an environment for collaborative variant curation with access to evidence (e.g. phenotypes, family history, genetic data, and functional studies)
2. Address the social, ethical, and legal challenges to global data sharing
3. Create a model for all disease genes

HOME ABOUT VARIANTS HELP DEFAULT MODE COMMUNITY

search for "c.1105G>A", "brca1" or "IVS7+1037T>C"

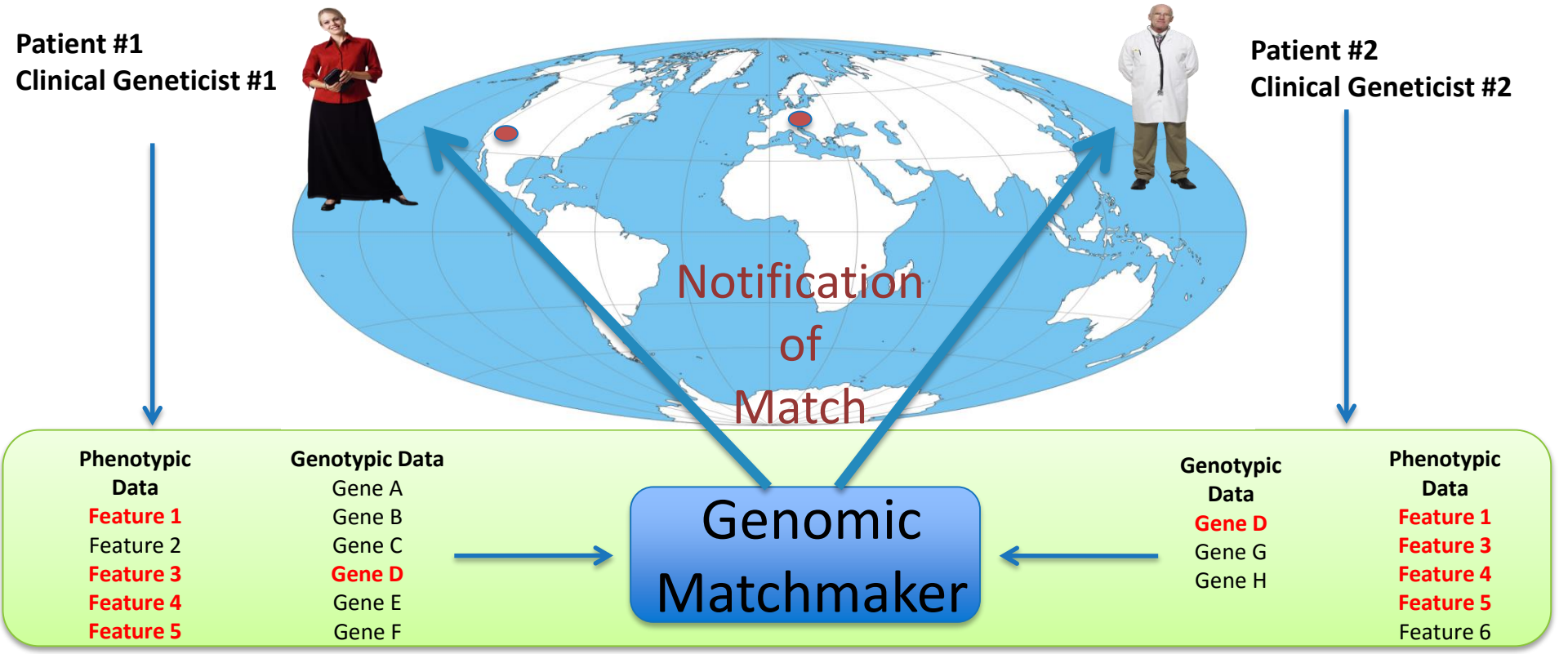
Just type in box above and use auto-complete to search for BRCA1 or BRCA2 variants. For more information about the BRCA1 and BRCA2 genes, genetic variation, and cancer, please click the *About* link at the top of the page.

This website is supported by the BRCA Exchange of the Global Alliance for Genomics and Health. The BRCA Exchange advances our understanding of the genetic basis of breast cancer, ovarian cancer and other diseases by pooling data on BRCA1/2 genetic variants and corresponding clinical data from around the world.

CIMBA
(The Consortium of Investigators of Modifiers of BRCA1/2)

brcaexchange.org

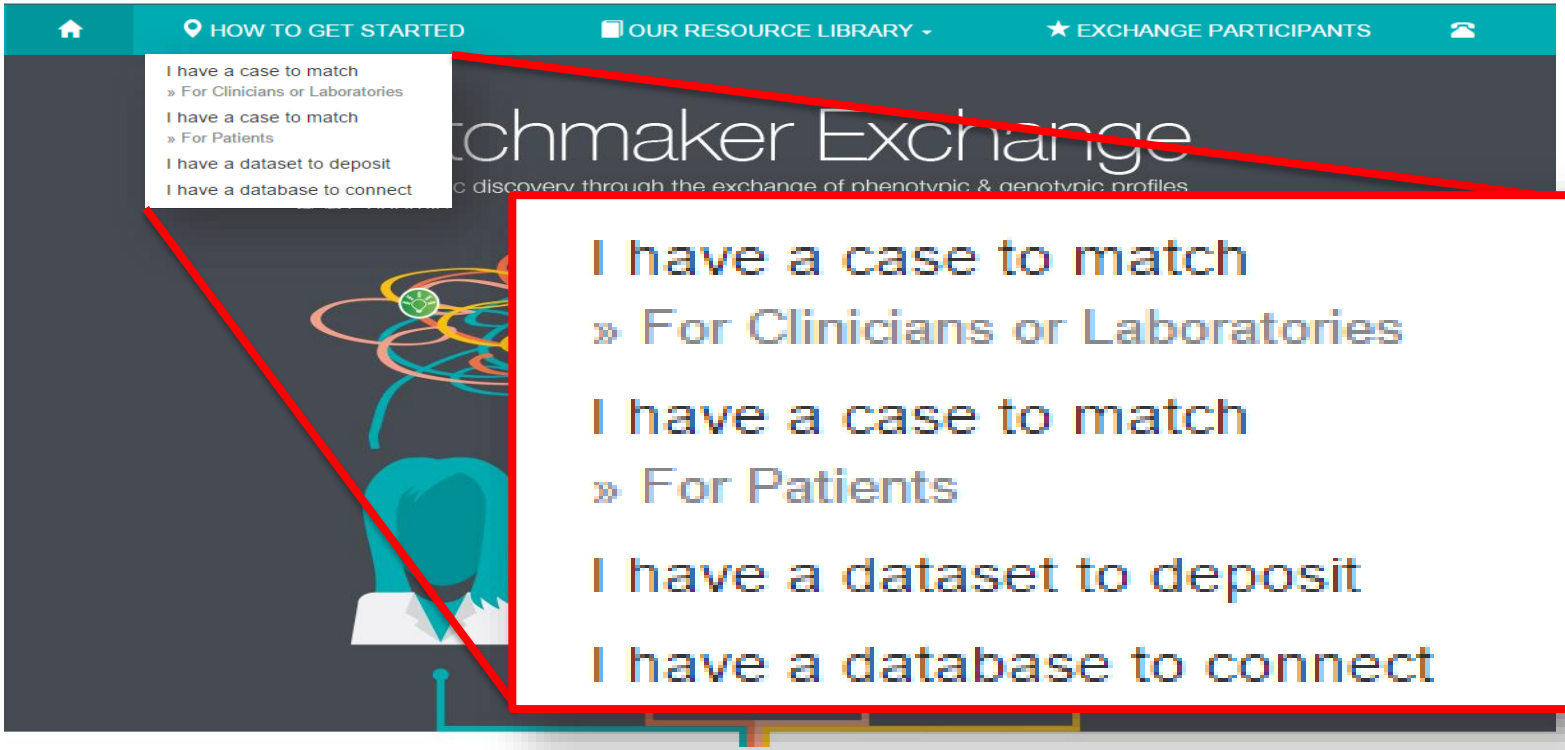
The Principles of Matchmaking



Courtesy of Joel Krier

The Matchmaker Exchange:

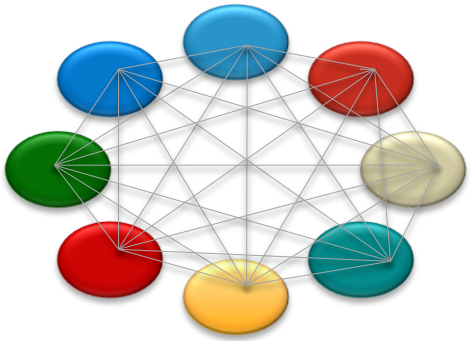
Connecting Matchmakers to Accelerate Gene Discovery



www.matchmakerexchange.org

Connected MME Services

Global Alliance for Genomics & Health



Federated Network

All databases connected through multiple APIs

Beacon – Data Discovery

Global Alliance for Genomics & Health

25+ Organizations

60+ Beacons

200+ Datasets

100K+ Individuals

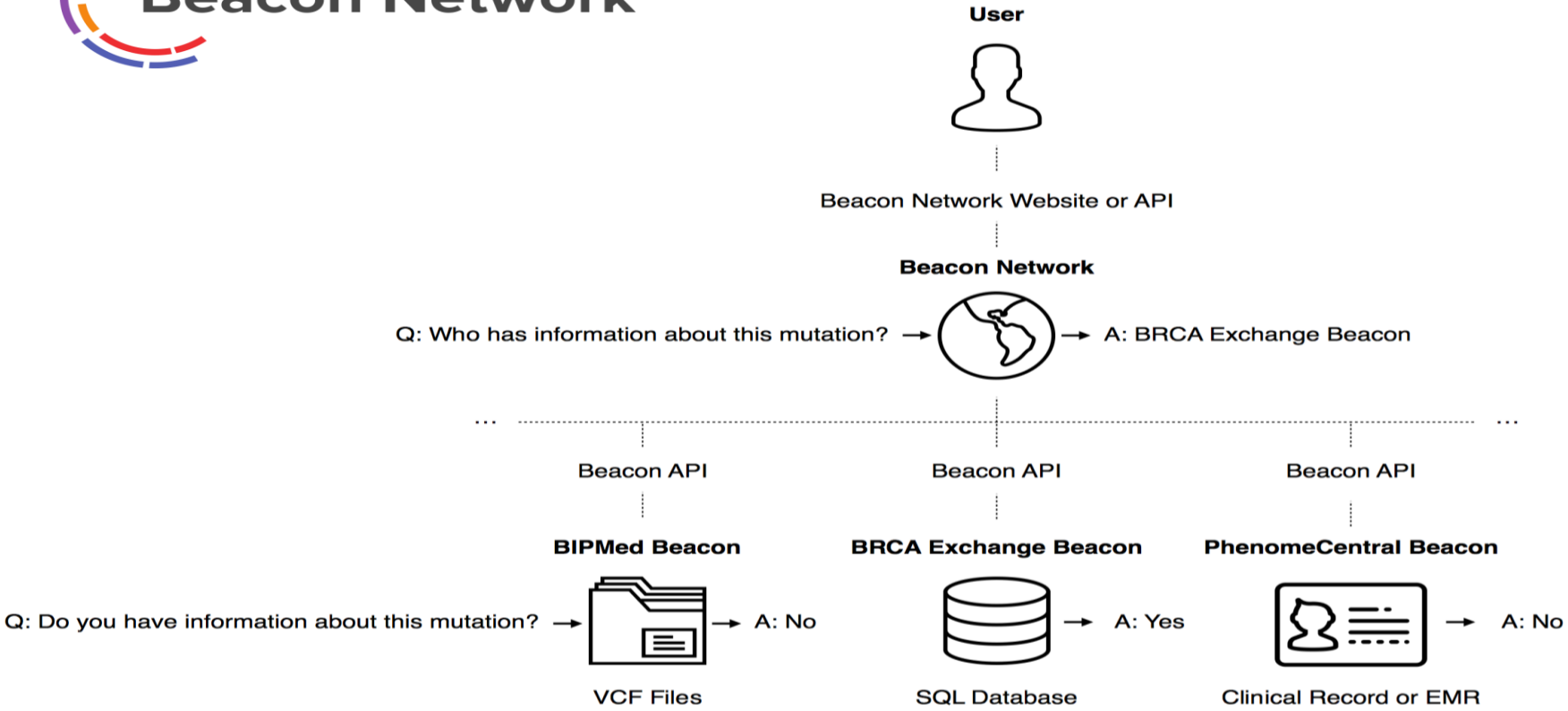







Beacon Network

Global Alliance for Genomics & Health



Variant Interpretation for Cancer Consortium (VICC)

OncoKB
Precision Oncology Knowledge Base
Annotation of Somatic Mutations in Cancer

Precision Medicine KnowledgeBase
Weill Cornell Medicine

CIViC
Clinical Interpretations of Variants in Cancer

Cancer bioMarkers-db
CANCER GENOME INTERPRETER

...

Global Alliance for Genomics & Health

Variant Interpretation for Cancer

- Gene
- Variant
- Cancer subtype
- Clinical implication: drug sensitivity, drug resistance, adverse response, diagnostic, or prognostic
- Source (e.g., PubMed identifier)
- Curation group

http://ga4gh.org/#/vic

ga4gh-dwg-vic@genomicsandhealth.org

VICC Co-chairs:

- Obi Griffith
- Nuria Lopez-Bigas
- David Tamborero
- Malachi Griffith

Goals/Principles:

- Clinical cancer variant interpretation
- Standards and guidelines
- Open content
- Interoperability

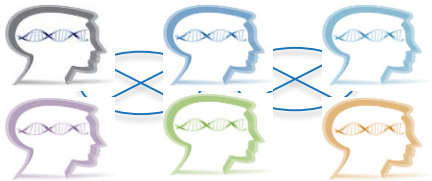
Challenges & Opportunities

Global Alliance for Genomics & Health

- The boundary between research and clinical care is blurring; opportunity for accelerated learning from Real World Data
- Linkage of **research and health data** is critically important but significantly increases the challenges and complexity of data sharing – particularly across **jurisdictional boundaries**…
- Patients attitudes to data sharing and research vary by disease and by culture – generally they trust their doctors

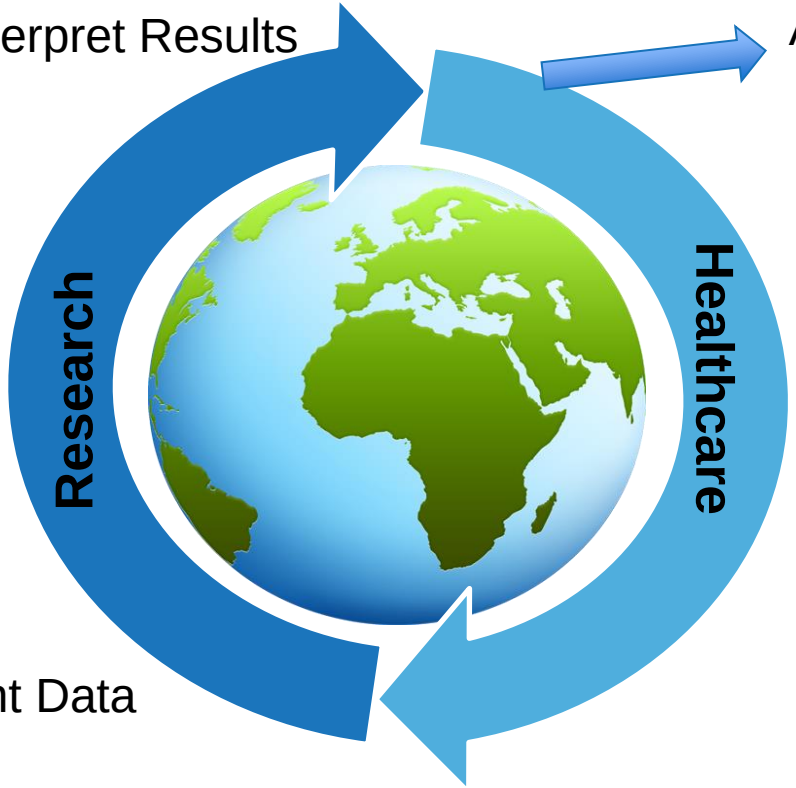
Coordination of eHealth Activities

1. HL7 Clinical Genomics workgroup (FHIR)
2. Global Genomic Medicine Collaborative (G2MC)
3. National Academies DIGITizE pilot
4. Precision Medicine Initiative
5. eMerge Network, IGNITE Network
6. ClinGen, Variation Modelling Collaboration
7. Healthcare Services Platform Consortium
8. Genetic Alliance
9. Other International groups (Genomics England, Swiss Institute of Bioinformatics, HUGO, HVP, HGVS, etc.)



Courtesy of Grant Wood

Learning Health System … or not



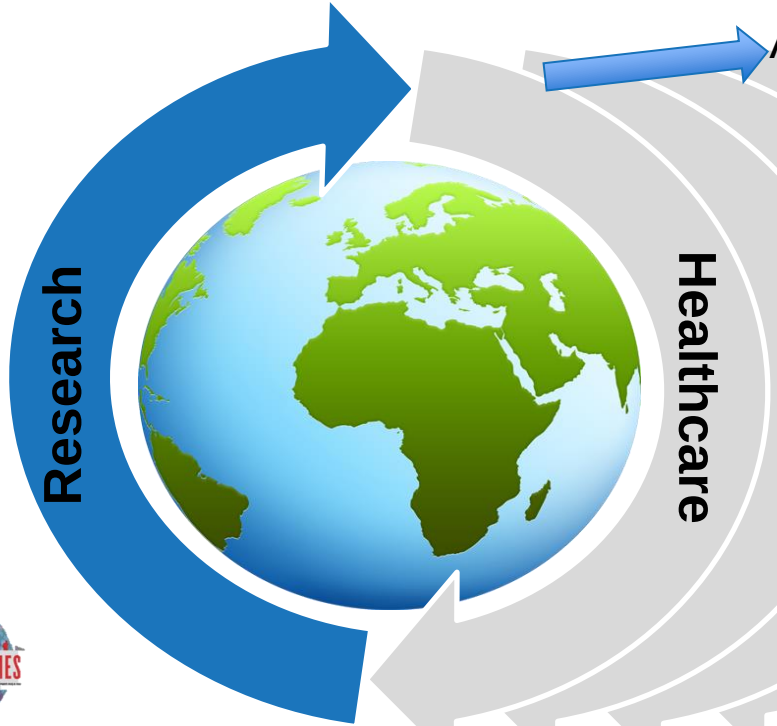
Global Health Learning ???

Human Genome Project (1990)

International HapMap Project (2002)

International Cancer Genome Consortium (2008)

1000 Genomes Project (2008)



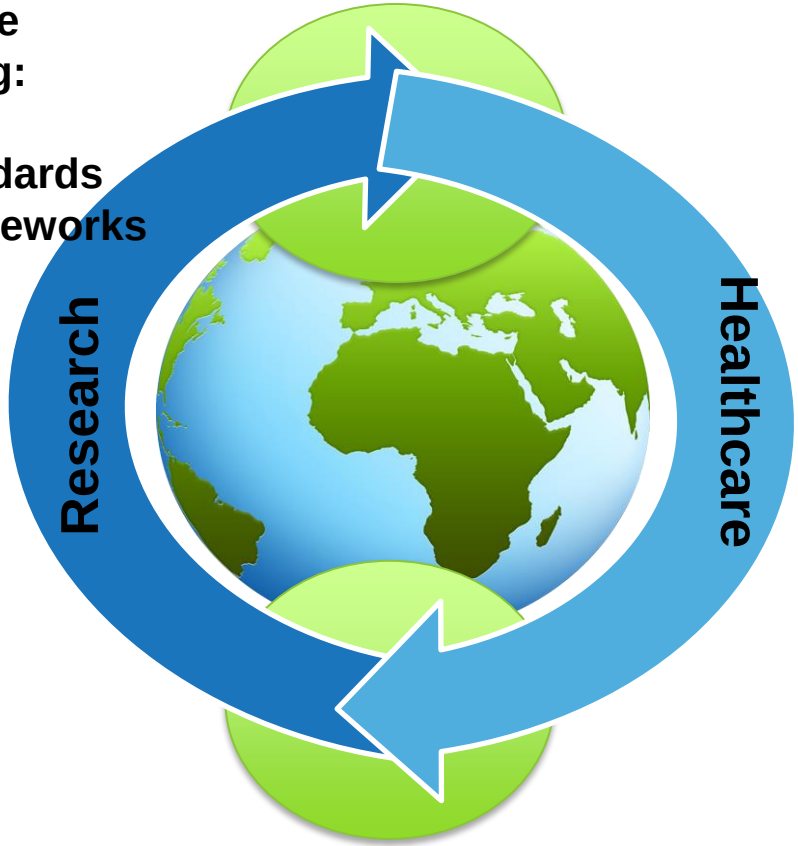
Academic Activities
- Journals
- Conferences

Jurisdictional Challenges:
- Health expenditures
- Legal systems
- Programming languages
- Infrastructure

Global Learning for Health

Interoperable Data Sharing:

- **APIs**
- **Standards**
- **Frameworks**



Genomic Knowledge Exchanges

BRCA CHALLENGE

Matchmaker Exchange

Cancer Gene Trust

Challenges & Opportunities

Global Alliance for Genomics & Health

- The boundary between research and clinical care is blurring; opportunity for accelerated learning
- Linkage of **research and health data** is critically important but significantly increases the challenges and complexity of data sharing – particularly across **jurisdictional boundaries**

Lessons Learned

- Interoperability through **API's** and, where appropriate, **standards**
- International data sharing by **federation** and use of **metadata** while respecting national/regional health data privacy and security requirements
- Data discovery is a pre-requisite to effective and expedient data sharing (send the question to the data)
- Genomic data is relatively simple compared to phenotype and FHx
- Beyond human scale - machine readable, machine learning

Global Health Implications

- Precision Medicine in High Income world and better Population Health in Low Middle Income world
- BOTH need Precision Understanding of the “Omics” of human health – based on global research and sharing rapidly and openly in knowledge exchanges

2016 and beyond

Global Alliance for Genomics & Health

- **Individuals** are key to **creating** the new tools, frameworks, enablers, solutions and opportunities
- **Organizations** are key to ensuring the **dissemination and adoption** of best practices and to support and reward responsible data sharing
- We need to **fully engage** with individuals and organizations in **all continents** to be truly global
- Great start up now need to **grow up -** structure, focus, roadmap and integration with major data sharing initiatives

Global Alliance
for Genomics & Health

Collaborate. Innovate. Accelerate.

Thank you