LIEBER INSTITUTE
Establishing the Nation’s First African American Neuroscience Research Initiative
EXECUTIVE SUMMARY

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THE GENOMIC REVOLUTION

Genomic research has the potential to provide some of the most personalized and effective medical treatments in human history. Advances in the biosciences, combined with big data analysis, have led us to the cusp of a revolution in medicine.
PRECISION MEDICINE: THE NEW FRONTIER

Precision medicine promises delivery of the right intervention to the right patient at the right time.

One size fits all

Precision medicine
Humans are **99.9%** genetically identical. The **0.1%** accounts for all human diversity on the planet.

The genetic similarity between a human and a fruit fly is: **61%**

The genetic similarity between a human and a domestic cat is: **90%**
WHY ANCESTRY MATTERS: THE 0.1% DIFFERENCE

The human genome consists of 3 billion DNA base pairs:

- > 88 million genetic variants account for all human diversity

The degree of genomic diversity is the highest among African ancestry populations, as a result of population history.
EXAMPLES OF ANCESTRAL VARIATIONS THAT CONTRIBUTE TO RISK FOR DISEASE OR RESPONSE TO TREATMENT

UNDERSTANDING HEALTH DISPARITIES

**APOL1 gene**

African Americans have higher prevalence of kidney disease related to variants in *APOL1* gene – a variant evolved to protect against African trypanosomiasis.

**ABCA7 & ApoE genes**

Alzheimer's disease is more common among African Americans. Two genes (genes ABCA7 and ApoE) are associated with higher risk of the neurodegenerative disorder, but their effects are different in African Americans than in European Americans.

DISCOVERIES IN BIOLOGY

**Regulation of blood pressure**

African Americans have higher frequency of PCSK9 – a variant that regulates low-density lipoprotein (LDL) receptors, as well as regulation of blood pressure and an inhibitor of this enzyme is a promising new therapeutic for hyperlipidemia – based on selection pressures due to malaria.

**HLA-B*5701**

Patients with the HLA-B*5701 allele may have a toxic effect or adverse reaction to Abacavir – a treatment for HIV. Studies show that a Kenyan Masai group have double the prevalence of this variant (13.6%) compared with European samples. The variant is absent among a Toruba group in Nigeria.
83,000 deaths occur each year because of health disparities between individuals of African descent and those of European descent.

<16% of the world is of European descent, but 81% of large-scale genomic datasets are of people of European descent.
MINORITY POPULATIONS ARE SIGNIFICANTLY UNDERREPRESENTED IN GENOMIC RESEARCH

- A recent analysis of 910 individuals of African descent revealed that the reference genome, used universally in genetic research to-date, omits almost 10% of the African genome (roughly 300 million base pairs).

- Polygene risk scores for common medical disorders predict illness risk in African Americans on average one tenth of the predictions in Caucasians.
In neuroscience research studies, underrepresented minority groups, including African Americans, make up less than 5% of cohorts.

< 1% of genomic studies on postmortem human brain tissue includes data from individuals of African ancestry.

- Postmortem brain studies in minority populations, including African Americans, have included a fewer number of subjects and therefore do not yield significant data for the diseases in question.
MOST EXTENSIVE BRAIN REPOSITORY IN THE WORLD

Expanding and scaling-up biological research on the largest African American postmortem brain repository for the study of neuropsychiatric conditions.

3,000+

With 3,000+ human brains collected, the Lieber Institute has assembled the largest, most carefully curated and characterized collection of human brains for study of neuropsychiatric disorders in the world.

500

Brains are individuals of African ancestry.
- All donations are consented by next of kin
- African American brain donation rates to LIBD are **60.5%**, higher than all other national brain banks
- Cases include disease areas such as major depression, schizophrenia, substance abuse disorder, post-traumatic stress disorder, bipolar disorder, suicide, and those with no known psychiatric disorders (controls)
- Mean age: 44

Results from LIBD Postmortem Genetic Studies:
MENTAL HEALTH: A GLOBAL HEALTH CRISIS

800,000 people die by suicide globally every year.

Suicide is the second leading cause of death globally among 15-29 year olds.

450 million People suffer from mental illness worldwide.

13% Neuropsychiatric disorders account for 13% of global disease burden – more than cardiovascular disease and cancer.

25 years The life expectancy gap in the U.S. for people with severe mental illness compared to the general population.

$2.5 trillion The cost of mental health worldwide per year, which is expected to increase to $6 trillion by 2030.
MENTAL HEALTH IN THE AFRICAN AMERICAN COMMUNITY

African Americans are 20% more likely to experience serious mental health problems than the general population.

2X Suicide rates for African American children under the age of 13 are twice as high as children of European ancestry.

1 in 4 African Americans will experience a mental health disorder in their lifetime.

20% Alzheimer’s disease is more prevalent among African Americans than among whites — with estimates ranging to almost 100% higher.

100% African Americans are more likely to experience certain factors that increase the risk for developing a mental health condition, such as homelessness and exposure to violence.

70% of youth in the juvenile justice system are living with at least one mental health condition.

Minorities make up 1/3 of the total U.S. youth population, but they make up nearly 2/3 of the young offenders behind bars.

URGENT NEED
Utilizing LIBD’s unique brain repository, there is an immediate opportunity to scale up genomic research in postmortem brains of individuals of African ancestry and create the largest open-access dataset in the world. These datasets could be used by researchers globally to advance new therapeutics and prevention strategies for individuals of African ancestry.
CALL TO ACTION

- Establish the world’s first African Reference Genome
- Secure funding to scale up neuroscience research initiative
- Convene first annual national meeting in Baltimore, Maryland
- Expand collaborations and partnerships
TODAY:
Genomic studies and clinical research studies predominately focused on individuals of European ancestry

IN THE NEXT DECADE:
Genomic studies and clinical research studies inclusive of minority populations
COMMUNITY LEADERSHIP

LIBD has partnered with prominent leaders of the faith-based community in Baltimore, working to ensure equity for African Americans in medical research.

“My clergy colleagues and I believe that precision medicine has the potential for finding cures and treatments for diseases that uniquely affect African Americans. This revolution in medicine has largely left behind ethnic minority groups like African Americans, and it is time to change this.”

Dr. Alvin C. Hathaway, Sr., Pastor
Union Baptist Church
LIEBER INSTITUTE FOR BRAIN DEVELOPMENT

Independent, not-for-profit medical research institute developing novel treatments for developmental brain disorders.

- Affiliated with the Johns Hopkins Medical School, LIBD was established in 2010 through the historic gift of Constance & Stephen Lieber and Milton & Tamar Maltz
- LIBD is the largest non-Hopkins employer in the East Baltimore Biotech Park
- Employing more than 100 multi-disciplinary experts
- Led by Dr. Daniel Weinberger formerly the head of the Genes, Cognition and Psychosis Program at the NIH
- World-class team of lead scientists with more than 200 years cumulative experience and 2,500 published scientific papers
- $30 million annual budget
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