Center for
Precision Psychiatry
MGH Department of Psychiatry

PREMIER MINISTRE
Liberté
Égalité
Fraternité

FRANCE 2030
PROGRAMME DE RECHERCHE
PSYCHIATRIE DE PRÉCISION

FRENCH PROGRAM IN PRECISION PSYCHIATRY (PEPR PROPSY)

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- Scientific Director, Program Project in Precision Psychiatry (PEPR PROPSY)

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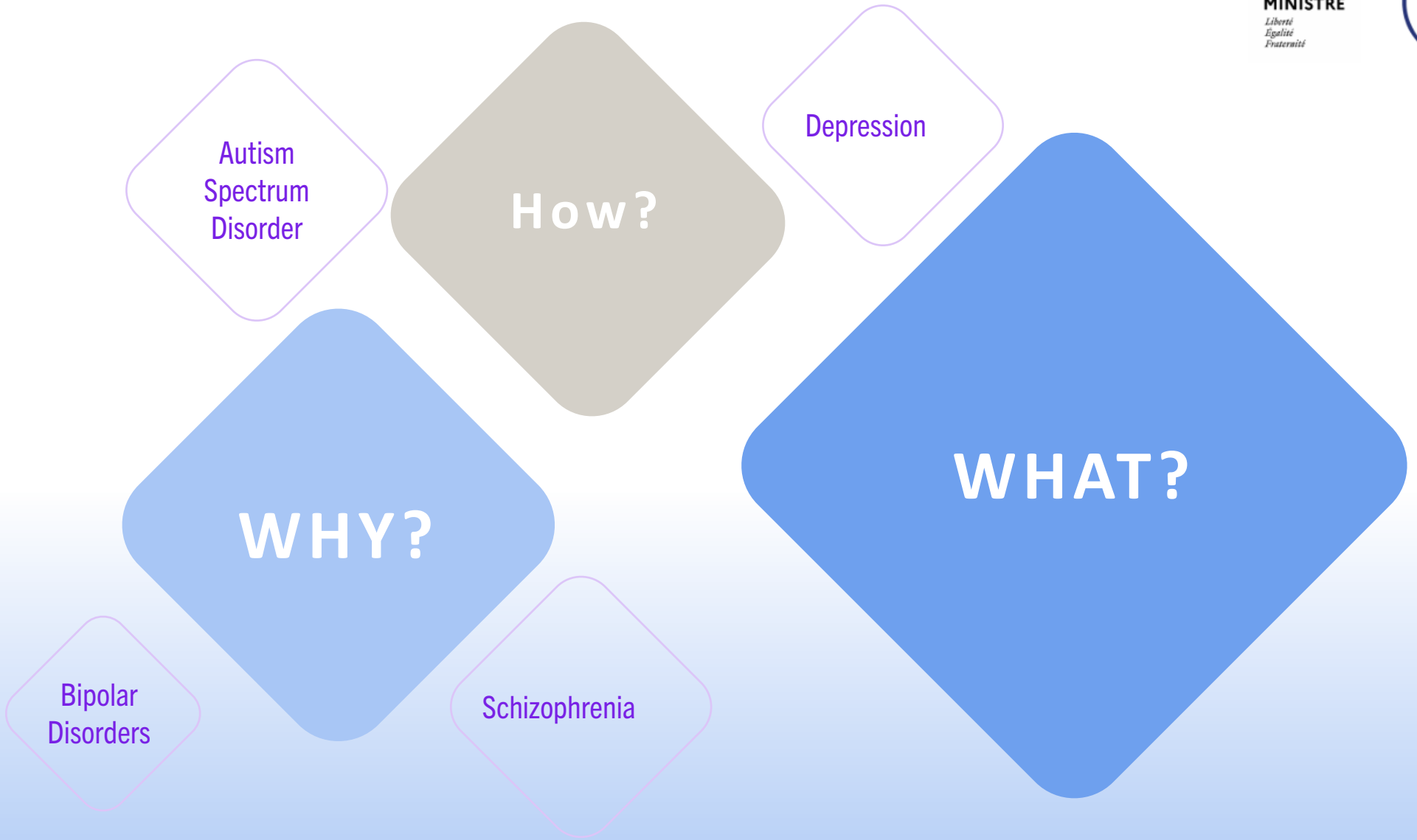
FRENCH PROGRAM IN PRECISION PSYCHIATRY (PEPR PROPSY)



WHY DO WE NEED PRECISION PSYCHIATRY?

One of the greatest challenge of the 21st century

A MAJOR PUBLIC HEALTH ISSUE

- **Top 10 leading** causes of **burden** worldwide
- Affect an estimated **800 million** people worldwide, **10.7%** of the Planet's population (OECD, 2022)
- An enormous economic burden: **4%** of a nation's GDP
- First cause **of handicap** (WHO, 2020)

BUT STILL A HIGH UNMET NEED

- Delayed and unprecise diagnosis
- Partial treatment and often with side effects
- Too few innovations

WE NEED TO DO BETTER…!

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WHY DO WE NEED PRECISION PSYCHIATRY?

Very Few Significant Treatment Breakthroughs In the last 50 years

3 REASONS TO EXPLAIN FAILURES OF CLINICAL TRIALS

- **CURRENT CATEGORICAL DIAGNOSIS**
  - good inter-rater reliability but no biological validity
  - heterogeneous and overlapping
- **ENDPOINTS USED IN CLINICAL TRIALS**
  - Not objectively measurable
  - Not specific to the treatment tested
- **TREATMENTS TESTED**
  - Not mechanisms-based
  - Most psychotropic drugs have been discovered by serendipity

3 RULES OF PRECISION PSYCHIATRY

- **PRECISE STRATIFICATION BIOMARKERS**
  to select homogeneous subgroups of patients
- **OBJECTIVE BIOMARKERS OF EFFICACY**
  to assess efficacy in clinical trials
- **MECHANISMS-BASED TREATMENTS**
  to target a specific etiological mechanism

WE NEED THE RIGHT TREATMENT FOR THE RIGHT PATIENT, AT THE RIGHT TIME!

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Miller A…Leboyer M, **Brain, Behavior and Immunity**, **2025, 125:319-329**
Leboyer M et al, **Jama Psychiatry**, in press

WHY DO WE NEED PRECISION PSYCHIATRY?

To improve measurement and stratification of heterogeneous categorical entities towards mechanisms-based treatments

MOVING away from

„ ONE SIZE FIT ALL

TO GO to

HAUTE COUTURE “

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Inserm

cnrs

HOW CAN WE MOVE TO PRECISION PSYCHIATRY?

What is needed to bring change to practice,

HOW?

TO ORGANIZE DEEP PHENOTYPING
Ex: French Networks of Expert Centers

TO YIELD and GATHER MULTI-MODAL DATA
into Data Warehouse
Ex : Suicidal behavior

TO SHARE EXISTING DATA
Ex: Cohort Club

HOW TO ORGANIZE PRECISION PSYCHIATRY?

Large cohorts of deeply-phenotyped patients

COHORTS of CATEGORICAL PSYCHIATRIC ENTITIES → **DEEP PHENOTYPING** → **BIG DATA ANALYSIS** → **STRATIFICATION SUBGROUPS/ DIMENSIONS** → **THE RIGHT TREATMENT to THE RIGHT PATIENT… targetting**

Heterogeneous
Overlapping
Progressive

CLINICAL ASSESMENT

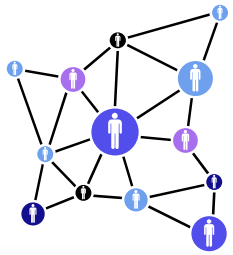
- Psychiatric
- Somatic
- Cognitive

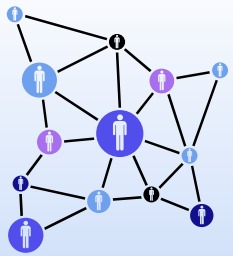
BIOMARKERS

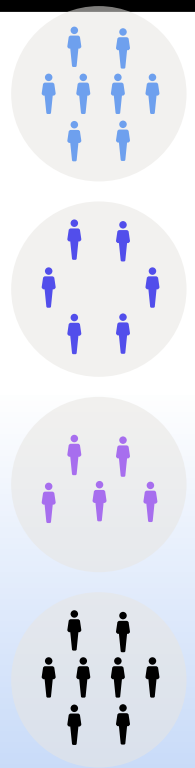
- Omics (Genetics, Pharmacogenetics, Transcriptomics, proteomics, metabolomics
- Immune markers
- Brain imaging
- Electrophysiology
- Exposome

DIGITAL PHENOTYPING

MULTIMODAL ANALYSIS







IMMUNE system

- Anti-inflammatory
- small doses Cytokines
- Boosting mitochondria
- Neutralizing auto-Antibodies
- Probiotics

NEURO-MODULATION

- Transcranial Magnetic Stimulation
- Deep Brain Stimulation

GENETIC

- Pharmaco_genetic
- Perdsonalised ttt for rare diseases

DIGITAL THERAPEUTIC

- Psycho-education
- Cognitive therapy
- Cognitive remediation
- Digital twins

LIFESTYLE RECOMMANDATIONS

- Sleep
- Diet
- Physical activity

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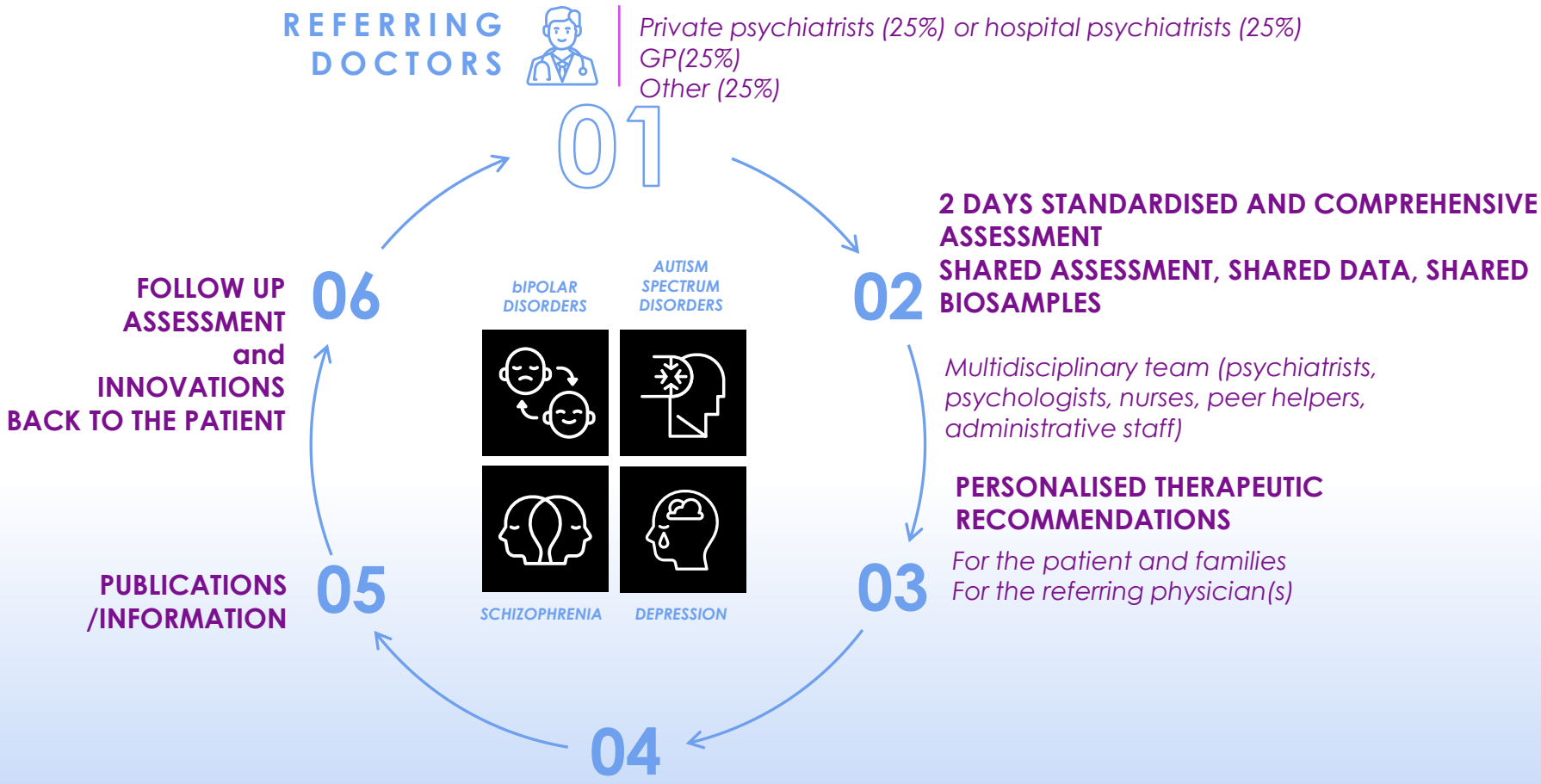
IN FRANCE, SINCE 2010,
4 NETWORKS OF 55 EXPERT CENTERS FOR PSYCHIATRIC DISORDERS
COORDINATED BY FOUNDATION FONDAMENTAL

FRENCH EXPERT CENTERS:
PLATFORMS FOR DIAGNOSIS AND RESEARCH



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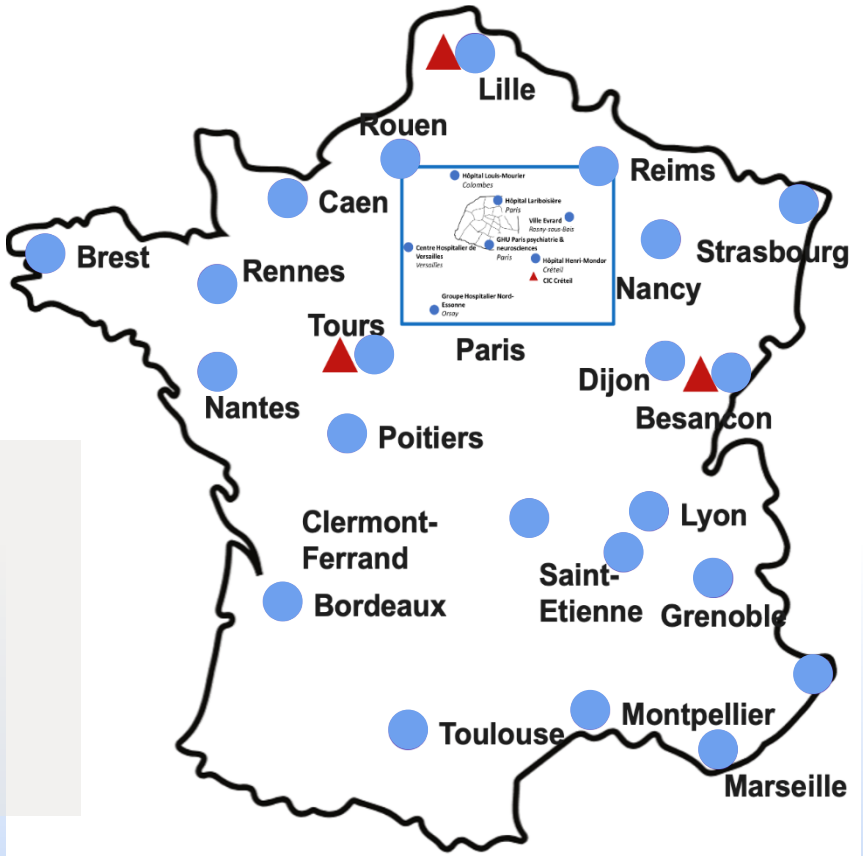
DIRECTION GÉNÉRALE DE L'OFFRE DE SOINS

NETWORKS OF EXPERT CENTERS IN FRANCE

sharing data and biobanks to create multimodal databases open for collaboration

National networks of expert centers for mental disorders, SHARING e-CRF, data, databases and biobanks



Mapping of the 29 FRENCH MINDS clinical sites and 4 CICs *(Centers for Clinical Investigation)*

- **4 networks for bipolar disorder, schizophrenia, resistant depression, autism**
- **55 Expert Centers**
- **4 shared data base « FACE »** (FondaMental Advanced Center of Expertise)
- **1 shared biobank** (DNA, RNA, PBMC, serum, plasma)
- **9000 patients** included in the FACE Data base
- **300 publications**

1 CENTRALIZED DATA WAREHOUSE **OPEN** FOR COLLABORATIONS

www.fondation-fondamental.org

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Leboyer et al, **J Aff Disorders**, **2022, 307: 149-156,** *Key findings in FACE-BD cohort*

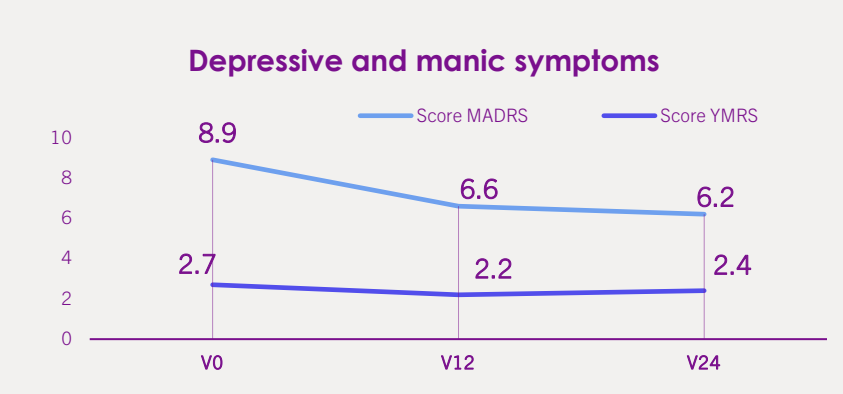
MEASURING THE IMPACT AFTER AN ASSESSMENT IN AN EXPERT CENTER : IMPROVEMENT OF PROGNOSIS

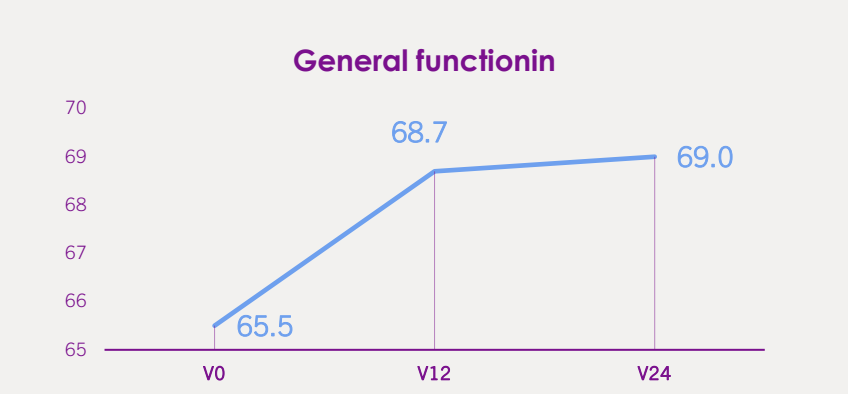
Example of bipolar disorder

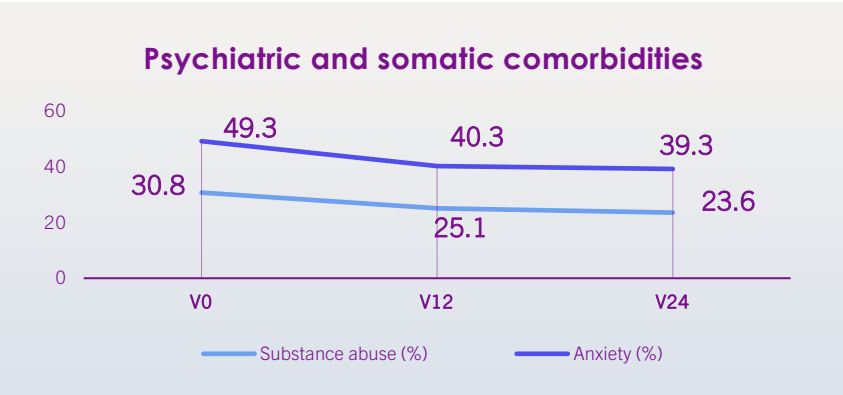
EXPERT CENTRES contribute to:

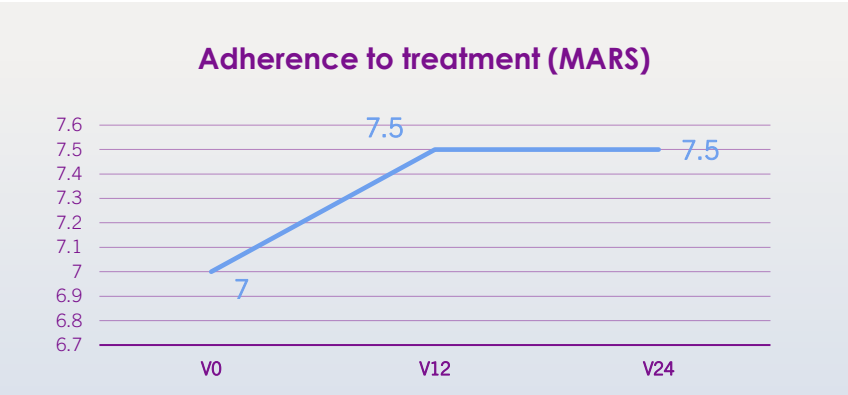
- **Clinical improvement** of symptoms, general functioning, and adherence to treatment
- **Screening** for psychiatric and somatic comorbiditie

N=987 individuals with bipolar disorder followed for 2 years









*Belzeaux et al, J **Aff Disorders,** 2013*
*Godin et al, **J Clincal Psy,** 2014*
*Henry et al, **Bipolar Disord** 2017*
*Laidi et al, **J Aff Disorders,** 2022*

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MEASURING THE IMPACT AFTER AN ASSESSMENT IN AN EXPERT CENTER : COST REDUCTION

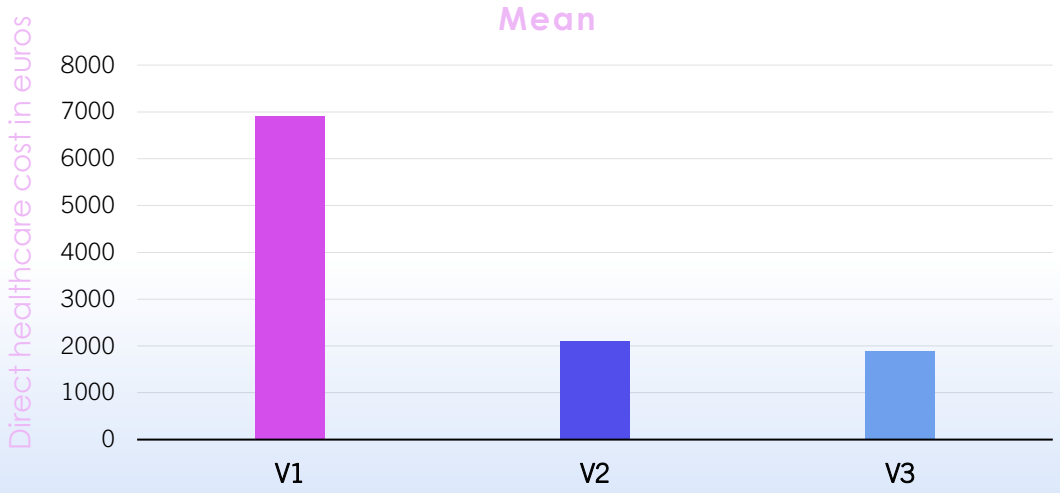
Example of bipolar disorder

NUMBER OF DAYS

RE-HOSPITALIZATIONS

DIRECT COST

(HOSPITALIZATIONS, CONSULTATIONS, MEDICATIONS)



REDUCTION of 50%* the number of days re-hospitalization

REDUCTION of 50%* the direct cost of bipolar disorder

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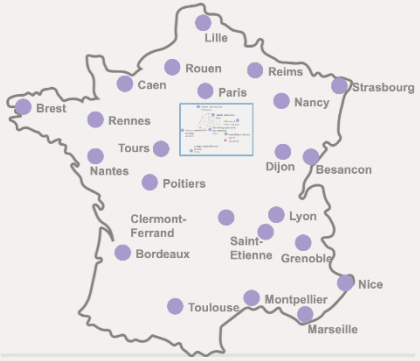
Henry c et al, ***Bipolar Disord***, *2017*
Laidi C et al., ***J Affective Disorders***, *2022*

EXTENSIVE DATA COLLECTION TOWARDS

Creating a multimodal, interoperable, open data warehouse: "FRENCH MINDS"

FRANCE 2030 — PROGRAMME DE RECHERCHE — PSYCHIATRIE DE PRÉCISION



e-CRF	Digital data	Genomics Metagenomic	Immunology Metabolomic Proteomic	Brain imaging Electrophysiology

Pseudonymisation, quality control, harmonisation, data ingestion, multi modal integration, inter operability

OUTSCALE

Pre-existing French cohorts
N=7000

Interoperability

French Minds
Mutlimodal data sets

Interoperability

International databases
Catalogue of meta data

Data Management

Data analysis platform

Data Replication ("Cohort-club")

Catalogue of meta data

Data access
Personal & Secure Access
Secure insulated bubble
Choice of computing power: CPU, RAM, GPU

Analysis
Environment of choice

DZHK
DEUTSCHES ZENTRUM FÜR HERZ-KREISLAUF-FORSCHUNG E.V.

GLOBAL BIPOLAR Cohort

IMPACT — INSTITUTE FOR MENTAL AND PHYSICAL HEALTH AND CLINICAL TRANSLATION — DEAKIN UNIVERSITY

EBRAINS

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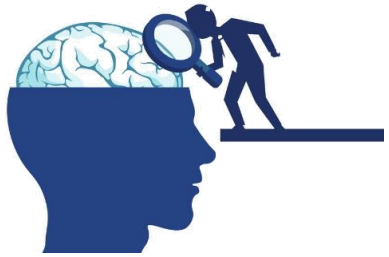
HOW TO SHARE DATA: THE COHORT CLUB



Towards precision psychiatry

Objectives – To create an online platform offering a map of existing European as well as Australian or North & South American cohorts for psychiatric conditions fostering collaborations on existing datasets.

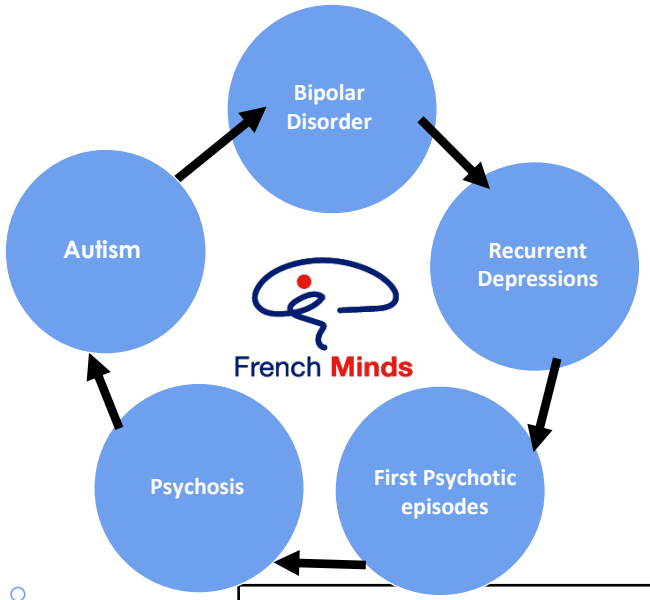
22

P.I.'s COHORTS
enrolled in this initiative

NAME OF ACCEPTED PARTICIPANT	COUNTRY	NAME OF COHORT
Europe		
Marion **LEBOYER**	**FR**	FACE BP/SZ/DR/ Autism & French Mind
Thomas **SCHULZE**	**DE**	PsyCourse
Andreas **MEYER-LINDERBERG**	**DE**	
Ole **KÖHLER-FORSBERG**	**DK**	Danish Cohort
Ole **ANDREASEN**	**NO**	Nodic Cohort
Per **QVIST**	**DK**	Cohorts of normal subjects
Brenda **PENNINX**	**NL**	NESDA Cohort
Peter **FALKAI**	**DE**	Centers of excellence
Nikos **KOUTSOULERIS**	**DE**	CDP cohort
Florian **RAABE**	**DE**	PRONIA cohort
Livia **DE PICKER**	**BE**	Utrecht
Paolo **BRAMBILLA**	**IT**	Italy
Celso **ARANGO**	**SP**	CIBERSAM first episode cohort
United Kingdom		
Neil **HARRISON**	**Cardiff**	
Carmine **PARIANTE**	**London**	
Rahcel **UPTHERGROVE**	**Oxford**	
Australia		
Michael **BERK**	**AU**	
Canada		
Ana **ANDREAZZA**	**CA**	
Brazil		
FLAVIO KAPCZINSKI	**BR**	USP cohort in Bipolar Disorder
USA		
Hilary **BLUMBERG**	**US**	Yale cohort
Mark **FRYE**	**US**	Mayo Clinic
LEANNE WILLIAMS	**US**	Stanford

FRENCH PROGRAM IN PRECISION PSYCHIATRY

The creation of the French "French Mind" cohort (10,000 patients and controls)

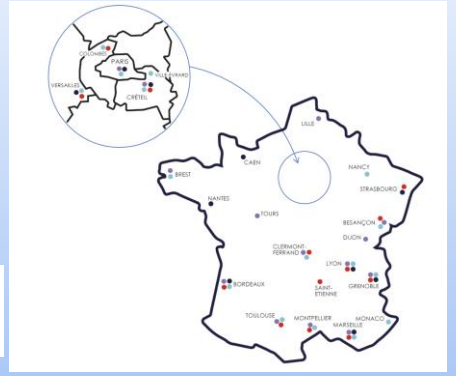


FRENCH MINDS COHORT

2500 Patients

500 controls

9000 patients included in the FACE Data base



WP2: EXPLORING MECHANISMS

CLINICAL PHENOTYPES
Behavioural
Somatic
Cognitive

DEEP PHENOTYPING

OMICS
Genomics
Metabolomics
Proteomics
Epigenetics
Immunological

DIGITAL
Conversational Agent
Self rating questionnaires

Ecological Momentary assessment
Sleep, physical activity
Social activities

EXPOSOME
Pollution
Stress
Ifnections…

BRAIN IMAGING
MRI 3T, 7T
fMRI
Diffusion MRI
SpectroscopY
ElectrophysiologY

WP3: VALIDATING BIOMARKERS CLINICAL TRIALS WITH MECHANISMS BASED TREATMENTS IN SPECIFIC SUBGROUPS

WP4: PUBLIC-PRIVATE PARTNERSHIPS

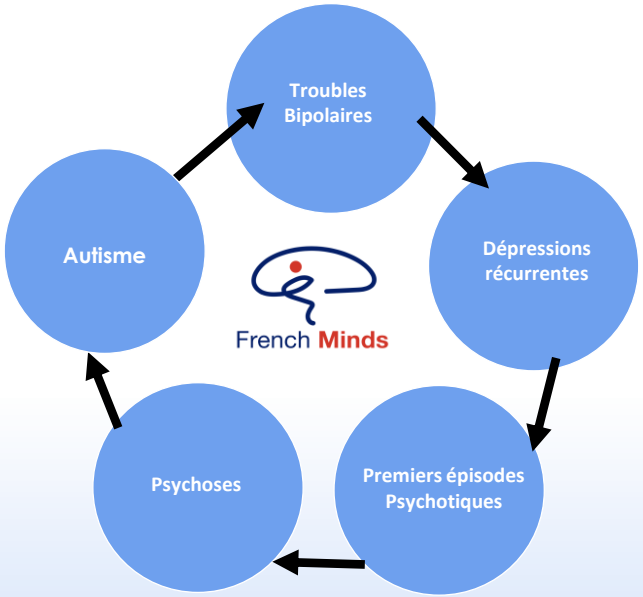
WP5: Inform & educate
Patients and Relatives
Healthcare professionals
Researchers, decision-makers…

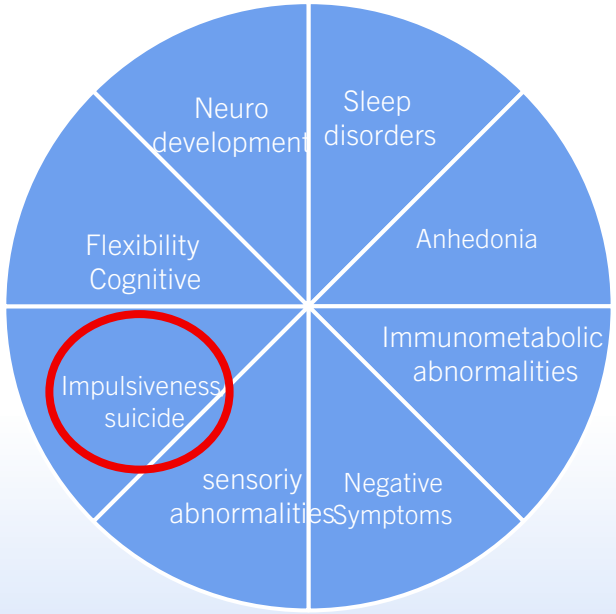
https://pepr-propsy.fr/en/home/

OBJECTIVES OF THE FRENCH MINDS COHORT

Identify trans or a-nosographic dimensions / homogeneous clinical forms

DIAGNOSTIC CATEGORIES » **QUANTITATIVE TRANSNOSOGRAPHIC DIMENSIONS** **&** **HOMOGENEOUS SUBGROUPS**





HOMOGENEOUS SUBGROUPS:
CLINICAL-BIOLOGICAL SIGNATURE
EX : AUTO IMMUNE PSYCHOSIS

To integrate clinical, cognitive, digital and biological data to search for uni/bi/multimodal signatures of transnosographic dimensions which may be the target of specific therapeutic strategies

https://pepr-propsy.fr/en/home/

ON THE ROAD TO PRECISION MEDICINE IN PSYCHIATRY…

Examples from French projects in precision psychiatry

WHAT?

IMMUNO-METABOLISM: can we stratify patients with **immuno-metabolic activated pathways** towards precise treatments?

GENOMICS: can we stratify patients with **genomic association or mutations** towards precise treatments?

BRAIN IMAGING : can we stratify patients with **brain imaging abnormalities** towards precise treatment strategies?

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CLINICAL TRIALS OF ANTI-INFLAMMATORY DRUGS IN DEPRESSION HAVE FAILED

Why ?

INCLUSION CRITERIA

Problem

Studies have included **heterogenous depressed populations** despite the fact that inflammation is only found in subgroups of depressed patients

We need to stratify and enrich

DRUGS

Problem

Most anti-inflammatory drugs tested have multiple target effects, and there have been few studies examining a specific immune dysfunction

We need to identify etiological mechanisms and to target them

OUTCOME

Problem

Primary outcomes are behavioral **measures** not specifically associated to inflammation

We need to use objective biomarkers as outcomes

Jha, Leboyer, Pariante, Miller, **JAMA PSY,** April 2025, *Should inflammation be a specifier for depression in the DSM-6*

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IMMUNO-PSYCHIATRY: WHAT HAVE WE LEARNT?

ENVIRONMENTAL Risk Factors

Infections | Pollution | Stress/ Trauma | Lifestyle

INTERACTIONS WITH THE IMMUNO-GENETIC BACKGROUND

Innate Immunity genes
TLR, NOD…

Maintaining inflammation
Mitochondria genes

Adaptive Immunity
HLA

Rev in Tamouza…Leboyer
Brain Behav Immuno, Jan 2021
91:731-739.PMID: 33031918

Therapeutic trial with small doses of Interleukin 2
Leboyer et al,
Brain, Behav and Immunity 2024

CHRONIC INFLAMMATION and ABNORMAL METABOLITES in 40% of PATIENTS with MENTAL ILLNESS

- Inflammation
- Neurotransmitter & Connectivity abnormalities

- Inflammation
- Immune cells

- cellular energy

- Digestive inflammation
- Changes in gut flora

Auto-immune Psychosis | Retro-virus Human Endogenous | Abnormal Metabolism/ mitochondria | Accelerated Aging | Intestinal dysbiosis

Immuno Modulation trial
TIM Depist *In progress*

SOMATIC AND PSYCHIATRIC COMORBIDITIES
Schizophrenia, bipolar disorder, depression, autism…

Polymicrobiotherapy trial
« Swing » *In progress*

Jezequel et al, **Nature Comm,** 2017

Leboyer and Tamouza, **Eur Neuropsychopharmacol**, Dec 2024

IMMUNO-PSYCHIATRY ON THE ROAD TO PRECISION PSYCHIATRY:

The example of « Auto-Immune Psychosis": anti NMDA-R , anti alpha7 nicotinic R…

CLINICAL PRESENTATION	BLOOD BIOMARKERS
Rapid onset of of Psychiatric symptoms: **Catatonia**	
Neurological soft signs (e.g. Headache paresthesia…)	**Intolerance /resistance** to antipsychotics
	Circulating Autoantibodies against neurotransmitter receptors
	Other immune markers: CD-14/various autoantibodies

AUTO-IMMUNE PSYCHOSIS

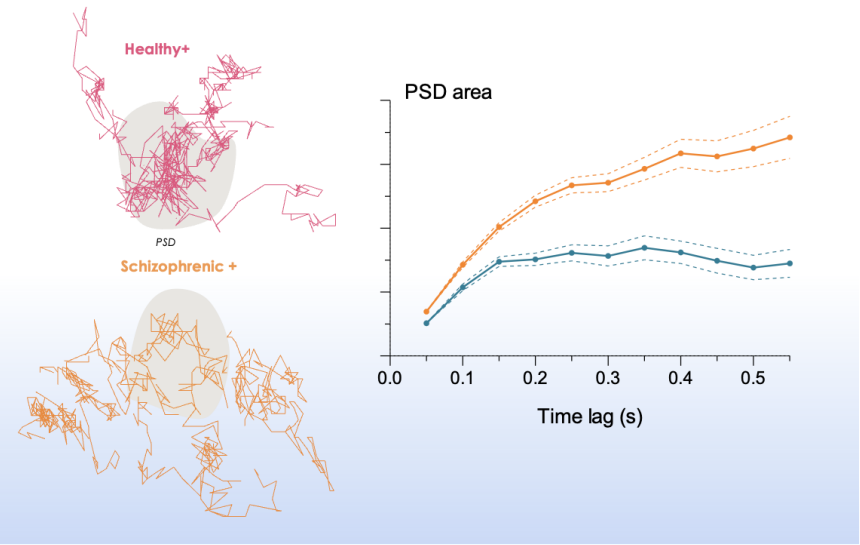
Family/personal history of autoimmune disorders	**Past history** of infection

MEDICAL HISTORY

Ellul…Leboyer, **Frontiers in Psychiatry**, 2017
Jezequel et al, **Biological Psychiatry**, 2017 Nov 15;82(10):766-772.
Polack et al, **Lancet Psychiatry**, 2020 Jan;7(1):93-108.
Darrau…Leboyer, Maskos, **Translational Psy**, Fev 2024

UNDERSTANDING MECHANISMS

USING SINGLE NANO PARTICLE TRACKING IN SYNAPTIC AREAS



Jezequel…Leboyer, Groc **Nature Comm** Nov 27, 8 (1) : 1791

TIMDEPIST PROTOCOL
(2023-26)

ImmunOptic

2 perfusions at 15 days
RITUXIMAB

ONLY IN PATIENTS WITH BLOOD AUTO ANTIBODIES AGAINST Brain Receptor (NMDA..)

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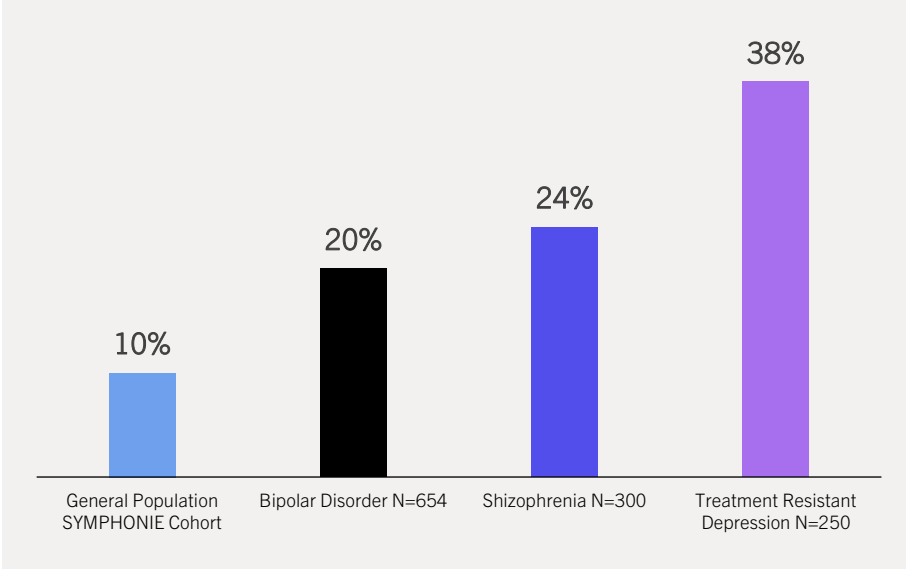
French Program in Precision psychiatry : auto-AB, exploration of mechanisms of action, therapeutic trials, training

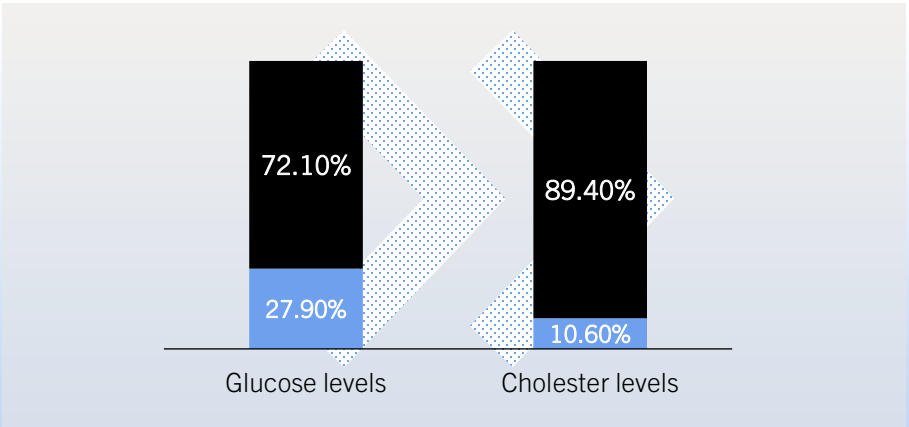
IMMUNO-METABOLIC PSYCHIATRY ON THE ROAD TO PRECISION PSYCHIATRY

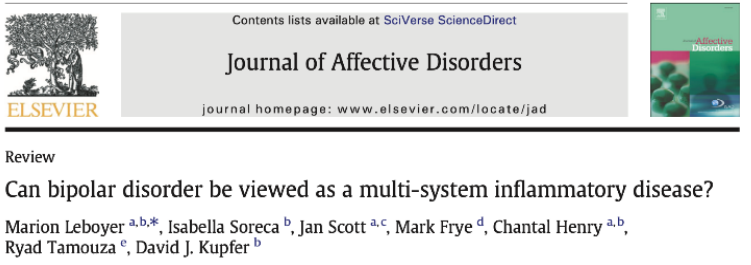
The example of metabolic syndrome in the FACE data bases (FondaMental Advanced Centers of Expertise)

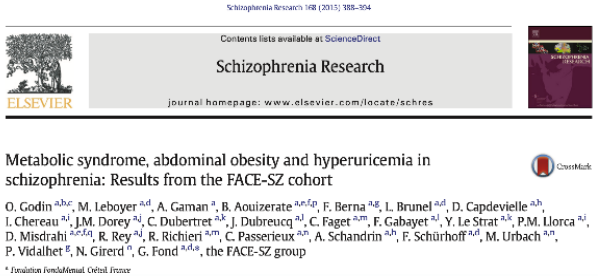
Metabolic syndrome definition

- **Waist circumference ≥** 94 cm for men and ≥ 80 cm for women
- **Hypertriglyceridemia**
- **Low HDL cholesterol level ≤** 1.03 mmol/L for men and ≤ 1.29 mmol/L for women
- **High Blood pressure ≥** 130/85 mm Hg or taking antihypertensive medication
- **High Blood glucose ≥** 5.6 mmol/L or use of hypoglycaemic drugs









Godin..Leboyer. **J Clin Psy, 2014**
Godin …Leboyer . **Schizophr Res, 2015**
Godin O..Leboyer **J Clin Psy, 2020**

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IMMUNO-PSYCHIATRY ON THE ROAD TO PRECISION PSYCHIATRY

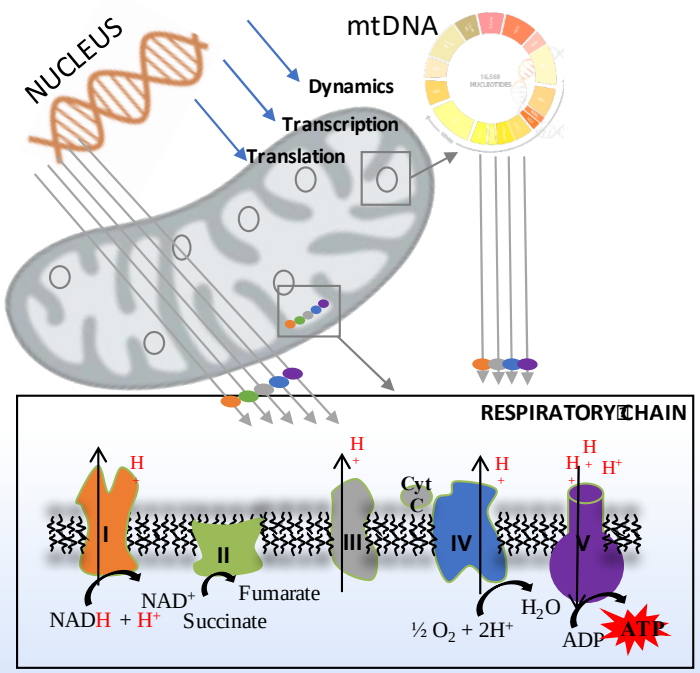
The example of metabolic syndrome and abnormal mitochondria in Bipolar Disorder

FUNCTIONAL
MITOCHONDRIA

- Cells of brain require energy (20% of our total energy)
- High mitochondrial density support energy demands, establish membrane excitability and execute complex processes of neurotransmission and plasticity

DYSFUNCTIONAL
MITOCHONDRIA

- Alter neurotransmitter release and firing rates
- Patients with classical mitochondrial disease present neurological manifestations including seizures, stroke-like episodes, developmental delays, neurological decline,
- And often psychiatric symptoms



Mitochondrial dysfunction in Bipolar Disorder is supported by

- Decreased mtDNA content (-36%)
- Higher frequency of mitochondrial DNA mutations
- Decreased mitochondrial complex I activity
- High levels of mitochondrial metabolite lactate levels
- Increased Reactive Oxygen species (ROS)production and increased oxidative stress in Dopamine prefrontal cortical regions

French Program in Precision psychiatry (PEPR PROPSY)

Identifying which patients are affected by mitochondrial dysfunction to select patients for future clinical trials targeting mitochondria.

Angrand et al, **Brain Behavior and Immunity, 2021**
Zachos et al, **Psychiatry Res, 2024**, 339: 116063
Freyberg et al, **Biol Psychiatry, 2025**, 10:267-277

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HOW TO STRATIFY PATIENTS WITH IMMUNO-METABOLIC ABNORMALITIES TOWARDS MECHANISMS BASED TREATMENTS?

	IMMUNO-METABOLISM	MITOCHONDRIAL DYSFUNCTIONS	AUTO-IMMUNE PSYCHOSIS	HUMAN ENDOGENOUS RETROVIRUS	GUT DYSBIOSIS
ENVIRONMENT	Infections	Pollutions	Urbanicity	Stress/ Trauma	Migration	Unhealthy life style
IMMUNOGENETIC	Dysfunctional Mitochondria	High Mt DNA	HLA haplotypes	Toll like Receptor genes	HLA haplotypes /Dectin
	Persistent, sterile, non resolving, increasing with age, low grade **INFLAMMATION**				
	Autism	Psychotic Disorders	Mood and anxiety Disorders		
SIGNATURE	Metabolic syndrome Treatment Resistance High Lactate & glucose, Lipid abnormalities, insulin resistance, Elevated ROS production, low ATP production	Negative symptoms, Cognitive Decline Treatment Resistance Chronic inflammation	Brain auto-antibodies Rapid onset of psyciatric symptoms Catatonia/mild neurologic symptoms Resistance to antipsychotic	History of trauma/infections ENV protein, Cytokines	Intestinal permeability Dysbiosis Gastro intestinal symptoms
MECHANISMS-BASED TREATMENTS	Diet Metformin/Statin	NAC, Minocyclin, Trimetazidine	IgG, Ritumixab	Anti-ENV antibody	Poly-microbiotherapy

USING GENOMICS TO DEVELOP DIAGNOSTIC TOOLS AND TREATMENTS IN PSYCHIATRY HAVE FAILED:

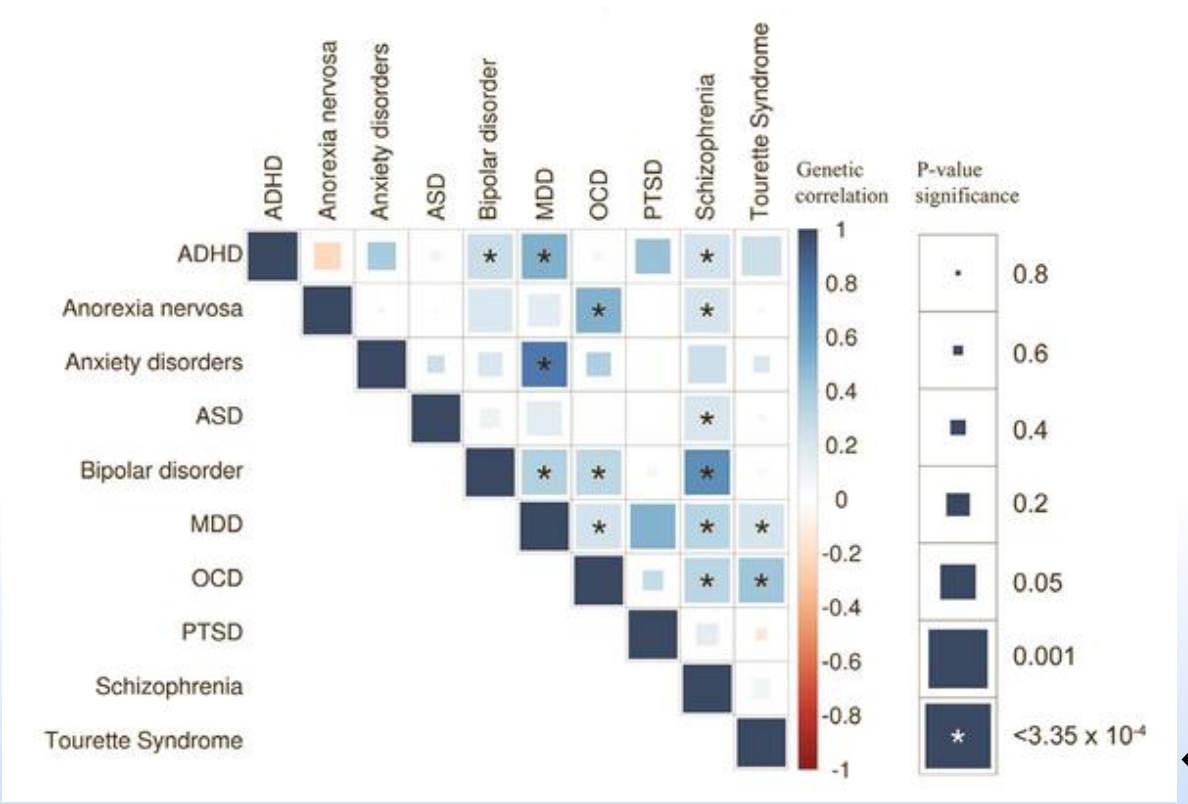
Genes don't read DSM…

DIAGNOSTIC

Problem

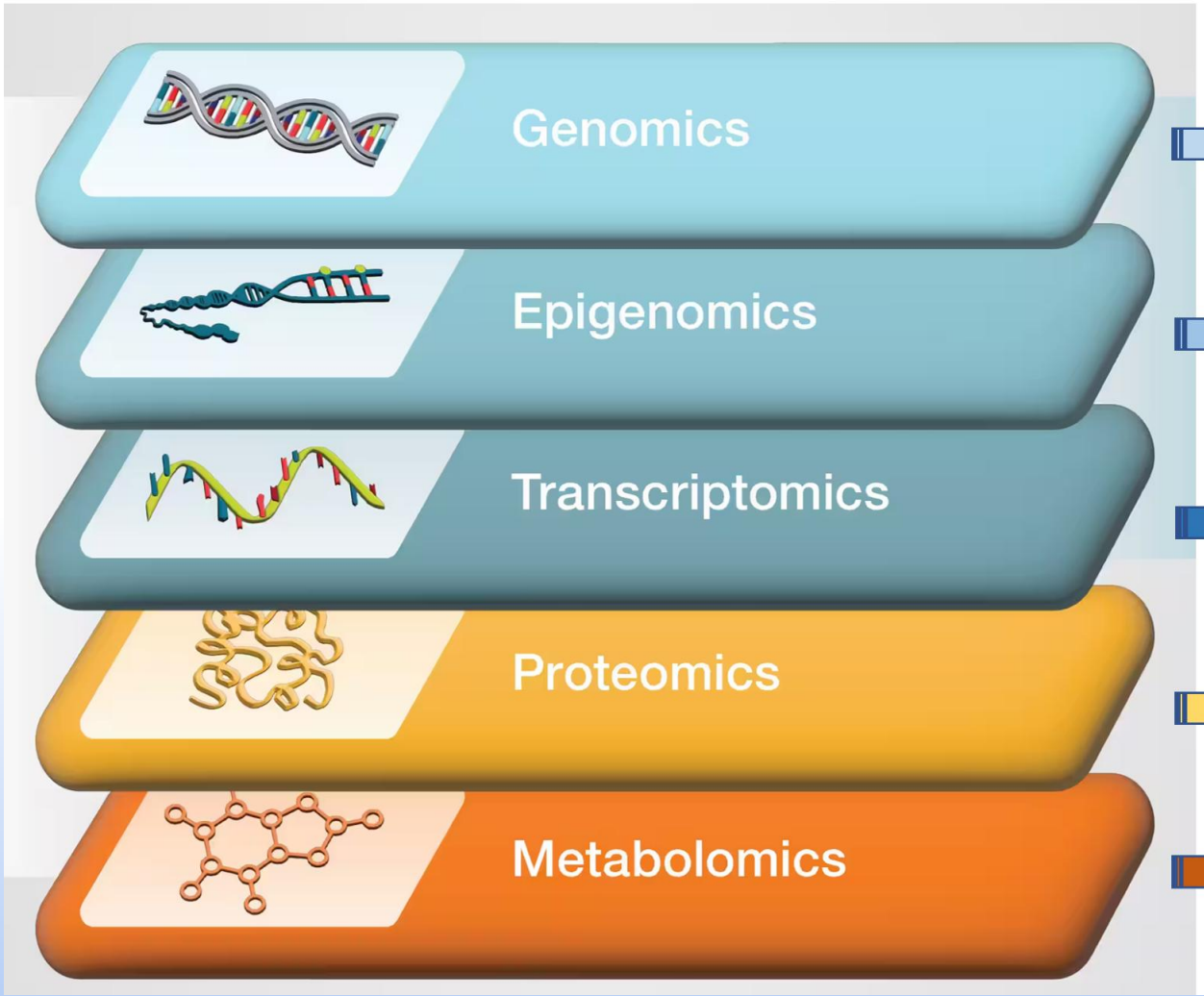
Genes don't read DSM…

We need to use molecular biology
- To identify rare disorders
- To personalize treatments
- To stratify patients
- To integrate environmental risk factors



Brainstorm Consortium - **Science 2018**, *22;360(6395)*

FRENCH MIND COHORT: OMICS ANALYSIS



Genotyping (GSA + immunochip)
Whole-Genome Sequencing
(Short reads, Illumina NovaSeq+, 30X)

DNA methylation (EPIC chip v2)

RNAseq (ribosomal depletion, paired end, 50 millions reads)

Multiplex assays (Olink)

NMR spectroscopy
Mass spectrometry

CRITERIA FOR ELIGIBILITY TO WHOLE GENOME SEQUENCING

FRANCE MEDECINE GENOMIQUE 2025

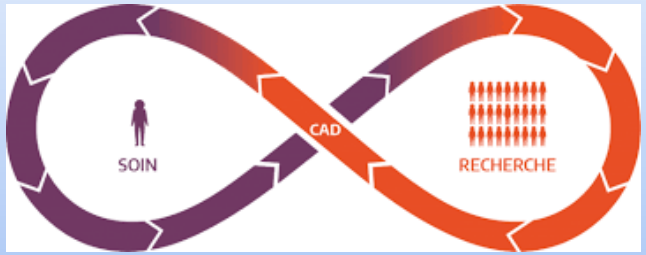
PFMG2025–integrating genomic medicine into the national healthcare system in France

PFMG2025 contributors[a]

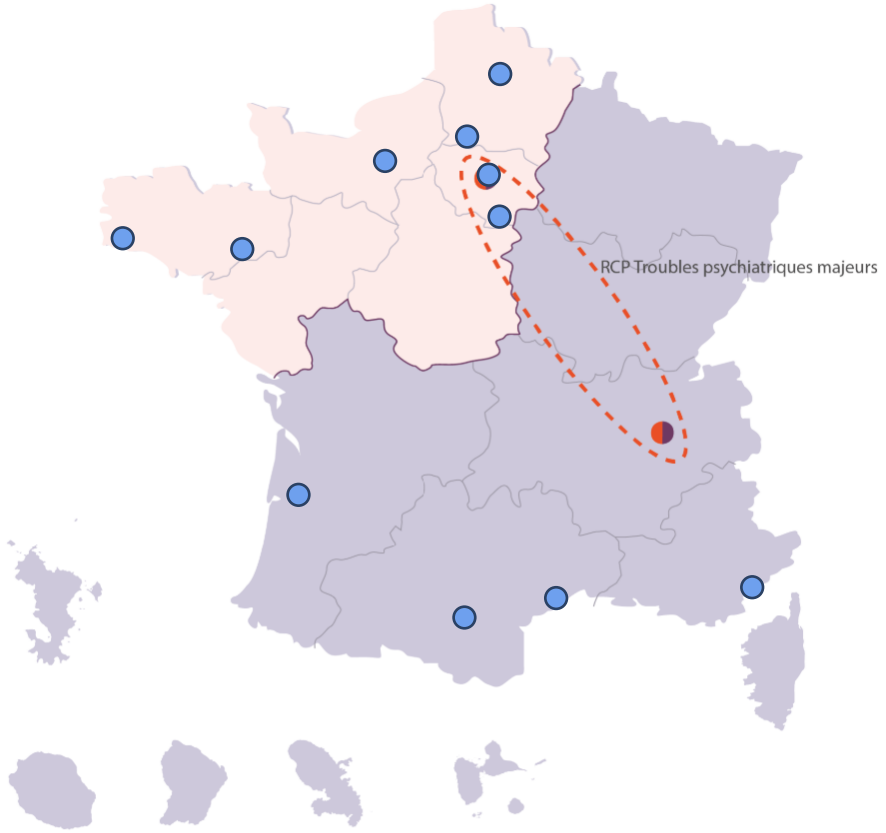
THE LANCET *Regional Health* Europe

SCHIZOPHRENIA OR BIPOLAR DISORDER WITH AT LEAST ONE OF THE FOLLOWING RED FLAGS

- Early age of onset
- Resistance to treatment
- Early and significant adverse effects of treatment
- Associated neurodevelopmental disorder
  (e.g. autism spectrum disorder, intellectual development disorder, learning disability, special schooling, etc.)
- Cognitive or motor disorders suggesting a neurodegenerative origin
  (e.g., decline in executive or memory functions at an early age)
- Dysmorphia or organic disease suggesting a genetic origin
  (e.g. poorly stabilized epilepsy, associated heart disease, etc.)
- Family history of psychiatric disorders or sporadic case
- Atypical presentation of the disorder
  (e.g. visual hallucinations, confusion, catatonia, etc.)



Genomic data collected during clinical care are uploaded to the CAD (Data Collector and Analyzer) for research purposes.



The number of centers able to prescribe whole genome sequencing has raised since 2023 from 2 to 13.

HOW TO USE GENETICS TO PERSONALISE AND IMPROVE THERAPEUTIC STRATEGIES?

	Autism	Psychotic Disorders	Mood and anxiety Disorders	
CATEGORY	**RARE DISEASES**	**PHARMACO-GENOMICS**	**GWAS and POLYGENIIC RISK SCORE**	**EPIGENOME**
CLINICAL RED FLAGS	Age at onset, neuro-developmental features…	Resistance to treatment Severe side effects	Somatic comorbidities…	Exposure to environmental risk factors
BIOMARKER	**Whole Genome Sequencing** Intelectual disability (ID): ~50% ASD with ID: ~30% ASD without ID*: ~10-15% Schizophrenia: ~5% Schizophrenia & neurodev features*: ~25% *french unpublished data	**Genotyping** Determining the genotype of genes involved in absorption, distribution, metabolism, and excretion HLA genotype helps to predict tolerance and response	**Individual risk profiles** -PRS related to certain pathways (ex: MitogeneRisk) -Testing the correlation between traits (ex: metabolic disorders) and diseases	**Testing the impact of environmental risk factors** Developing a DNA methylation score of the disorders or of exposure to certain environmental factors or episignature
STRATEGY	- Integrating genomic medicine into the national health care system - Developing etiological treatments	Developing a pharmacogenomic passport to help choose the drug & the doses	Stratification based on PRS risk profiles, for ex - Cardiovascular risk could be better estimated - Treatment boosting mitochondria in the subgroup with high mitoRisk score	To obtain an objective marker of environmental exposure

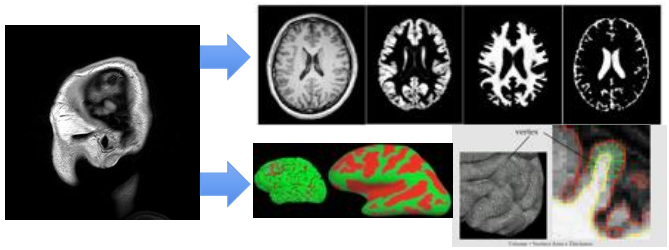
FRANCE MEDECINE GENOMIQUE 2025

As of August 2025, France has authorized the clinical sequencing of over 300 individuals diagnosed with specific forms of schizophrenia or bipolar disorder.

The Lancet Regional Health Europe

HOW CAN WE USE NEUROIMAGING IN PRECISION PSYCHIATRY

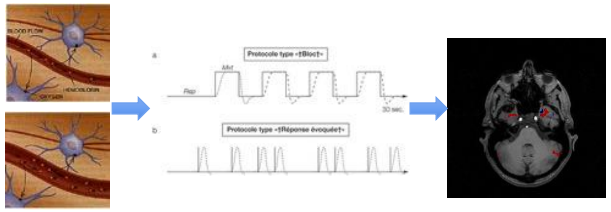
Transdiagnostic atypicalities in schizophrenia, bipolar disorder and autism



Anatomical MRI

Decreased cortical thickness

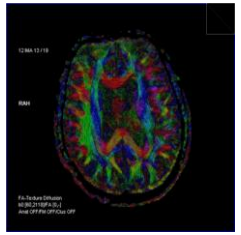
Laidi, Leboyer, Houenou et al.
Biological Psychiatry 2022PMID: 36137706

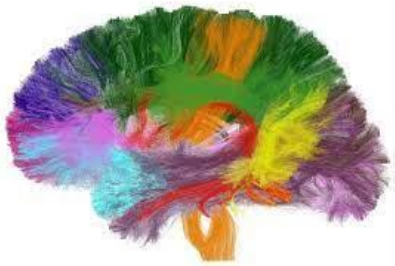


Functional MRI

Altered functional connectivity

Krystal, Houenou Favre et al.
Molecular Psychiatry 2023 PMID: 38724567





Diffusion MRI

Decreased anatomical connectivity

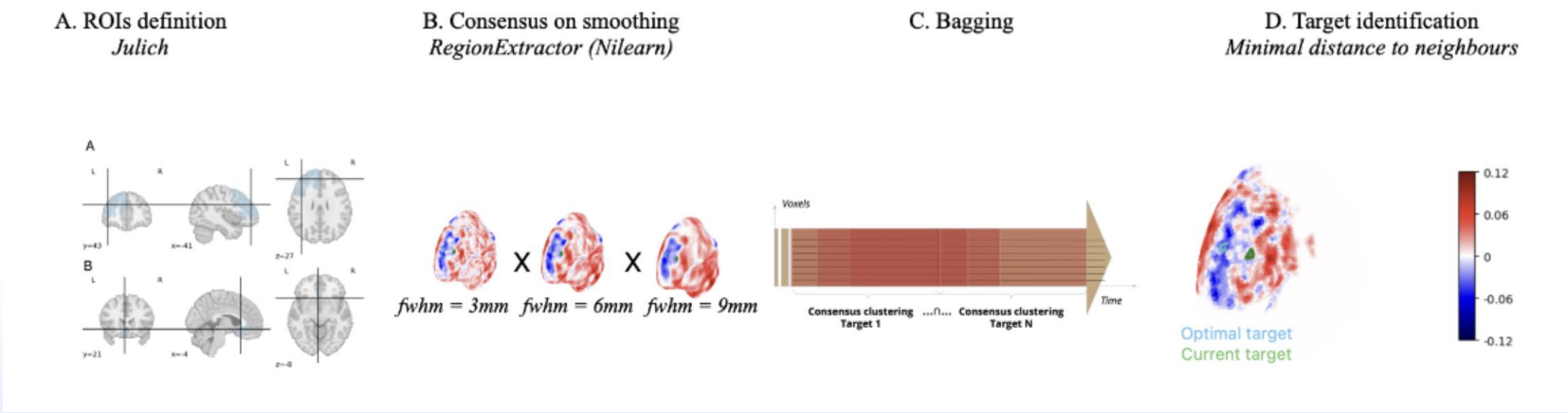
d'Albis, Leboyer, Mangin, Houenou
Brain 2018 PMID: 30423029

No MRI modality / brain region is involved in a specific psychiatric disorder

Neuroimaging can guide targeted interventions in psychiatry

FROM NEUROIMAGING TO TREATMENT PERSONALIZATION

Individualized target
for Transcranial Magnetic Stimulation in depression



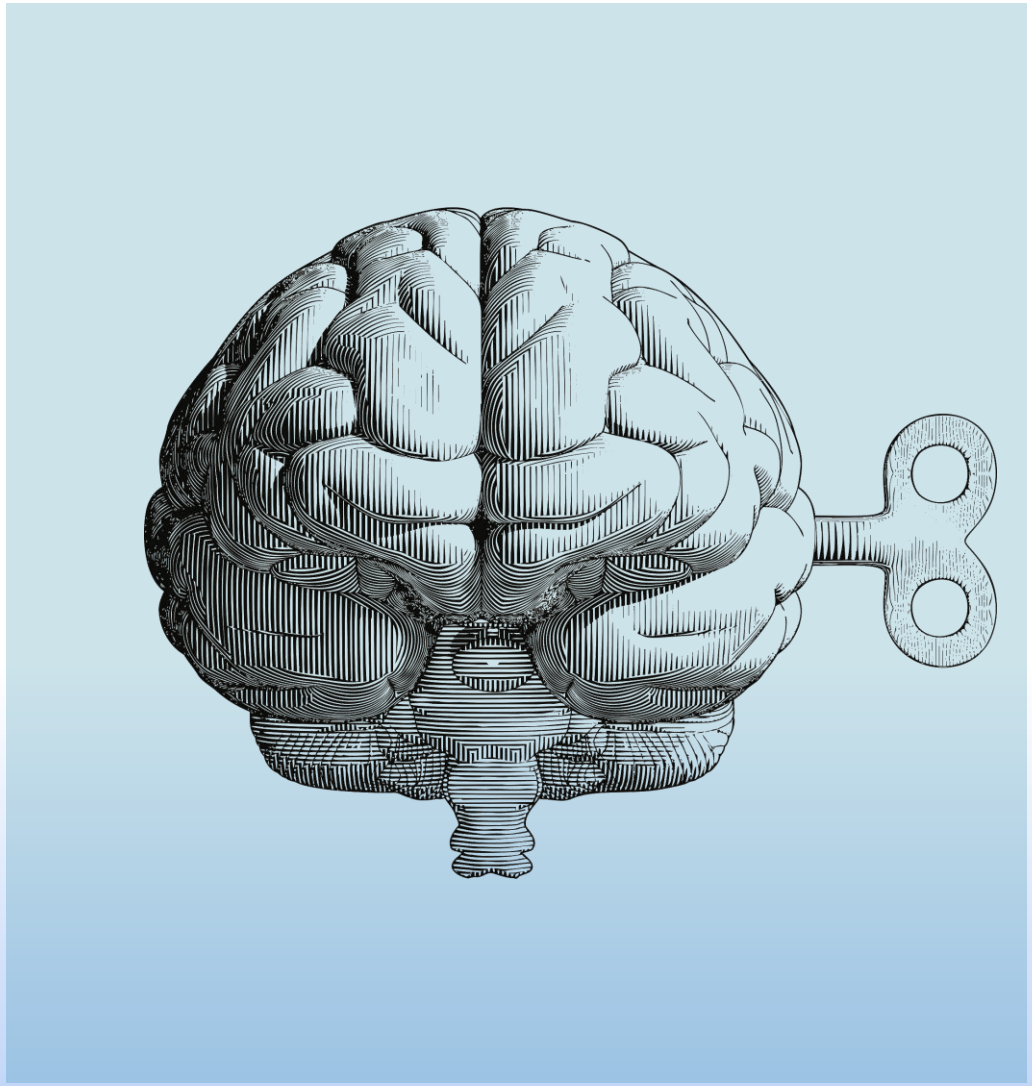
Mondor-stim: an open-source pipeline to optimize the targets for Transcranial Magnetic stimulation, based on fMRI Functional Connectivity

Talou, Bouaziz, Bertrand, Laidi et al. 2024
Zenodo archive https://doi.org/10.5281/zenodo.13323615

BRAIN IMAGING PAVING THE WAY TO PRECISION PSYCHIATRY:

Hypothetical subgroups identification and mechanisms-based treatments

	DECREASED CORTICAL THICKNESS	ATYPICAL FUNCTIONAL CONNECTIVITY	CEREBELLAR ALTERATIONS
	Autism	Psychotic Disorders	Mood and anxiety Disorders
CLINICAL SIGNATURE	Early age at onset Negative symptoms Cognitive impairment Chronicity	Anhedonia Apathy Blunted affects	Negative symptoms Cognitive Decline Treatment Resistance
BLOOD BASED SIGNATURE	Complement activation HLA / C4 Gene	Chronic inflammation ?	Maternal immune activation ?
MECHANISMS-BASED TREATMENTS	Immuno-modulation?	Immuno-modulation?	Non-invasive brain stimulation



It is time for PRECISION PSYCHIATRY…

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www.foundation-fondamental.org

https://pepr-propsy.fr