ARCHIMEDES

A pan-Canadian health care data platform

Alan Evans, PhD, OC, FRS, FRSC, FCAHS, FCAS
Montreal Neurological Institute/McGill University

UNIVERSITY OF OTTAWA HEART INSTITUTE
INSTITUT DE CARDIOLOGIE DE L'UNIVERSITÉ D'OTTAWA
MCIN MCGILL CENTRE for INTEGRATIVE NEUROSCIENCE
INTERCONNECTOME COEUR-CERVEAU BRAIN-HEART INTERCONNECTOME
McGill neuro uOttawa

ARCHIMEDES
www.archimedesdata.ca

The *Advanced Research Collaboration for Health Integration, Medical Exploration, and Data Synthesis* **(ARCHIMEDES)** is a **multimodal informatics infrastructure that provides users with access to curated and federated health data,** with open-access repository and advanced predictive analytics functionality

Harmonized Governance

Interoperable Infrastructure

Multi-modal Data Sharing

Healthy Brains, Healthy Lives

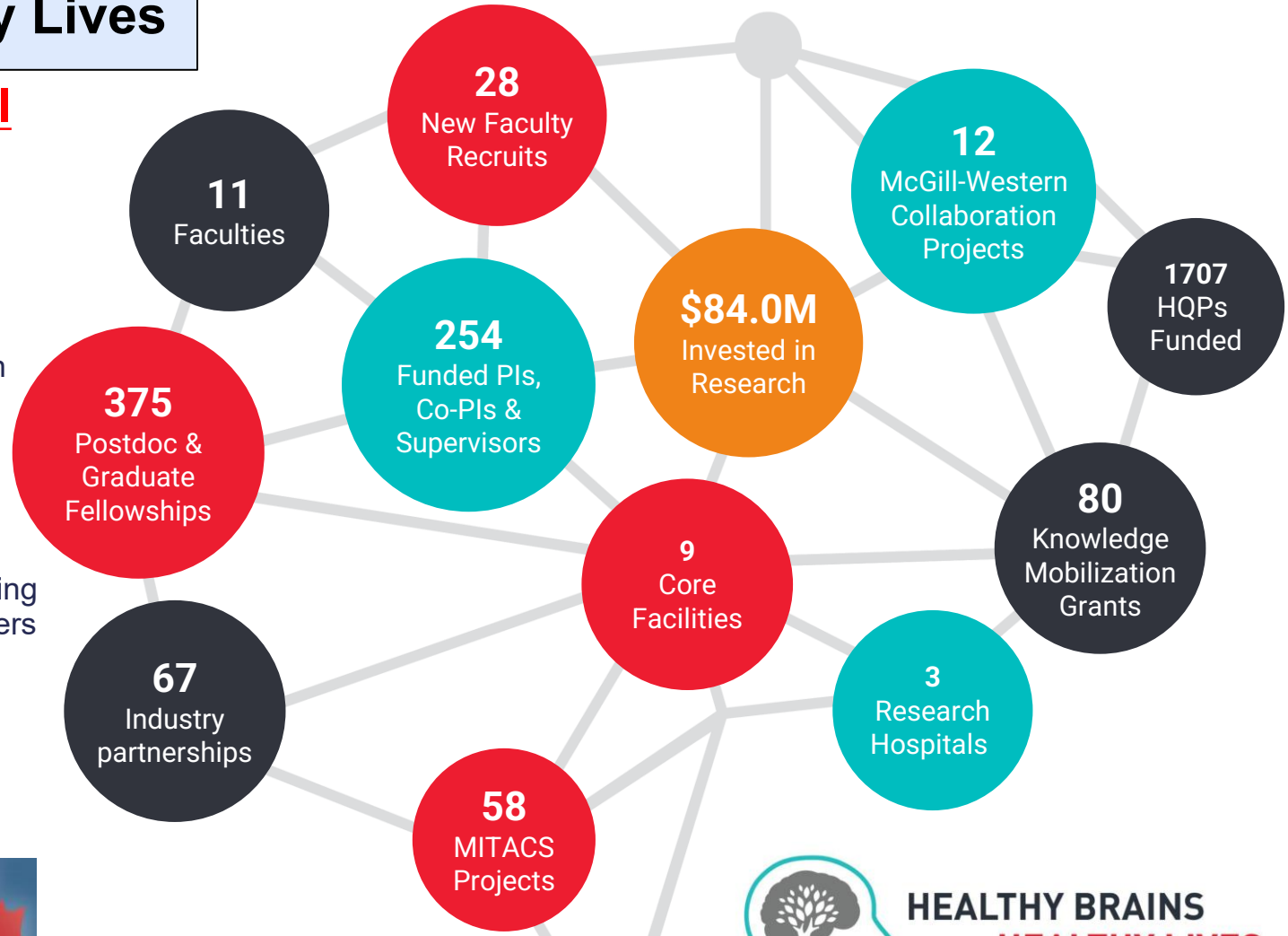
www.mcgill.ca/hbhl

Mission

Create global CoE in neuroinformatics
Translate discoveries to improve brain health

Themes

1. Neuroinformatics & Computational Modelling
2. Mechanisms of neurodegenerative disorders
3. Cognitive neuroscience of brain plasticity
4. Population neuroscience and brain health

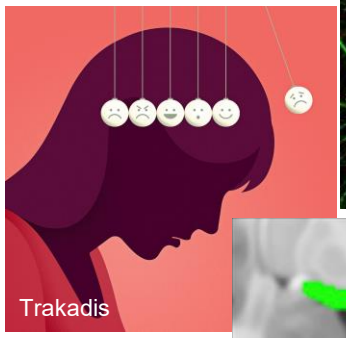


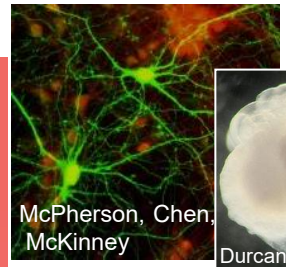
Canada First Research Excellence Fund

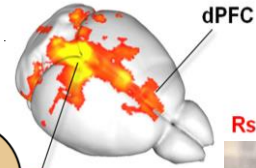
HEALTHY BRAINS HEALTHY LIVES

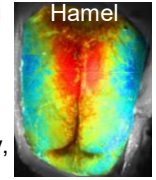
Theme 2: Mechanistic Models of Neurodegenerative Disorders

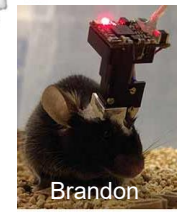
HEALTHY BRAINS FOR HEALTHY LIVES

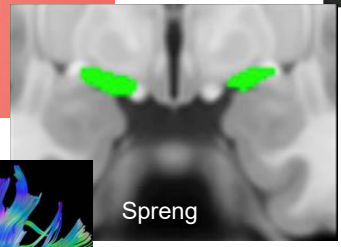


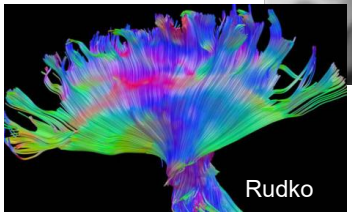






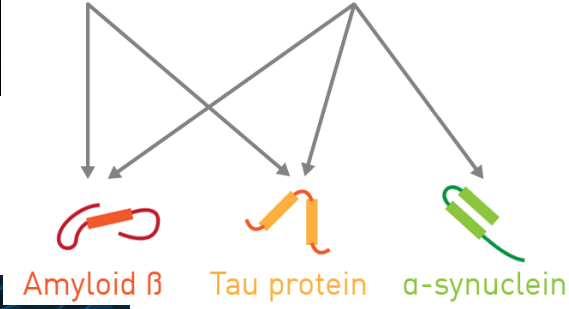


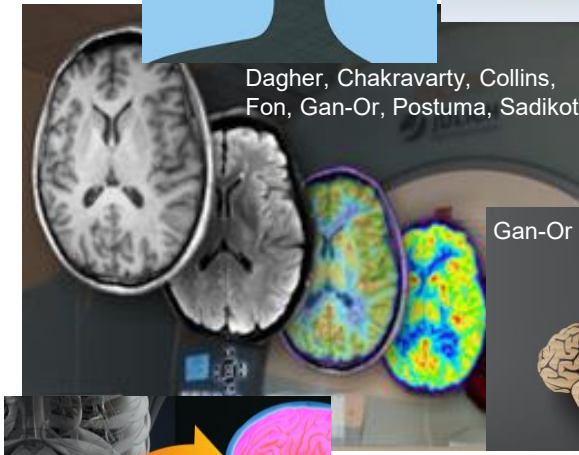


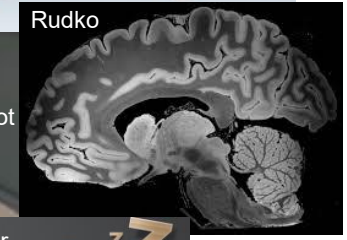


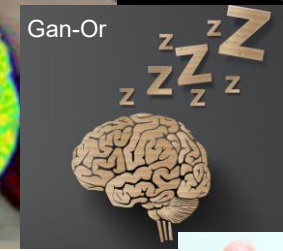
Alzheimer's Disease

Parkinson's Disease

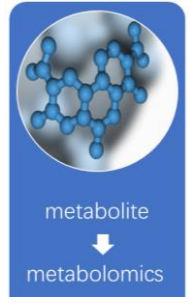


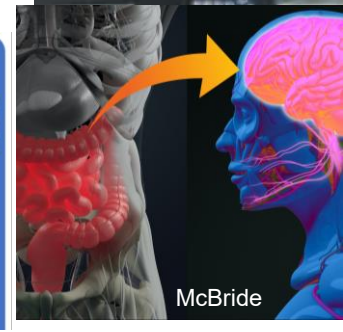






Trakadis

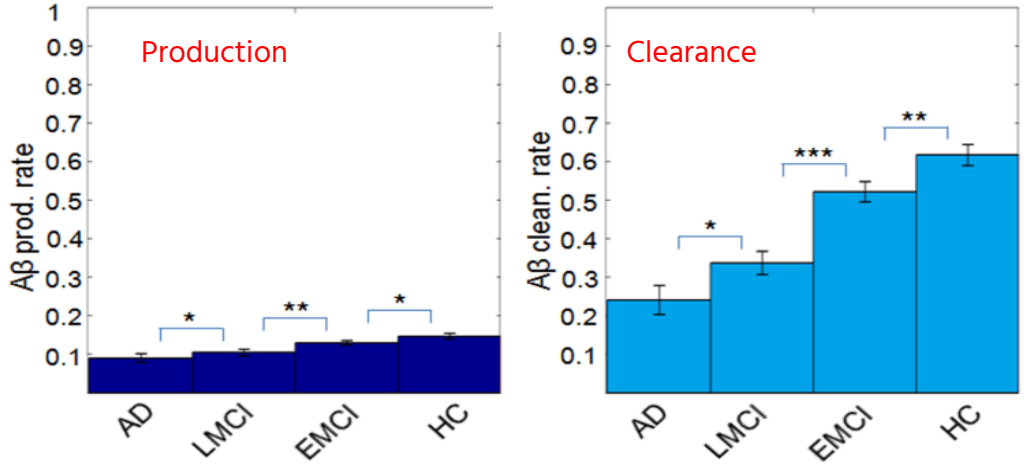




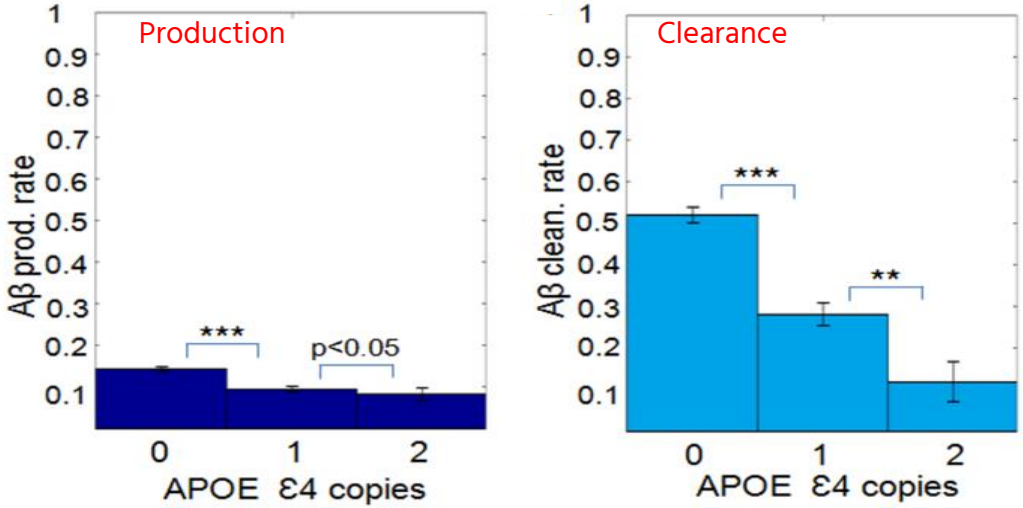
A_{β} Production and Clearance Rates from ESM model

HEALTHY BRAINS FOR HEALTHY LIVES

Clinical group



APOE ε4 alleles



Iturria-Medina Y,..,Evans AC PLoS Comput Biol (2014)

ARCHIMEDES leverages CFREF Investment and Innovation

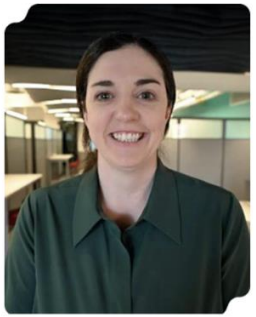
A Common Goal

HEALTHY BRAINS FOR HEALTHY LIVES

INTERCONNECTOME COEUR-CERVEAU BRAIN-HEART INTERCONNECTOME

Leadership Team

Dr. Jodi Edwards, PhD
Co-Chair



Dr. Kelly Cobey, PhD
Co-Chair

Dr. Alan Evans, PhD
Co-PI

Dr. Peter Liu, MD, FRCPC
Co-PI

Our Partners

UNIVERSITY OF OTTAWA HEART INSTITUTE
INSTITUT DE CARDIOLOGIE DE L'UNIVERSITÉ D'OTTAWA

uOttawa

INTERCONNECTOME COEUR-CERVEAU BRAIN-HEART INTERCONNECTOME

McGill

CFREF

Organ/disease-agnostic platform

Network

IT

HEALTHY BRAINS FOR HEALTHY LIVES

Neurology, psychiatry

BRAIN-HEART INTERCONNECTOME

Cardiology, neurology

ARCHIMEDES

https://archimedesdata.ca

CONP PCNO

pan-Canadian data/tool-sharing

C-BIG

Open tissue biorepository

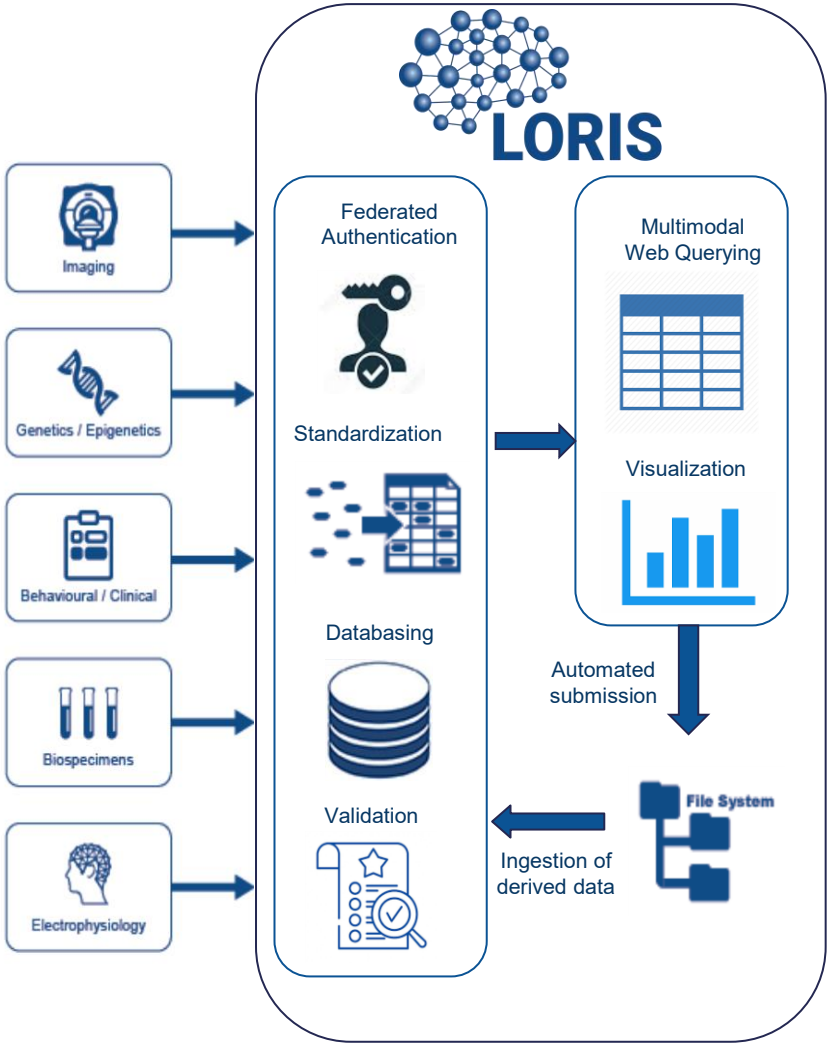
LORIS

Multi-modality, multi-site database

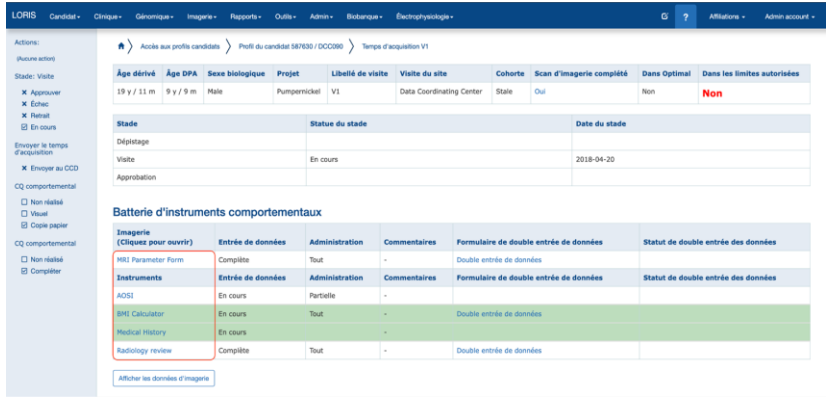
cbrain

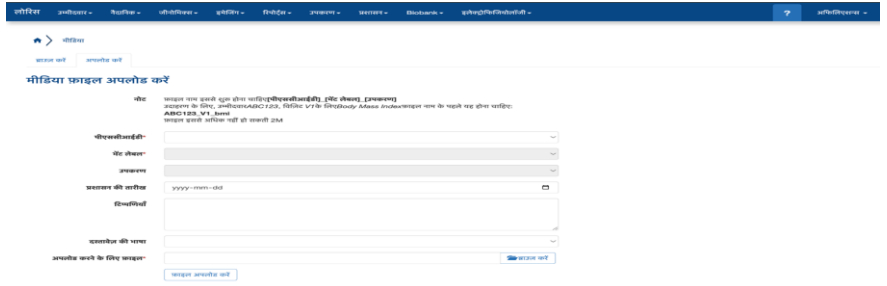
HPC/cloud analytics portal

Multi-modality, multi-lingual, multi-timepoint, multi-site



English, French, Japanese, Hindi, Chinese





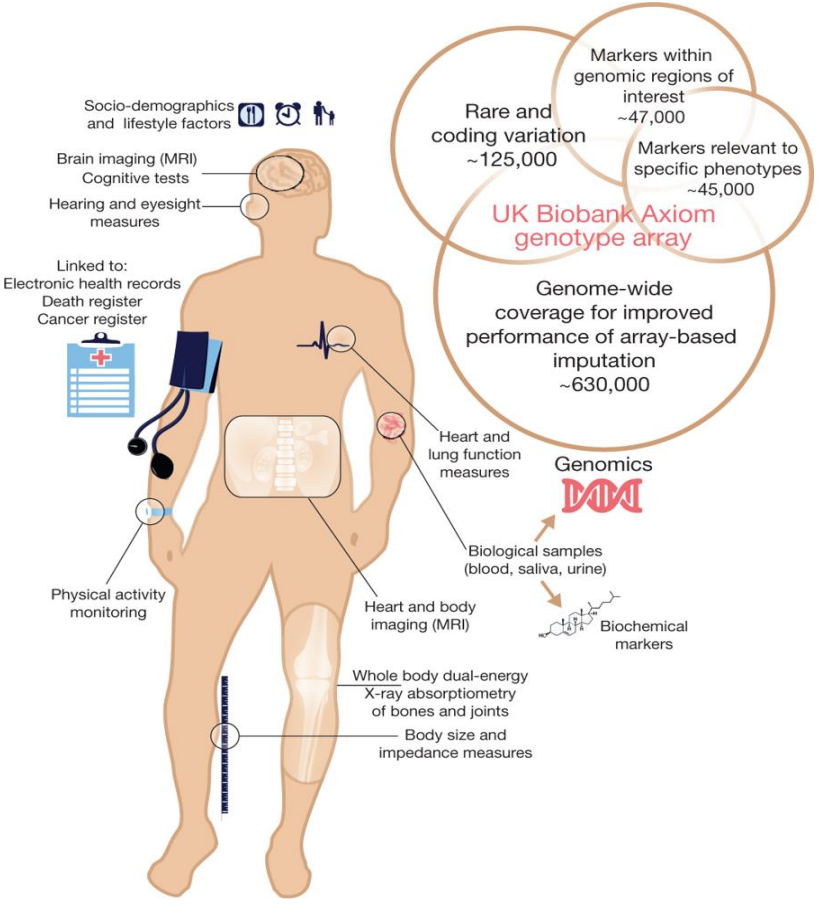
UKBiobank at HBHL

- Prevention, diagnosis and treatment of a wide range of illnesses
- ~500K people (54% Female, 94% White ; Age 37-81 → 57 ± 8.2)
- First large sample genotype, deep phenotype, brain imaging

- **Quantitative**
  - Genomics → 488K
  - Brain MRI → 40K
  - Heart MRI
  - Abdominal MRI
- **Demographic**
  - Primary demographics
  - Early life
  - Education and employment
  - Geographical and location
- **Health**
  - Self-reported medical conditions
  - Cognitive function summary
  - Diet and alcohol summary
  - Linked health outcomes
  - Mental health
  - Physical measure summary

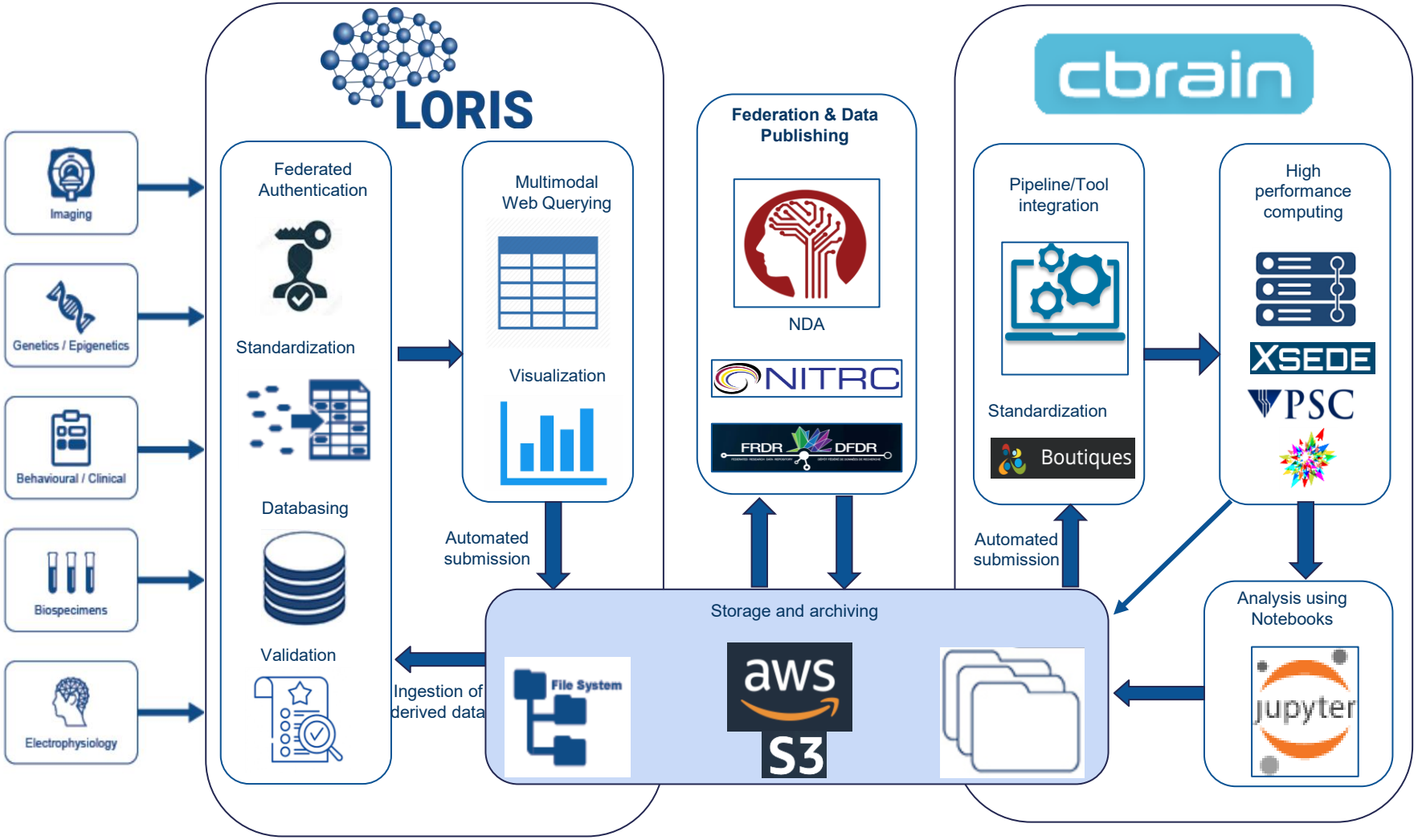
Brain MRI (N ~ 40,000)

- Structural MRI -T1
- Structural MRI -T2/FLAIR
- Susceptibility weighted brain images
- Multiband diffusion brain images
- Functional brain images - resting
- Functional brain images - task



Bycroft, Clare, et al. "The UK Biobank resource with deep phenotyping and genomic data." Nature 562.7726 (2018): 203.

HEALTHY BRAINS
HEALTHY LIVES

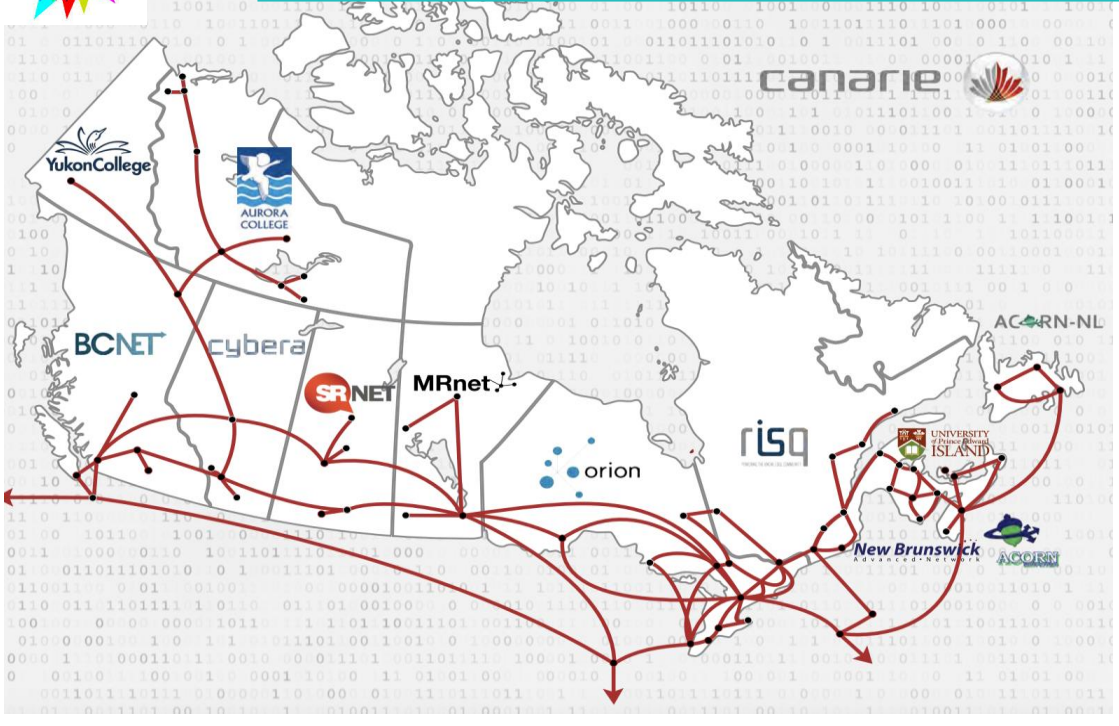


cbrain

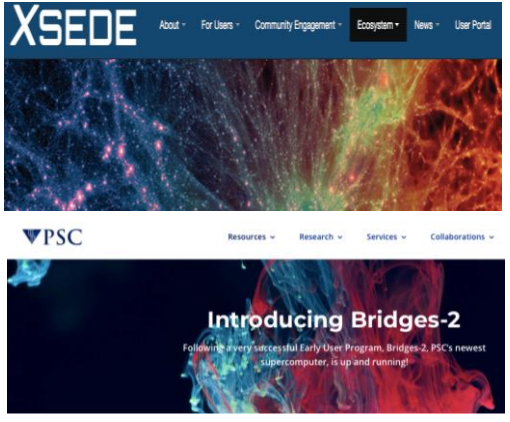
National

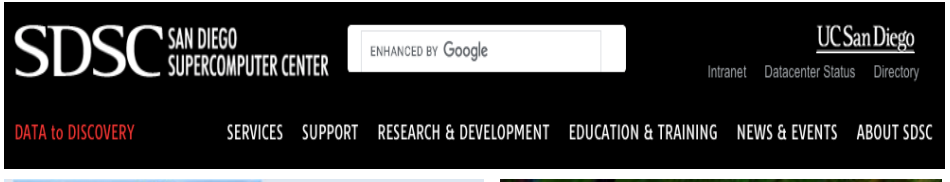
compute canada | calcul canada

Computational Resources provided by Compute Canada
~7 million CPU hours per year
8 PB of storage



International

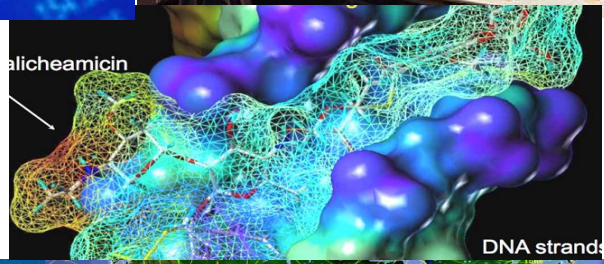


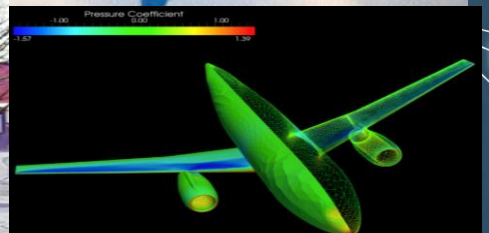


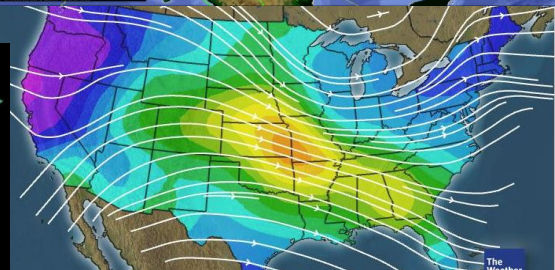
Hydro Québec

TMX Montréal Exchange

CBRAIN





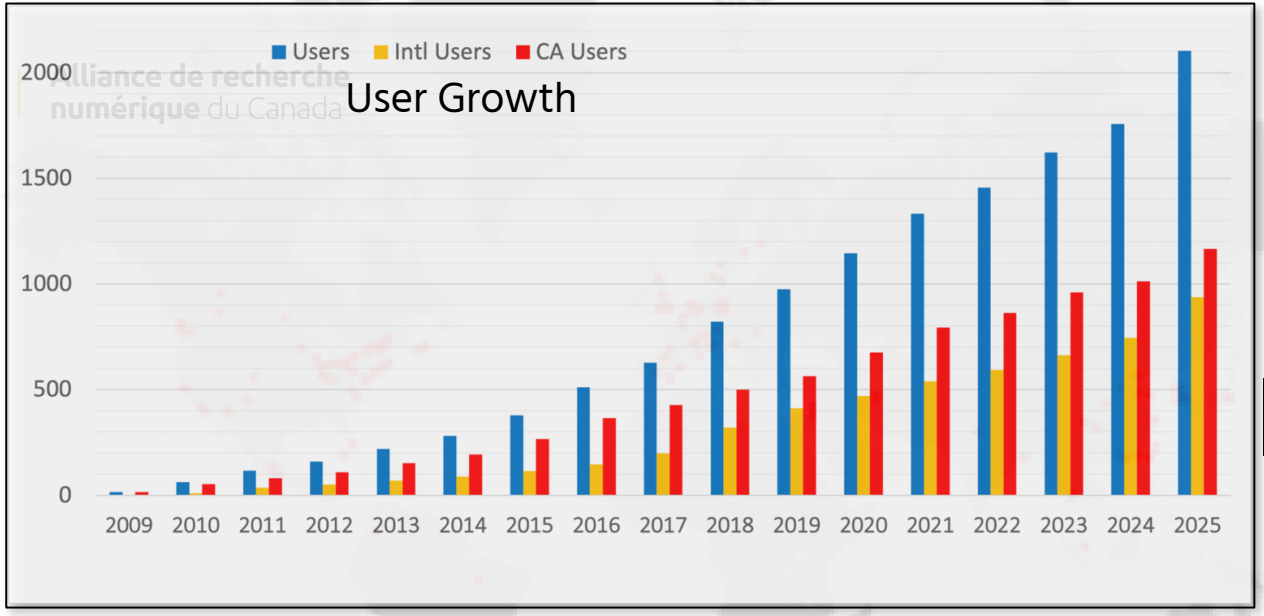


Connected Resources

cbrain

Digital Research Alliance of Canada

Alliance de recherche numérique du Canada



JÜLICH Forschungszentrum

XSEDE

ACCESS

SURF SARA

SDSC SAN DIEGO SUPERCOMPUTER CENTER

PSC

UNIVERSITY OF MINNESOTA Driven to Discover®

TACC TEXAS ADVANCED COMPUTING CENTER *Powering Discoveries That Change The World*

cbrain

Cloud Service Providers

2100+ users, 193 sites in 59 countries

Global Interoperability

- **Example: Cell Detection**
  - Scalable AI-based instance segmentation workflow implemented in PyTorch
    - Boutiques Descriptor created to define UI for inference scripts

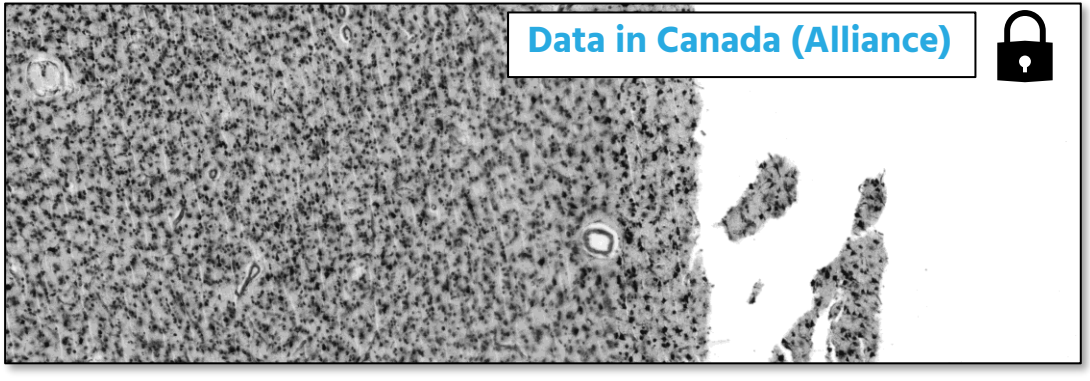
User anywhere in the world

Task Type	Version	Description	Owner	Execution Server	Current Status	Results On	Time Submitted	Last Updated
celldetection	0.4.9		bcaron	Nibi	mpleted	MainStore	2025-10-16 22:39:53 EDT	2025-10-16 23:03:14 EDT

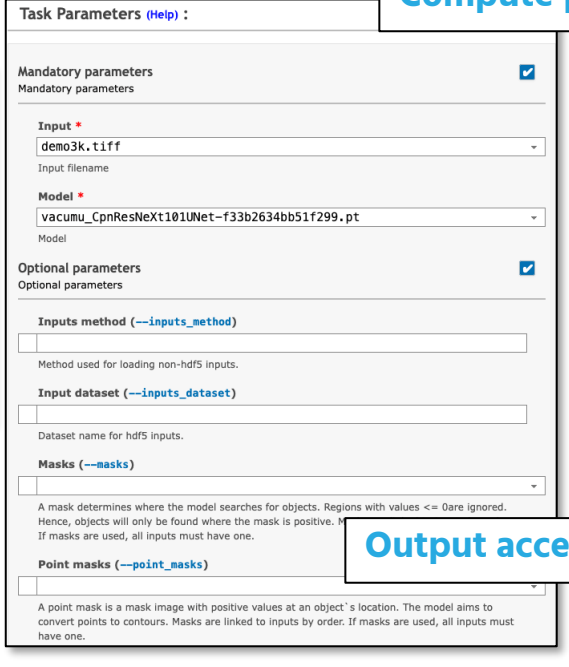
Workdir archiving status symbols: ◇: On Cluster ∇: As File

Task launched from anywhere

Compute performed in Canada



Data in Canada (Alliance)



Output accessible from anywhere

https://docs.celldetection.org

Eric Upschulte, Stefan Harmeling, Katrin Amunts, Timo Dickscheid, Contour proposal networks for biomedical instance segmentation, Medical Image Analysis, Volume 77, 2022, 102371, ISSN 1361-8415.

Highlight Software Tools

cbrain

cbrain 160+ Tools

fMRI Analysis
FSL-MELODIC
PLSNPAIRS
SPARK
FSL FEAT
XCP-D
Micapipe

fMRI Preprocessing
ABCD HCP
ABCD Infant HCP
ICA-AROMA
fMRIPrep (including BIDS)
Phys IO
MRIQC

Structural MRI
Freesurfer-Recon-all
Recon_all Longitudinal
FSL ANAT
CIVET (including MINC tools)
NEOCIVET
BigBrainWarp

Genomics/Transcriptomics
Cell Ranger
MethylationPipeline
PCEV
ePRS_5HTT
imputePrepSanger
GATK (SelectVariant)
scRNAbox

Tractography
FDT
Tractoflow
QSIprep
NDMG

PET
APPIANPET

Arterial Spin Labeling
Oxford_asl
ExploreASL

EEG
InverseSolutionsforEEG
BEsT
qeeg
HarMNqEEG
pyLossless

Data Conversion and Data Handling Tools
Dcm2mnc, Minc2analyze, Mnc2nii, Dcm2nii, Fdf2dcm, Fdf2sdt, Dicom2hrrt, SimpleFileExtractor,SubfolderFileExtractor

Statistics
RANDOMIZE

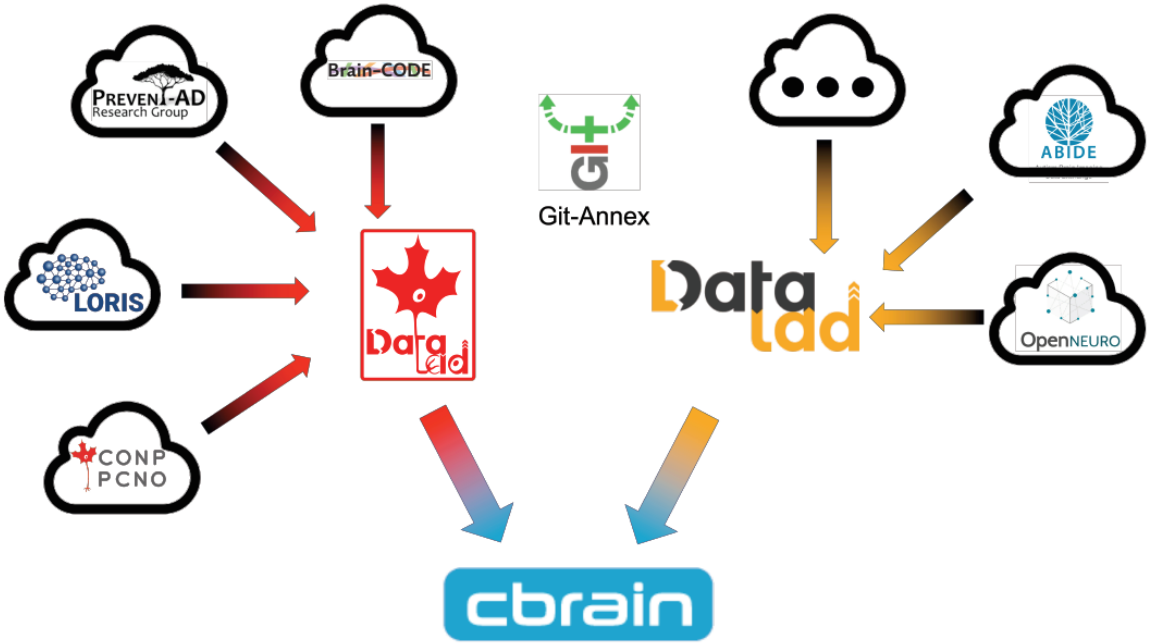
MRS
Osprey

Datalad Integration

Datalad is a Python tool that builds on top of git-annex and extends it with an intuitive command-line interface to enable transparently operating and managing data.

A CBRAIN Datalad DataProvider allows data from any Datalad repository to be imported into CBRAIN for pipeline execution.

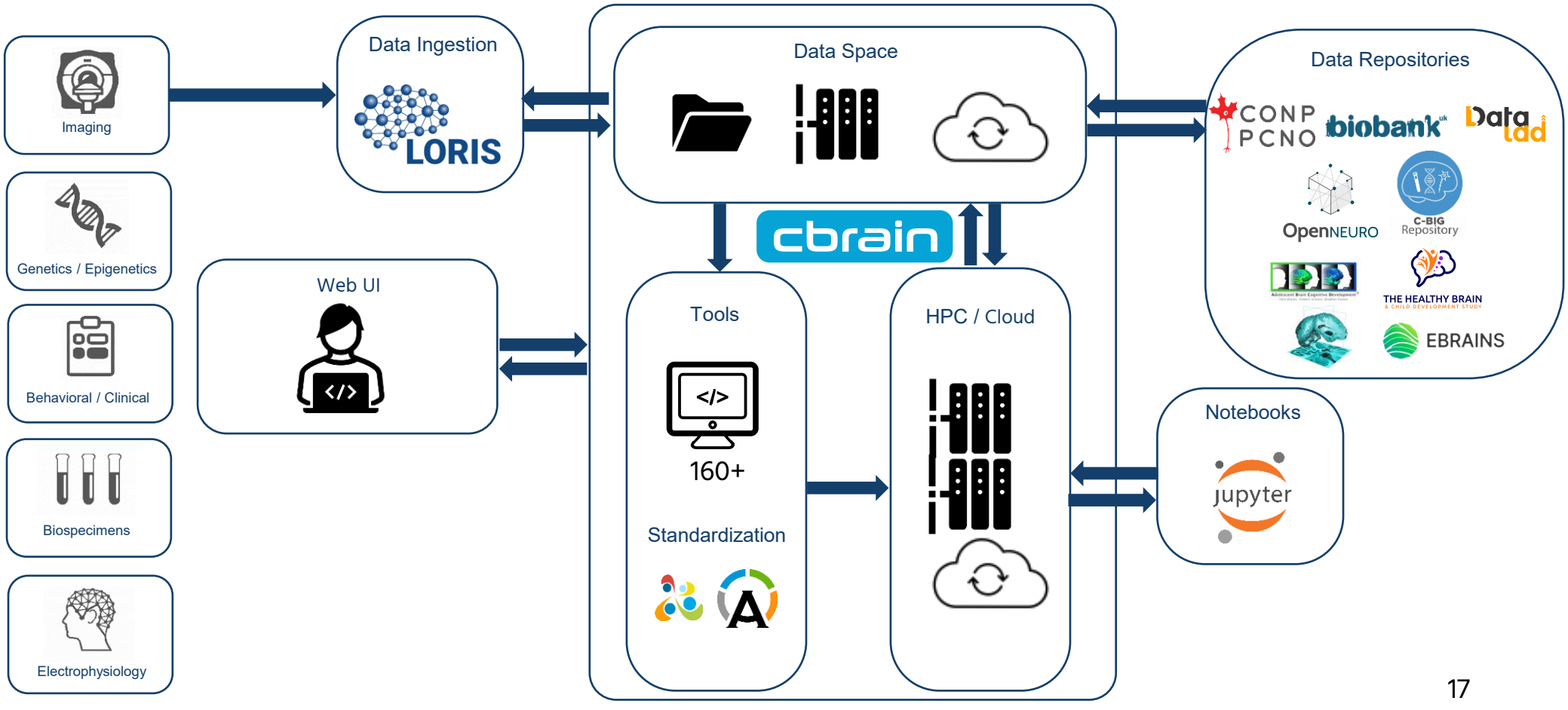
Pull data from the Canadian Open Neuroinformatics Platform



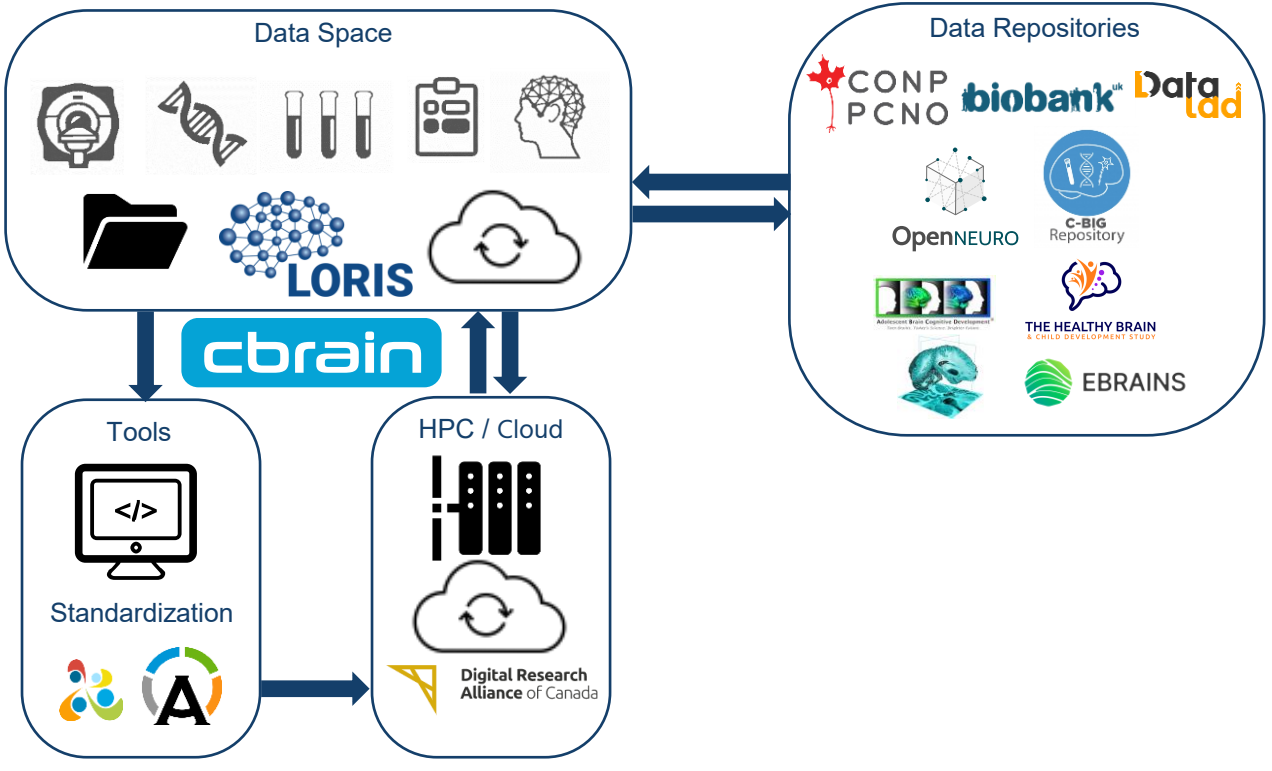
Pull data from any Datalad enabled resource

If data is in Datalad, it is now automatically available in CBRAIN!

Service Interconnections



ARCHIMEDES



Interoperability and Federation Layer (GA4GH Standards)

Authentication & Authorization (Passports Visas)	Data Discovery (Search / Metadata) Beacon APIs	Data Access & Transport Data Repository Services (DRS)	Workflow Execution and Analysis CBRAIN ←→ WES / TES

Pan-Canadian Genome Library

Bibliothèque génomique pancanadienne

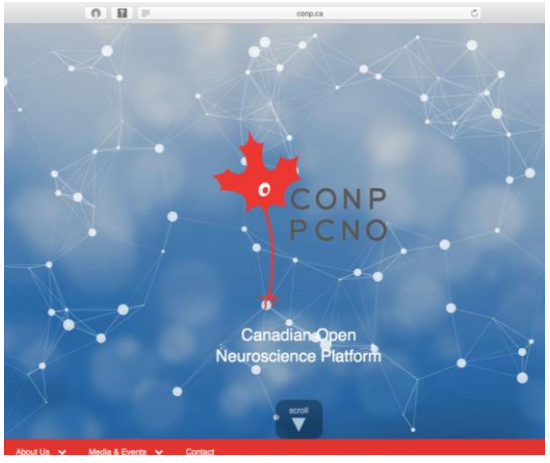
SecureData 4Health

Canada Networks

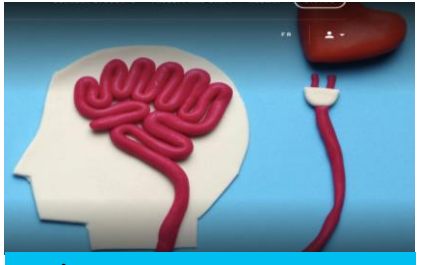
C-BIG Repository

CENTRE LUDMER CENTRE
SINGLE-CELL BRAIN INITIATIVE

CANADIAN OPEN PARKINSON NETWORK



HEALTHY BRAINS FOR HEALTHY LIVES


Brain-Heart Interconnectome

MyeliNeuroGene

Réseau pour transformer les soins en autisme

Transforming Autism Care Consortium

Canadian Consortium on Neurodegeneration in Aging

Québec 1000 families • familles

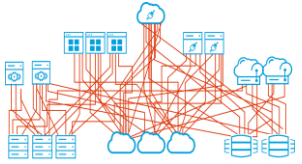
EEGNet

CALSNIC

Canadian Open Neuroscience Platform

Organizational Design

Scalability



Interoperability

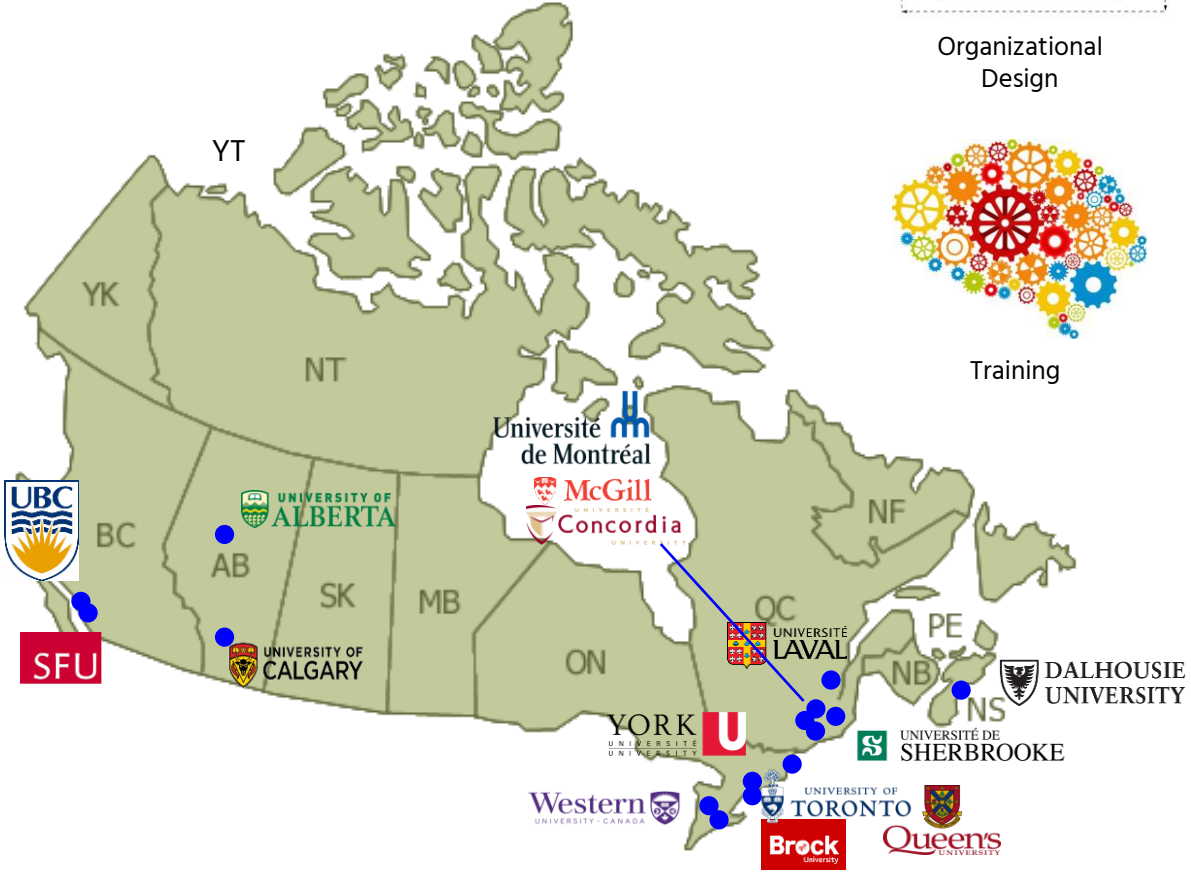
Analysis Packages

Training

International Partnerships

Ethics and Data Governance

Communications Platform



www.conp.ca

CONP Portal

Home

Data

Tools & Pipelines

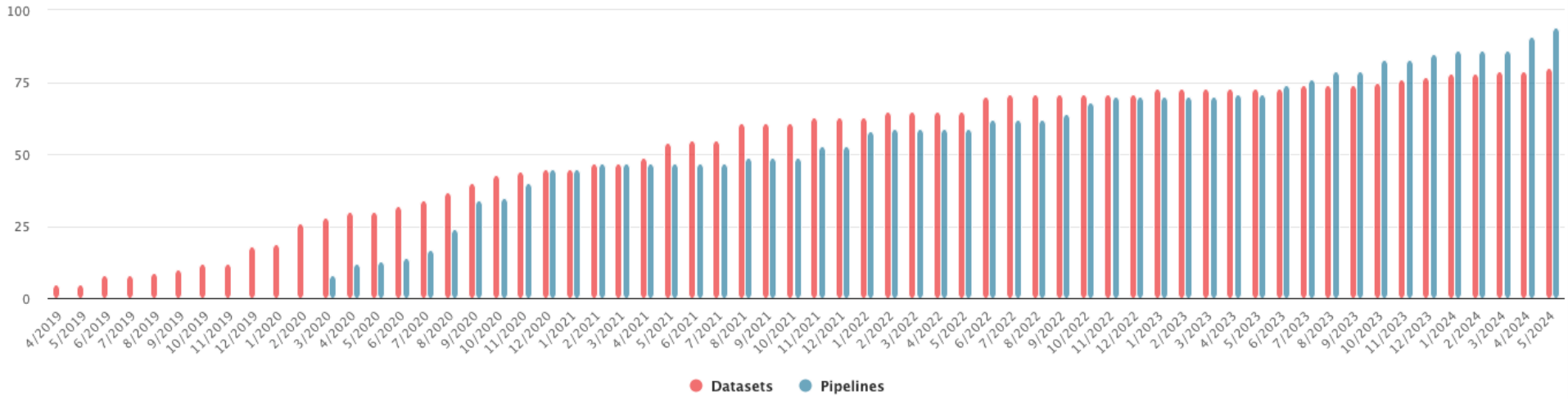
Share

Download

The Canadian Open Neuroscience Platform (CONP) Portal is a web interface that facilitates open science for the neuroscience community by simplifying global access to and sharing of datasets and tools. The Portal internalizes the typical data cycle of a research project, beginning with data acquisition, followed by data processing with published tools, and ultimately the publication of results with a link to the original dataset. Read more

The CONP would like to thank its sponsors, national partners and international partners.

Cumulative Number of Datasets and Pipelines



View Analytics

CONP Publications

PLOS COMPUTATIONAL BIOLOGY

PERSPECTIVE

The Canadian Open Neuroscience Platform—An open science framework for the neuroscience community

Rachel J. Harding[1], Patrick Bermudez[2], Alexander Bernier[3], Michael Beauvais[3], Pierre Bellec[4,5], Sean Hill[6,7,8,9], Agâh Karakuzu[16,17], Bartha M. Knoppers[3,10], Paul Pavlidis[11,12,13], Jean-Baptiste Poline[14], Jane Roskams[13,15], Nikola Stikov[16,17,18], Jessica Stone[2], Stephen Strother[19], CONP Consortium, Alan C. Evans[2]*

1 Structural Genomics Consortium, University of Toronto, Toronto, Ontario, Canada, **2** McGill Centre for Integrative Neuroscience, Montreal Neurological Institute, McGill University, Montréal, Québec, Canada, **3** Centre of Genomics and Policy, Department of Human Genetics, Faculty of Medicine, McGill University, Montréal, Québec, Canada, **4** Centre de Recherche de l'Institut Universitaire de Gériatrie de Montréal, Montréal, Québec, Canada, **5** Department of Psychology, Université de Montréal, Montréal, Québec, Canada, **6** Krembil Centre for Neuroinformatics, Centre for Addiction and Mental Health, Toronto, Ontario, Canada, **7** Institute of Medical Sciences, University of Toronto, Toronto, Ontario, Canada, **8** Department of Psychiatry, University of Toronto, Toronto, Ontario, Canada, **9** Department of Physiology, University of Toronto, Toronto, Ontario, Canada, **10** Canada Research Chair in Law and Medicine, Montréal, Québec, Canada, **11** Michael Smith Laboratories, University of British Columbia, Vancouver, British Columbia, Canada, **12** Department of Psychiatry, University of British Columbia, Vancouver, British Columbia, Canada, **13** Djavad Mowafaghian Center for Brain Health, University of British Columbia, Vancouver, British Columbia, Canada, **14** ORIGAMI Neuro Data Science Laboratory, Montreal Neurological Institute, McGill University, Montréal, Québec, Canada, **15** Neurosurgery University of Washington, Seattle, Washington, United States of America, **16** NeuroPoly Lab, Institute of Biomedical Engineering, Polytechnique Montréal, Montréal, Québec, Canada, **17** Montréal Heart Institute, Université de Montréal, Montréal, Québec, Canada, **18** Center for Advanced Interdisciplinary Research, Ss. Cyril and Methodius University, Skopje, North Macedonia, **19** Rotman Research Institute, Baycrest, and Department of Medical Biophysics, University of Toronto, Toronto, Ontario, Canada

* alan.evans@mcgill.ca

Abstract

The Canadian Open Neuroscience Platform (CONP) takes a multifaceted approach to enabling open neuroscience, aiming to make research, data, and tools accessible to everyone, with the ultimate objective of accelerating discovery. Its core infrastructure is the CONP Portal, a repository with a decentralized design, where datasets and analysis tools across disparate platforms can be browsed, searched, accessed, and shared in accordance

OXFORD (GIGA)n SCIENCE

GigaScience, 2024, 13, 1–7
DOI: 10.1093/gigascience/giad114
Review

Open Data Governance at the Canadian Open Neuroscience Platform (CONP): From the Walled Garden to the Arboretum

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scientific data

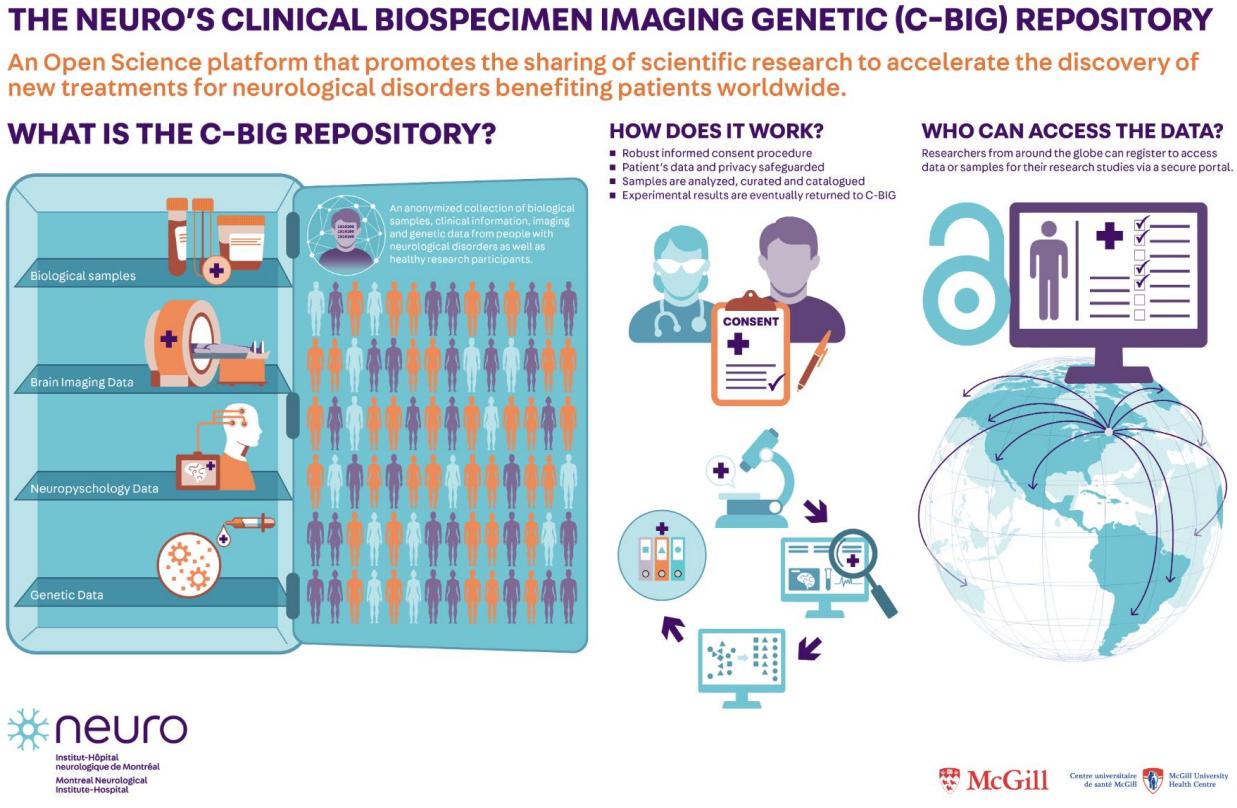
Check for updates

Data and Tools Integration in the Canadian Open Neuroscience Platform

Jean-Baptiste Poline[1,2,3,17] ✉, Samir Das[4,17], Tristan Glatard[5,17], Cécile Madjar[4], Erin W. Dickie[6], Xavier Lecours[4], Thomas Beaudry[5], Natacha Beck[4], Brendan Behan[7], Shawn T. Brown[8], David Bujold[9], Michael Beauvais[10], Bryan Caron[2], Candice Czech[2], Moyez Dharsee[11], Mathieu Dugré[5], Ken Evans[11], Tom Gee[11], Giulia Ippoliti[1,12], Gregory Kiar[4], Bartha Maria Knoppers[13], Tristan Kuehn[14], Diana Le[15], Derek Lo[4], Mandana Mazaheri[5], Dave MacFarlane[4], Naser Muja[4], Emmet A. O'Brien[2], Liam O'Callaghan[2], Santiago Paiva[1,4], Patrick Park[14], Darcy Quesnel[4], Henri Rabelais[4], Pierre Rioux[4], Mélanie Legault[4], Jennifer Tremblay-Mercier[16], David Rotenberg[6], Jessica Stone[4], Ted Strauss[3], Ksenia Zaytseva[9], Joey Zhou[5], Simon Duchesne[3], Ali R. Khan[14], Sean Hill[6] & Alan C. Evans[4]

We present the Canadian Open Neuroscience Platform (CONP) portal to answer the research community's need for flexible data sharing resources and provide advanced tools for search and processing infrastructure capacity. This portal differs from previous data sharing projects as it integrates datasets originating from a number of already existing platforms or databases through DataLad, a file level data integrity and access layer. The portal is also an entry point for searching and accessing a large number of standardized and containerized software and links to a computing infrastructure. It leverages community standards to help document and facilitate reuse of both datasets and tools, and already shows a growing community adoption giving access to more than 60 neuroscience datasets and over 70 tools. The CONP portal demonstrates the feasibility and offers a model of a distributed data and tool management system across 17 institutions throughout Canada.

Clinical, Biological, Imaging, Genetic Repository (C-BIG)



C-BIG Repository

Jason Karamchandani

- 200+ cell lines
- 6,000 donors
- 120,000 tissue samples
- 105 collaborations in 13 countries

Das S et al. (2022) *The C-BIG Repository: An institution-level Open Science platform* **Neuroinformatics 20: 139–53**

C-BIG Status

- >125,000 samples from > 6,100 patients & healthy controls (> 99% recruitment rate for patients)
  - > 2,000 patients with Parkinson's Disease
  - > 400 patients with ALS
  - > 300 patients with neuromuscular disease
  - > 900 patients with multiple sclerosis
  - 160 unique patient-derived iPSC cell lines (many with isogenic controls)

Collaborations (> 130)

Academic

- Harvard University
- Oxford University
- Cambridge University
- Stanford University
- University of Toronto
- University of Korea
- Queen's University
- La Jolla Institute of Immunology
- etc…

Industry

- Merck
- Takeda
- Genentech
- Ventus Therapeutics
- Vigil Neuroscience
- Cerevel
- Congruence Therapeutics
- Capsida Biotherapeutics
- etc…

CCNA
Canadian Consortium on Neurodegeneration in Aging

CCNV
Consortium canadien en neurodégénérescence associée au vieillissement

CCNA: The first pan-Canadian study on dementia

Since 2016, over 1,200 participants have been recruited from 32 sites **across the country**:

Province	Cities	Site Investigators
BC	Vancouver, Victoria	Robin Hsiung, Teresa Liu-Ambrose, Alexandre Henri-Bhargava
AB	Calgary, Edmonton	Eric Smith, Richard Camicioli
SK	Saskatoon	Andrew Kirk
ON	Toronto, Hamilton, Peterborough, London, Waterloo, Ottawa	Nicole Anderson, Howard Chertkow, James Sahlas, Alexandra Papaioannou, Jenny Ingram, Sarah Brisbin, Penny MacDonald, Michael Borrie, Elizabeth Finger, Manuel Montero-Odasso, Sandra Black, Mario Masellis, Carmela Tartaglia, Anthony Lang, Laura Middleton, Quincy Almeida, Stephanie Yamin, Andrew Frank
QC	Montreal, Quebec, Sherbrooke	Serge Gauthier, Vasavan Nair, Simon Ducharme, Louis Verret, Tamas Fulop, Susan Vaitekunas, Elise Levinoff, Josée Filion, Philippe Desmarais, Ron Postuma, Marie-Jeanne Kergoat, Sylvie Belleville
NB	Saint John	Pamela Jarrett
NS	Halifax	Maia Von Maltzahn, Kenneth Rockwood

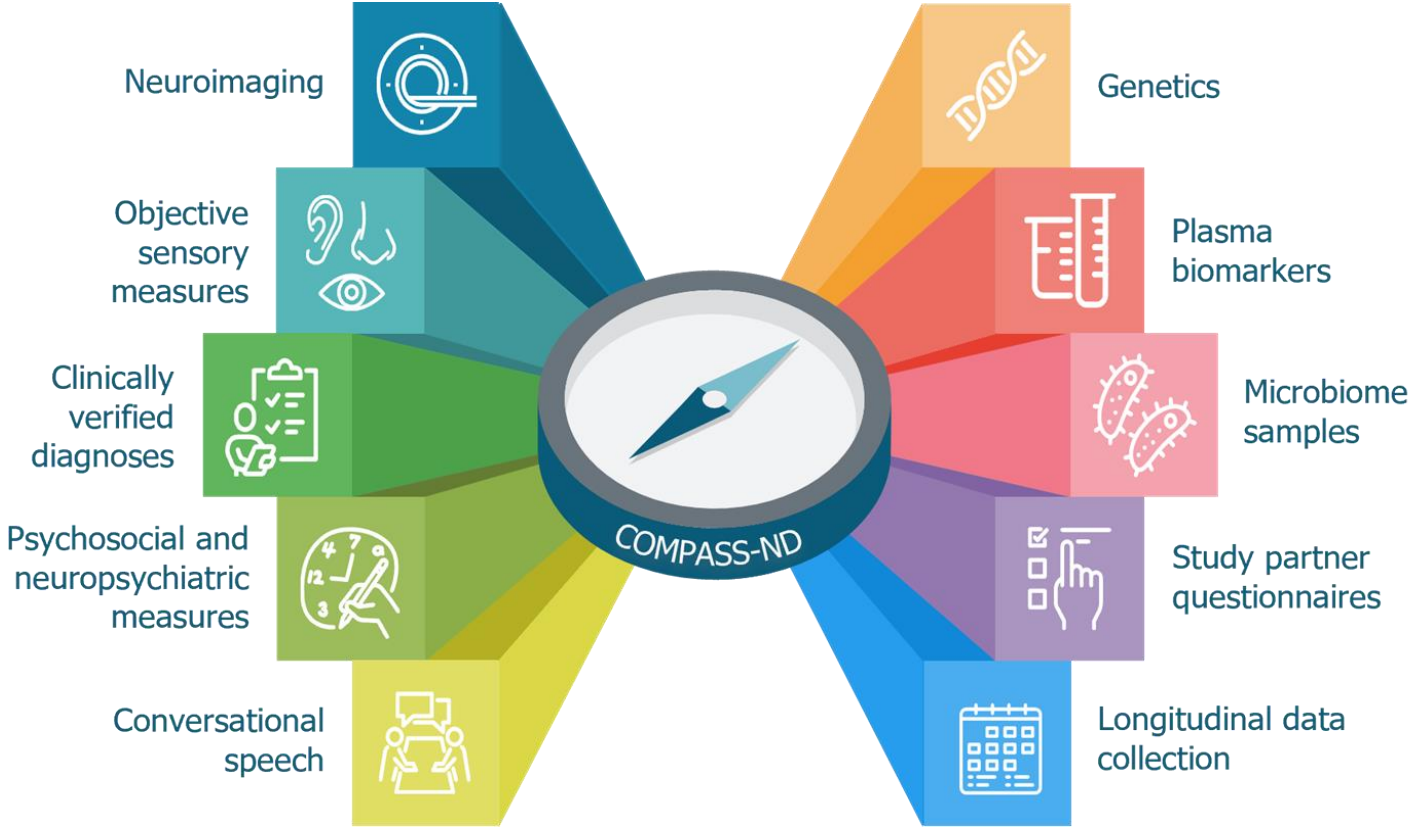
Encompasses a wealth of data

COMPASS-ND is notable for **its breadth**, evidenced by 10 syndrome cohorts and a control group:

	Diagnostic Cohort		Time 1	Women	Time 2	Women
	Cognitively Unimpaired Group	CU	176	63%	104	74%
	Subjective Cognitive Decline	SCD	147	66%	43	65%
AD spectrum	Mild Cognitive Impairment	MCI	275	38%	170	43%
AD spectrum	Vascular MCI	V-MCI	161	47%	49	43%
AD spectrum	Alzheimer's Disease	AD	111	43%	69	41%
AD spectrum	AD + Vascular profile	V-AD	83	49%	31	42%
	Frontotemporal Dementia	FTD	44	43%	9	44%
LBD spectrum	Parkinson's Disease	PD	83	45%	37	43%
LBD spectrum	PD with MCI	PD-MCI	44	14%	21	29%
LBD spectrum	PD dementia	PDD	17	12%	13	23%
LBD spectrum	Lewy Body Disease	LBD	32	19%	9	22%
	Total		1,173	47%	555	49%

Encompasses a wealth of data

CCNA is notable for **its depth** – in addition to the extensive clinical, cognitive, and neuropsychological data collected at baseline (Time 1), our study includes:



ARCHIMEDES

The CANadian Openscience Ecosystem (CANOE - an application for rare diseases)

Genomics meets Phenomics: integrated analysis to enhance gene discovery and modeling of variants in an interdisciplinary approach

Large-Scale Genomics Resources

Pan-Canadian Genome Library

Bibliothèque génomique pancanadienne

Current C-BIG Infrastructure

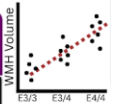
ID	Sex	Phenotype	Blood Sample	Imaging	Genomics	IPSCs
CBIG-001	F	Parkinson disease	S_002546	IMG_1214	WGS_44558	C_0341
CBIG-002	M	Alzheimer disease	S_007882	IMG_7554	EXM_04631	NA
CBIG-003	M	Congenital Malformation	NA	IMG_9491	WGS_12100	C_0074

ID	Disease Category	Phenomic Data	Genomic Data	Biological Material	Genomic Assessment	Gene	Variant	Zygosity	Frequency in PCGL
CBIG-464	Neurological	Phen_0464	WGS_00464	NA	Affected homz child, carrier parents	*SPG11*	c.5769del (p.Ser1923fs)	Homz	4.22e-4
CBIG-772	Muscular	Phen_0772	EXM_00772	iPSC_772	*De novo* het child, non-carrier parents	*LMNA*	c.116A>G (p.Asn39Ser)	Het	1.08e-6
CBIG-893	Pediatric, Rare	Phen_0893	WGS_00893	FB_893	Affected het carrier, parents unknown	*KMT2D*	c.16018C>T (p.Arg5340Ter)	Het	NA

Examples of use cases:

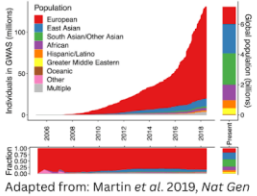
A) Family based analysis in rare disease

B) Modeling of variants of interest coupled with multimodal data



Benefits of Our Approach

1) Overcoming the European bias of genomics data: increase representation of underrepresented populations to enhance and expedite genetic diagnosis



Adapted from: Martin *et al.* 2019, *Nat Gen*

VCF **European Genome** ~50 candidate variants to resolve

VCF **Non-European Genome** >500 candidate variants to resolve

2) Expanding global-resources: contribute novel genes and variants to identify additional samples and disseminate data

GENEMATCHER

Matchmaker Exchange

CONP PCNO

Disease-Specific Genomics Initiatives

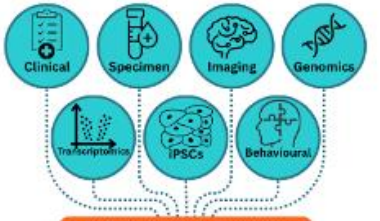
3) Leveraging interdisciplinary teams and methods: model genes and variants *in vitro* and *in vivo* to functionally validate novel findings

Early Drug Discovery Unit (EDDU) + Centre for Gene Therapy

- iPSCs and Other Cell Models
- Animal Models
- Gene Therapy

A. Pan-Canadian Genome Library participating centres

B. Current model of the C-BIG Repository



Multi-Modal Curation

ID	Sex	Phenotype	Blood Sample	Imaging	Genomics	iPSCs
CBIG-001	F	Parkinson disease	S_002546	IMG_1214	WGS_44558	C_0341
CBIG-002	M	Alzheimer disease	S_007882	IMG_7554	EXM_04631	NA
CBIG-003	M	Congenital Malformation	NA	IMG_9491	WGS_12100	C_0074

C. Structuring of C-BIG's interoperable, secure database

Flexible Data Input

Send us raw data to format

Use our guidelines to format data

Standardized Data Output

D. Disease and data versatility of the C-BIG model

Data Expansions in Progress

Integration of Single-Cell Transcriptomics

Current Phenotypes Captured

>110 Neurological Conditions
E.g. Behavioural disorders, congenital malformations, mood disorders, neurodegenerative diseases, developmental disorders

Opportunities for Expansion

- Cardiovascular Diseases
- Lung and Respiratory Diseases
- Cancers
- Autoimmune Diseases
- Metabolic Diseases
- Skeletal Muscular Conditions

International

biobank uk
Improving the health of future generations

IBIS
INFANT BRAIN IMAGING STUDY
$65.7M

HIBALL
HELMHOLTZ International BigBrain Analytics & Learning Laboratory

THE HEALTHY BRAIN & CHILD DEVELOPMENT STUDY

THE UNITED CONSORTIUM

What is the GBC?

An organization for “democratization” of brain mapping practices into Low- and Middle-Income Countries(LMICs).

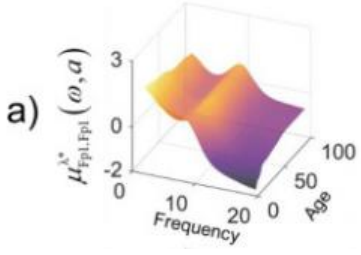
Start with EEG: inexpensive and high temporal resolution

GBC goals

- increased access for LMIC to neuroelectrophysiology data, tools, methods, infrastructure
- collaborative neuroscience
- best practices for international open science
- applications for disease/disorder discovery
- equitable global mental health

Global EEG Norms

Pedro Valdes-Sosa
Jorge Bosch-Bayard

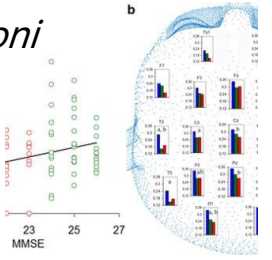


NeuroScience of Early Adversity

Janina Galler
Simon Anderson

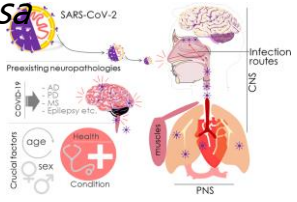
Biomarkers of Dementia

Claudio Babiloni
Görsev Yener



COVID-Induced Brain Dysfunction

Mitchell Valdes-Sosa
Ben Becker



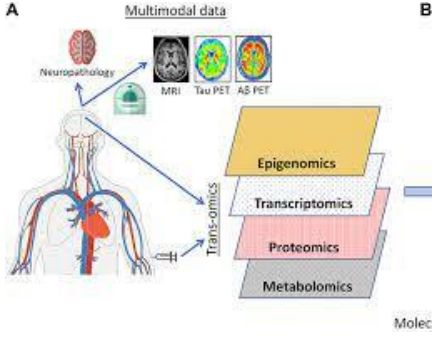
GLOBAL BRAIN CONSORTIUM

Biomarkers of Parkinson's Disease

Paul Thompson
Alain Dagher

Data-driven electrophysiological approaches for individually- tailored diagnosis

Paolo Rossini
Yasser Iturria



GLAD: Global Longitudinal study on Child and Adolescent Brain Development

Damien Fair
Giuseppe Chiarenza
Faisal Mushtaq

BiBBrain

BACOMICS

Dezhong Yao
Ludovico Minati

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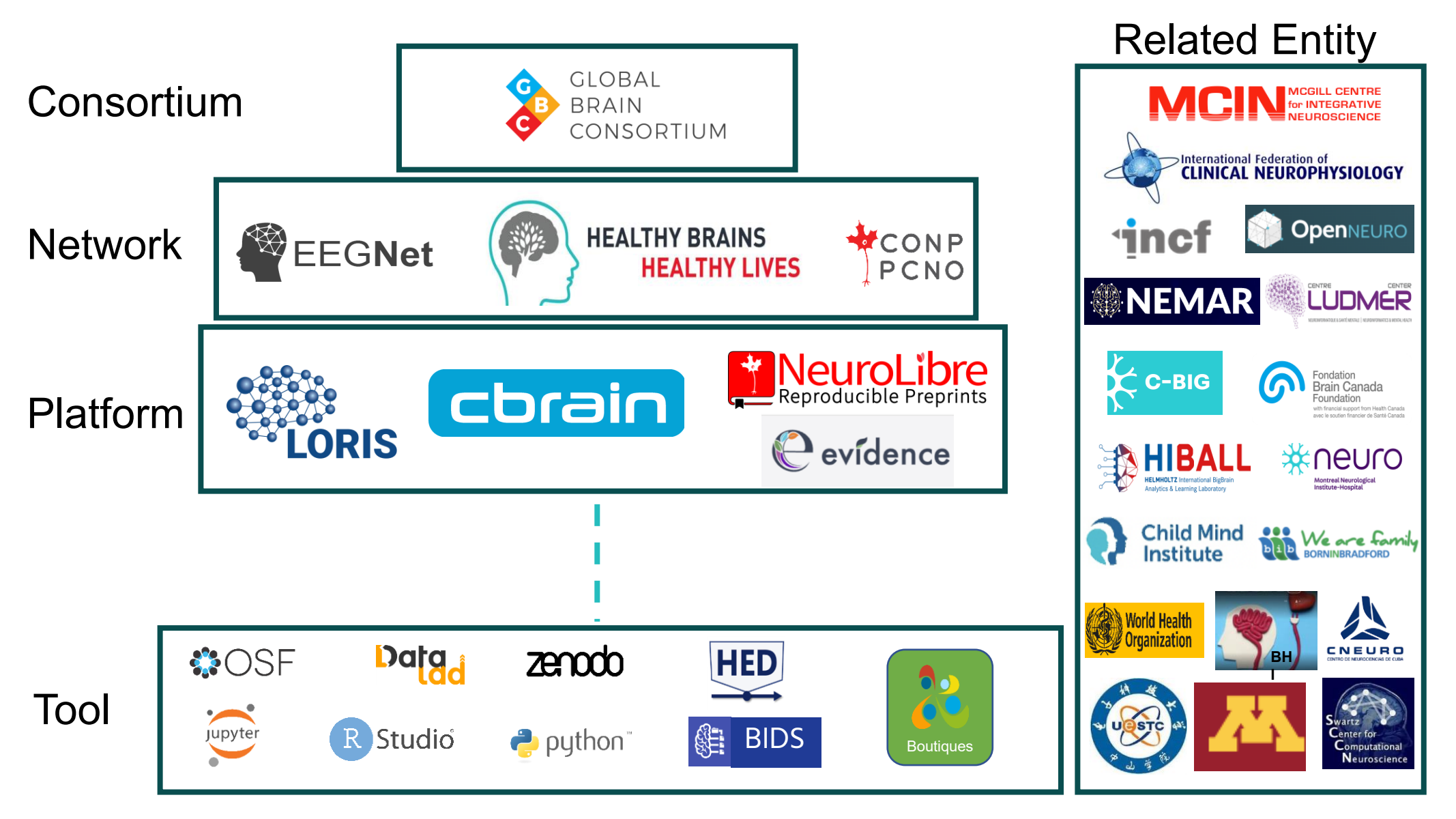
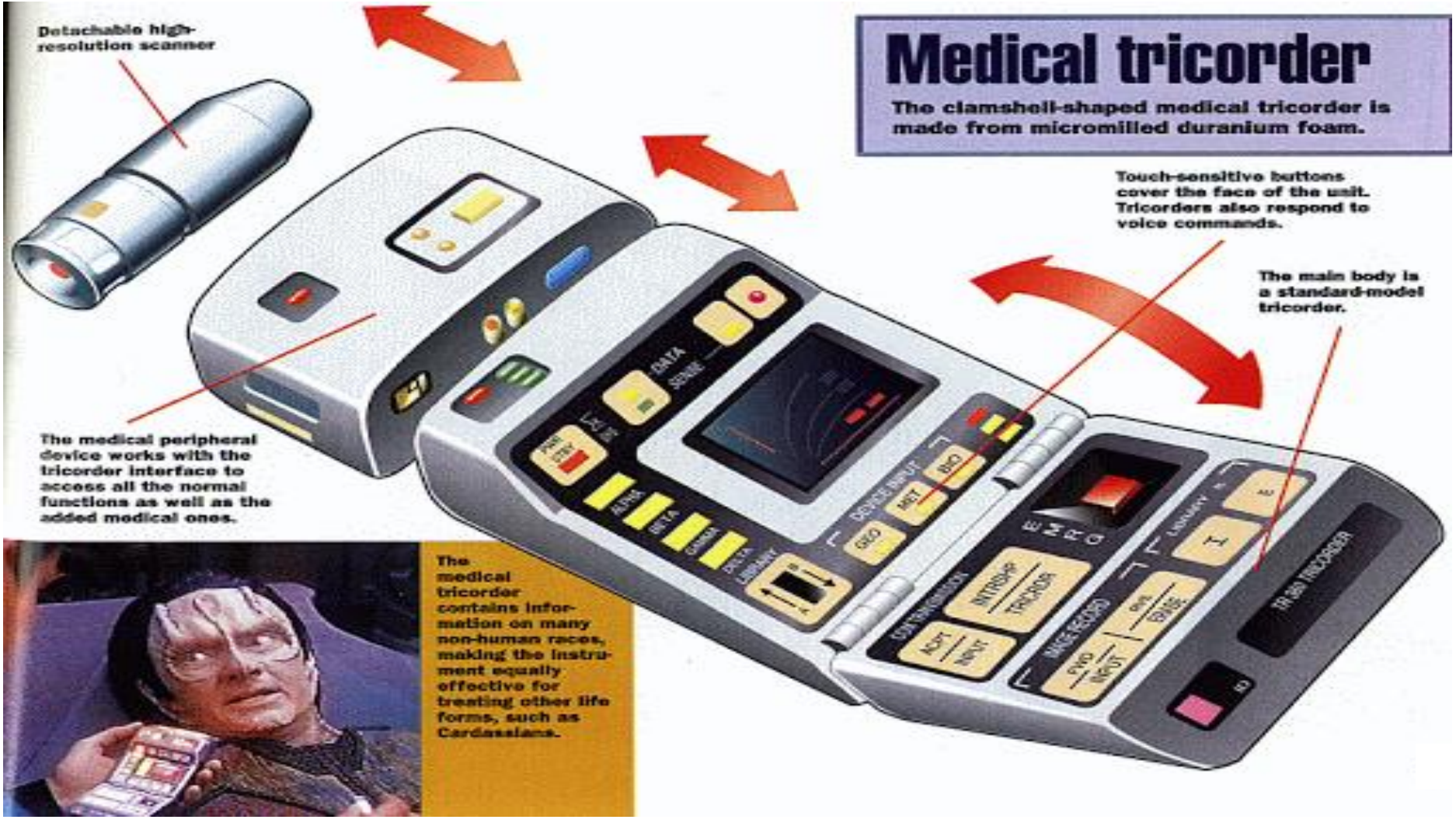

Consortium
GLOBAL BRAIN CONSORTIUM
Network
EEGNet
HEALTHY BRAINS HEALTHY LIVES
CONP PCNO
Platform
LORIS
cbrain
NeuroLibre Reproducible Preprints
evidence
Tool
OSF
DataLad
zenodo
HED
jupyter
RStudio
python
BIDS
Boutiques
Related Entity
MCIN MCGILL CENTRE for INTEGRATIVE NEUROSCIENCE
International Federation of CLINICAL NEUROPHYSIOLOGY
incf
OpenNEURO
NEMAR
CENTRE LUDMER CENTER
C-BIG
Fondation Brain Canada Foundation
HIBALL HELMHOLTZ International BigBrain Analytics & Learning Laboratory
neuro Montreal Neurological Institute-Hospital
Child Mind Institute
We are family BORNINBRADFORD
World Health Organization
BH
CNEURO CENTRO DE NEUROCIENCIAS DE CUBA
UESTC
Swartz Center for Computational Neuroscience

Make it so !


Detachable high-resolution scanner
Medical tricorder
The clamshell-shaped medical tricorder is made from micromilled duranium foam.
Touch-sensitive buttons cover the face of the unit. Tricorders also respond to voice commands.
The main body is a standard-model tricorder.
The medical peripheral device works with the tricorder interface to access all the normal functions as well as the added medical ones.
The medical tricorder contains information on many non-human races, making the instrument equally effective for treating other life forms, such as Cardassians.

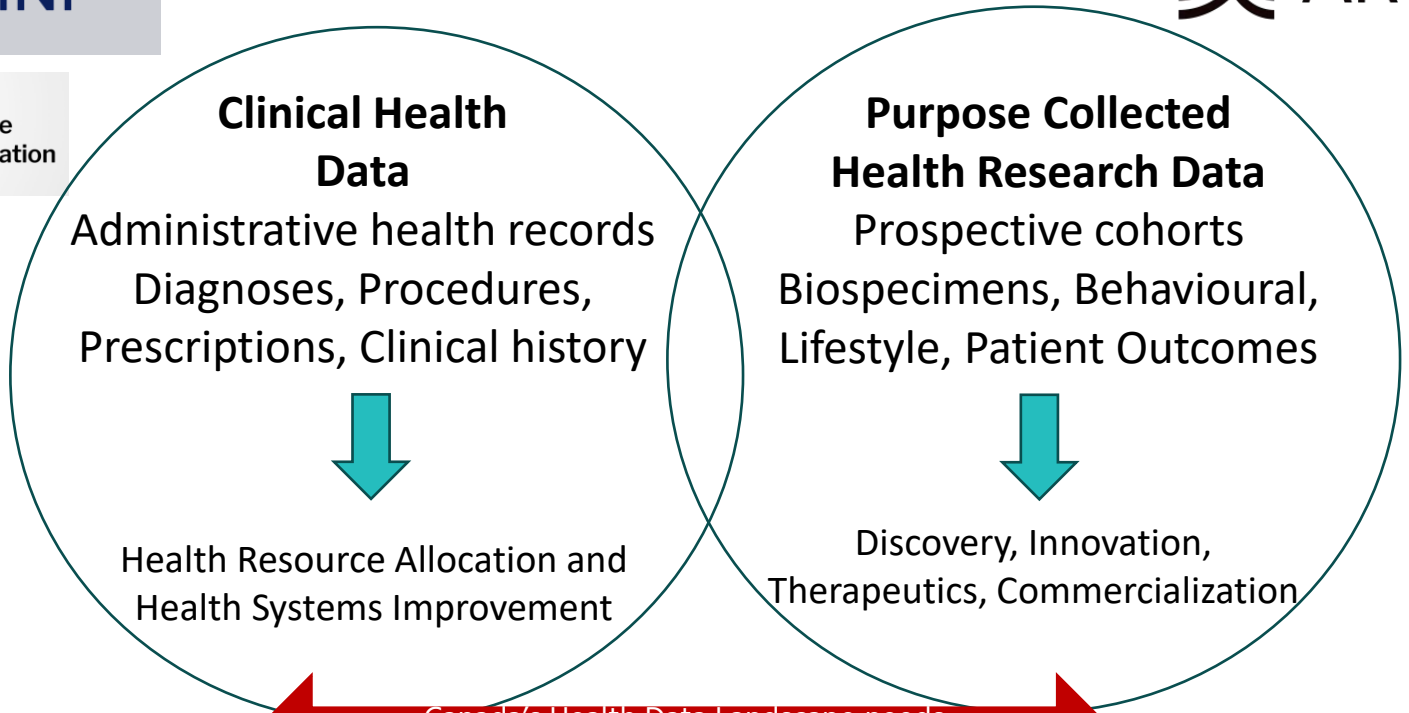
Back-up slides

Why is ARCHIMEDES Strategically Important for Canada?

GEMINI

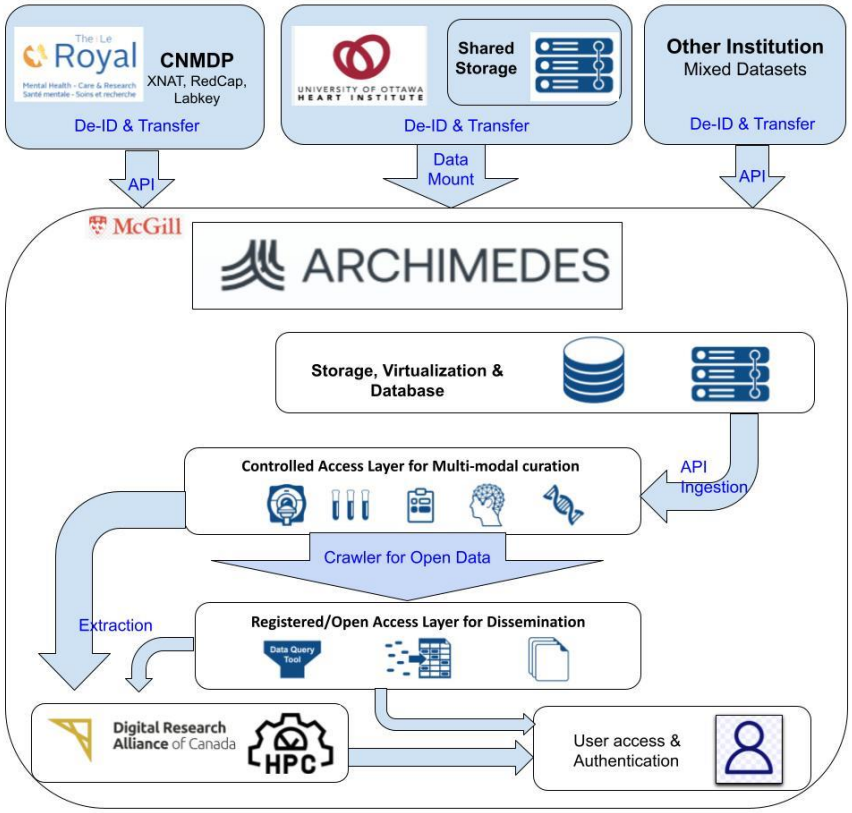
Canadian Institute for Health Information

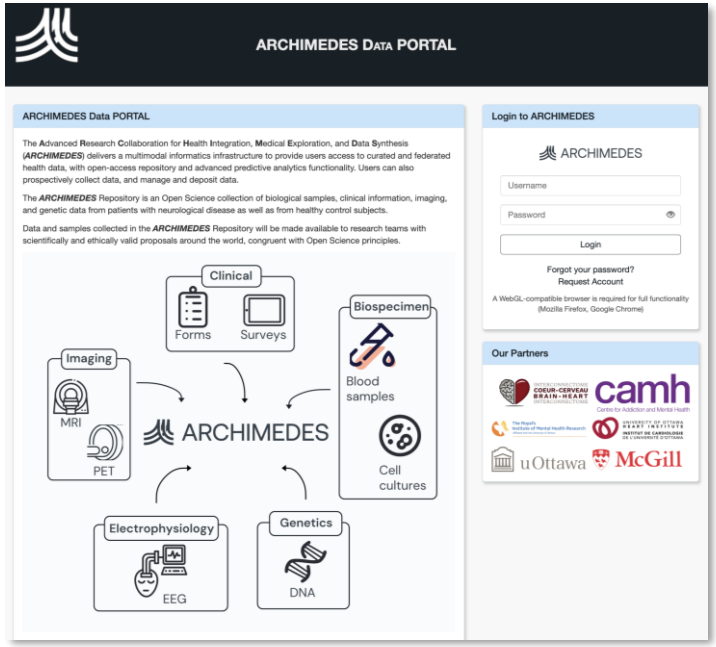
ARCHIMEDES



ARCHIMEDES

www.archimedesdata.ca





Harmonized Governance

Interoperable Infrastructure

Multi-modal Data Sharing

UNIVERSITY OF OTTAWA HEART INSTITUTE
INSTITUT DE CARDIOLOGIE DE L'UNIVERSITÉ D'OTTAWA
uOttawa
INTERCONNECTOME COEUR-CERVEAU BRAIN-HEART INTERCONNECTOME
The Royal's Institute of Mental Health Research
affiliated with the University of Ottawa
McGill
camh
Centre for Addiction and Mental Health

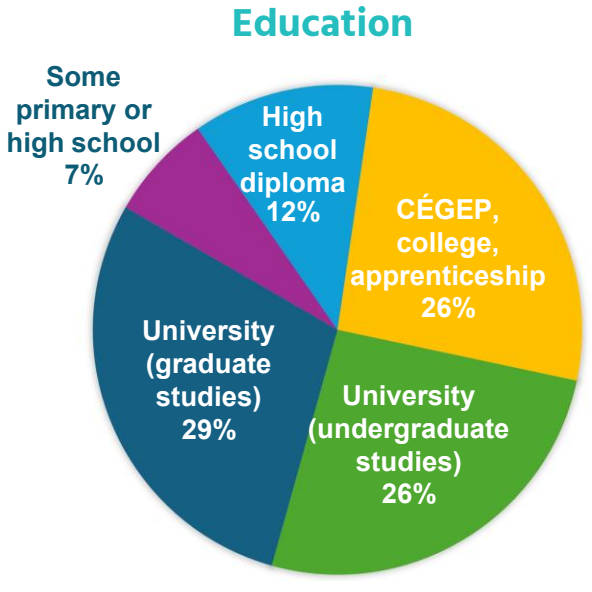
Cohort demographics

Diagnostic Cohort	Time 1	Women
Cognitively Unimpaired	176	63%
Subjective Cognitive Decline	147	66%
Mild Cognitive Impairment (MCI)	275	38%
Vascular MCI	161	47%
Alzheimer's Disease (AD)	111	43%
Vascular + AD (Mixed dementia)	83	49%
Frontotemporal Dementia	44	43%
Parkinson's Disease (PD)	83	45%
PD with MCI	44	14%
PD dementia	17	12%
Lewy Body Disease	32	19%
Total	1,173	47%

Community	Ratio
Urban	59%
Suburban	31%
Rural	10%

Ethnicity	Ratio
White	89%
Visible minority	11%

Age	Years
Mean	77.9
Stdev	7.8



CCNA•CCNV annual conference / conférence annuelle

The Comprehensive Assessment of Neurodegeneration and Dementia
COMPASS-ND

Clinical assessment

This extensive evaluation has instruments spread out over multiple visits and take-home questionnaires:

Sociodemographic Information

- Birth, sex, handedness
- Languages
- Living situation, partner status
- Reproductive history
- Education, employment, income
- Driving history

Psychiatric Assessment

- Geriatric Depression Scale
- Generalized Anxiety Disorder 7-Item Scale

Medical and Family History

- Current medications
- Past medications
- Medical history
- Mental health history
- Surgical history
- Family history

General Health Assessment

- Anthropometry
- Vital signs
- Health status
- Self-perception
- Constant fatigue
- Grip strength
- Vision
- Hearing
- Olfaction
- Nutrition
- Oral health
- Sleep
- Physical activity
- Falls and balance
- Pre-gait assessment
- Gait assessment
- Hobbies and leisure activities
- Smoking
- Alcohol consumption
- Activities of daily living
- Instrumental activities of daily living
- Mayo Clinic Fluctuations Scale
- Quality of life
- End-of-life care
- Caregiving assessment
- Social network
- Social support
- Social activities
- Adverse Childhood Experiences Questionnaire

The Comprehensive Assessment of Neurodegeneration and Dementia
COMPASS-ND

Clinical assessment

This extensive evaluation has instruments spread out over multiple visits and take-home questionnaires:

Disease Signs, Symptoms, and Onset

- Initial symptoms and disease course
- Signs and symptoms

Physical and Neurological Assessment

- Physical exam
- Neurological exam
- Hachinski Ischemic Score
- Clinical Diagnosis Confirmation

Lewy Body Spectrum Disorders Assessment

[PD, PD-MCI, PDD, LBD only]

- Freezing of Gait Questionnaire
- Schwab & England Activities of Daily Living Scale
- Parkinson's Disease Quality of Life Questionnaire MDS – Unified Parkinson's Disease Rating Scale (UPDRS)

Primary Informant Assessment

- General information
- Behavioral Inhibition Scale
- Interpersonal Reactivity Index
- Revised Self-Monitoring Scale
- Neuropsychiatric Inventory – Questionnaire
- Apathy Inventory
- Activities of daily living
- Instrumental activities of daily living
- Schwab & England Activities of Daily Living Scale *[PD, PD-MCI, PDD, LBD only]*
- Quality of life
- Caregiving assessment

Expanding biosample analyses available to researchers

General health
- CBC, electrolytes
- Creatinine, urea
- Liver function
- B12
- Calcium
- Albumin
- 25-OH vitamin D level
- Ferritin
- Glycosylated hemoglobin
- Insulin level
- Glucose
- Homocysteine
- Cystatin C
- VEGF

Inflammation
- IGF-1
- TNF-alpha
- Interleukin-6
- C-reactive protein

Lipidomics
- Total Cholesterol
- Triglycerides
- HDL-C
- LDL-C
- ApoA-1, ApoB

Hormone profile
- Adrenocorticotropic hormone
- Androstenedione
- Cortisol
- Dehydroepiandrosterone sulfate
- DHT
- Estradiol
- Estrone sulfate
- Follicle-stimulating hormone
- Free thyroxine (T4)
- Luteinizing hormone
- Progesterone
- Prolactin
- Sex hormone binding globulin
- Testosterone
- Thyroid stimulating hormone

Oxidative stress
- Vitamin E
- Alpha-1 antitrypsin
- Biliverdin
- Ferritin

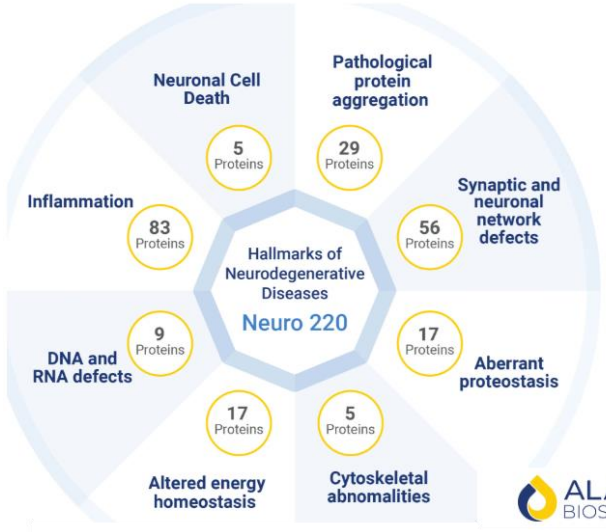
Synaptic function, plasticity
- BDNF levels

CSF biomarkers (13% cohort)
- Amyloid ß 1-42
- Phosphorylated tau 181
- Total tau
- Alpha synuclein

SIMOA plasma biomarkers
- Amyloid ß 1-40
- Amyloid ß 1-42
- Neurofilament light chain
- Glial fibrillary acidic protein
- Phosphorylated tau 181

In the works:

NULISAseq™ Neuro 220 Panel



Salivary & fecal microbiome analyses

Genetic analyses

- Genetic analyses were run on blood and saliva using Illumina's **Neuro Booster Array** (75,000 single nucleotide polymorphisms, or SNPs, important in investigating NDDs), centered on the backbone of the **Global Diversity Array** (>1.8M SNPs)

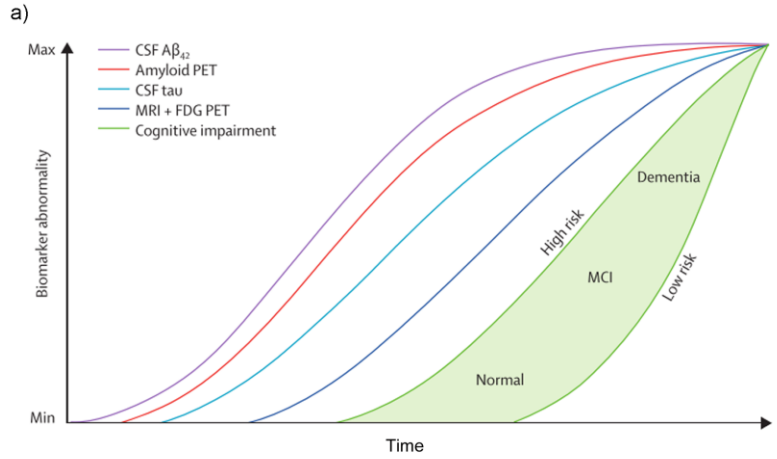
- Genes of interest include:
  - **TREM2** (inflammatory pathways, phagocytosis, microglial clustering)
  - **TOMM40** (mitochondrial protein transport role)
  - **APOE** (implicated in AD)

- 390 other risk genes for AD, PD, LBD, and FTD

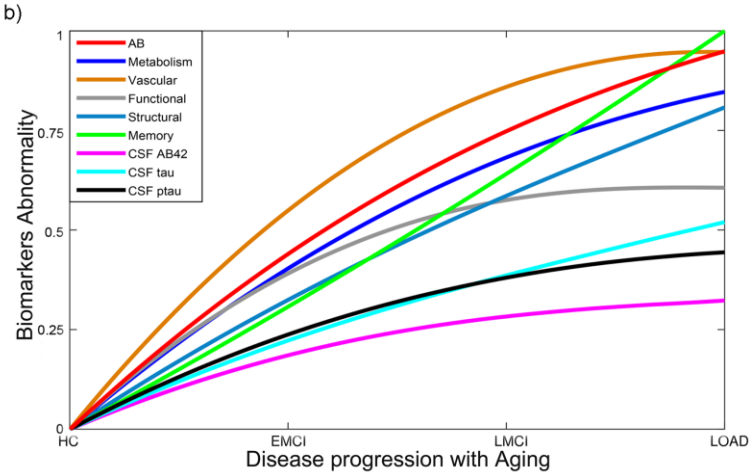
- **Polygenic risk and hazard scores** for Alzheimer's disease and Parkinson's disease will also be generated from the data

Hypothetical vs. data-driven models of LOAD progression

Jack C et al. 2010,2013



Iturria-Medina Y et al., 2016



Main differences:

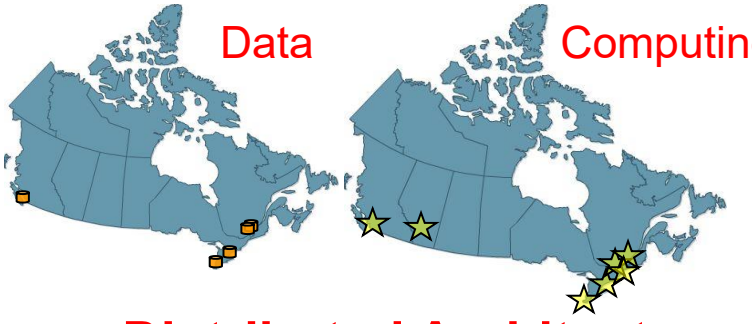
➡ (A) Absence of a vascular component, assumption that $A_ß$ is earliest biomarker.
(B) Vascular dysfunction is earliest pathological event, followed by $A_ß$ deposition.

➡ (A) CSF $A_ß$ and tau are the two major proteinopathies.
(B) Not among the earliest/strongest altered proteins (abnormality positions 85, 41).

➡ (A) Cognitive decline only detectable at advanced stage.
(B) Cognitive changes observable in parallel with alterations in primary factors.

Iturria-Medina Y et al. (2016) Nature Communications

CBRAIN Canadian Distributed Neuroimaging Platform



Distributed Architecture

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