

# Precision Mental Health

NEUROSCIENCE-INFORMED CLINICAL SOLUTIONS

Leanne Williams, PhD | Professor of Psychiatry and Behavioral Sciences

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### **Dr. Williams' Roadmap for Precision Mental Health**

*To improve the quality of life of individuals, there are five areas of intersecting focus that will use personalized neuroscience to translate learnings about the human brain into real-world care. These areas will not operate in silos or in sequence—instead they will build upon and inform each other. These areas will be advanced in the Williams Lab and others in the context of the new Center for Precision Mental Health and Wellness and its collaborators.*

#### **1. Personal Biotype Imaging**

*Identifying how human brain circuits are disrupted and expressed in symptoms is key to getting valid and precise diagnostics for depression and related mood disorders. In this area of personal biotype imaging, the Williams Lab is already using advanced techniques to make a visual representation of circuit biotypes at the individual-person level. These researchers are leveraging our lead in developing the first circuit classification for mood disorders and developing technologies to characterize biotypes with sub-millimeter resolution. As this effort progresses, they are continuously working to increase the speed of fMRI tests. The goal is to make this information immediately available to clinicians who are on the front lines of care.*

#### **2. Novel Technologies**

*To deeply characterize the mechanisms of personal biotypes, the center will integrate imaging with data on personal genetics, microbiome, and life experiences that can quantify brain states. They will then expand to acquiring markers to track brain and stress associations. The goal is to capture as much information about each individual patient as possible—ideally daily—to provide a more complete picture. The center is designing wearable technologies that capture personalized data connected with biotypes and will also integrate other novel technologies.*

**Time is everything.** If you have an infection, lab tests are returned within 24–48 hours that identify the first-choice antibiotic—for you. Lives are saved. But if you suffer from a mood disorder, such as depression or anxiety, the difference in your experience is stark. It can take months or years of “trial and error” to find the most effective treatment. And similar to infections that aren’t treated in time, mental health disorders can progress rapidly, which is why closing the time gap to determine targeted, individualized treatments for mood disorders is paramount.

**Leanne Williams, PhD**, professor of psychiatry and behavioral sciences and associate chair of translational neuroscience, understands that time is consequential. She has developed a personalized, rapid diagnostic and treatment framework to identify the first-choice treatment for mood disorders in three hours—not three years. The potential impact on individuals, their families, and society overall will be enormous.

**Depression alone is a major global public health threat** affecting more than 400 million people worldwide. In the United States, more than 16 million people suffer from it, and 44,000 die by suicide each year—one person every 40 seconds. Another 40 million suffer from related anxiety disorders and 5.7 million from bipolar disorders. Unfortunately, only one-third of patients recover on the first treatment they try. Depression and related conditions prevent sufferers from living normal and fulfilling lives and cost the global economy \$1 trillion in lost productivity every year. One in 10 will suffer from depression during their lifetime, but the wide net it casts is even greater when considering the impact on families and friends.

**With an innovative research roadmap**, Dr. Williams is working to reduce the global impact of mood disorders and other psychiatric disorders by tackling them from an entirely different perspective. Her goal is to introduce a new model of care using personalized neuroscience to translate insights about an individual person’s brain into real-world care and accelerate treatment, which would vastly improve, and potentially save, the lives of many people who suffer from these conditions.

**Dr. Williams' work is at a tipping point**, and investments in this work will be vital for success. She is on track to more than double the treatment success rate and speed up the timeframe. To keep the momentum going, Stanford University School of Medicine recently approved the launch of the Center for Precision Mental Health and Wellness, with Dr. Williams serving as its director. Stanford is poised to become the hub of precision mental

### 3. Targeted Interventions

Given that current mood disorder treatments are only effective in 30 percent of patients, the Williams' roadmap fast-tracks neuroscience-informed interventions and treatment plans using identified biotypes. Through Dr. Williams' early work with biotype classifications, she has shown that her team can, at a minimum, double this efficacy rate. In partnership with colleagues developing novel interventions, they plan to launch the world's first mechanistic studies that test which biotype responds to which intervention, including novel pharmacotherapy, neuromodulation, and behavioral techniques, and why it responds. They will take the biotype findings, layered with personal data, to begin testing which categories of depression respond best to which treatment type (e.g., typical drugs versus atypical drugs, neuromodulation, mindfulness, and cognitive training).

### 4. Data Sciences and Computation

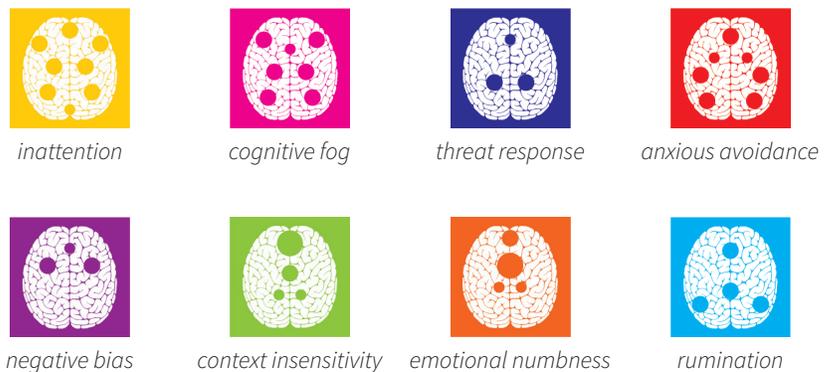
By harnessing data science innovations, the center can transform models of mental health. To accelerate personalized biotype imaging and produce detailed imaging tests and reports, the center will need to enhance cloud-based technologies for storing and sharing much larger, data-packed files. Also needed are transformative computational pipelines. Statistical inference models capable of handling novel features will enhance prediction of risk states and personally tailored interventions. Partnering with experts to develop cutting-edge, machine learning and deep learning models will optimize the center's data, the discovery of new biotype networks, and the laser precision of classifications.

### 5. Clinical Translation and Biotype-Guided Trials

The center is already piloting the first-ever trials to guide treatment according to biotype. With their trial design experts, they will launch a Bay Area biomarker-guided clinical translational trial, testing transformative interventions and novel targets for prevention on scale. Through these efforts, the goal is to establish the social economic case for a new model of care, launch outreach programs to address stigma through neuroscience, and train the next generation of clinical and research leaders.

health, given its location in Silicon Valley and the breadth and depth of multi-disciplinary collaborators across campus. There is already an affiliate team composed of specialties including neuroradiology, psychology, genetics, bioengineering, chemical engineering, computer sciences, population health sciences, global health, and biomedical data sciences that are ready to join forces.

**By enhancing functional MRI (fMRI) technology** and integrating it with her innovative biotyping framework, Dr. Williams and her team have mapped and measured patients' brain circuitry at the millimeter level to identify eight biotypes, or subcategories, of depression. These biotypes reflect combinations of dysfunction in six major networks of the human brain. Based on these patterns of brain activation and behavior, they can now classify the overlapping subtypes of mood disorders as:



Through these subtypes, they are able to guide the choice of treatment for depression, with a 71–81 percent cross-validated success rate in their initial clinical trials. In the future they will apply this same framework to other disorders and emerging novel treatments to create efficiencies and develop a scalable product model.

**To move this novel framework into the real world,** clinical settings for broad application are needed. Subtype-guided clinical trials need to be done on a larger scale, the speed at which tests are completed and reviewed needs to increase, and the timeframe of incorporating new technologies into the mix also needs to be fast-tracked. To achieve these goals, investment in the early stages of research is key. With your philanthropic partnership, we can accelerate this important work to bring hope and healing to many.

# Create Impact

**Imagine a world** where people suffering from depression or a related mood disorder can get immediate test results and personalized treatment within days. With Dr. Williams' research roadmap and your philanthropic support, this could become a reality.

You can create impact and transform lives by helping in our efforts to:

- Secure and retain catalytic leaders and innovators through endowment. An endowed professorship would sustain crucial leadership and would create a lasting legacy in a field the donor cares about deeply.
- Catalyze this bold venture through expendable research support and seed grants that link basic, translational, and clinical sciences to rapidly bring new treatments to patients.
- Create critical infrastructure to carry out the mission of the center. A dedicated research psychiatrist, platform design engineer, and center manager are critical to scale this research vision.
- Empower patients to participate in clinical trials to create a better future for those with mental health disorders.
- Provide training opportunities for currently practicing clinicians, medical students, residents, and fellows in neuroscience-based care strategies who will take these strategies to care settings all over the world.

Join us in changing the landscape of mental health across the globe.

## Contact Us

**Philanthropy** | For questions or a personalized conversation, contact the philanthropic advisor for Psychiatry and Behavioral Sciences.

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