

Personalized Medicine for the Brain

A Call for Action

Disorders of the human brain, such as depression, schizophrenia, and addiction, are the cause of immeasurable human suffering. Because they are largely chronic and strike in youth, brain disorders lead to greater disability and loss of productivity than any other category of illness. On October 24-25, 2009, leaders from the worlds of research, medicine, industry, government, and philanthropy convened at the Mayflower Hotel in Washington D.C. to launch an initiative fostering personalized medicine for the brain. The Mayflower Action Group Initiative was instigated by BRAINnet, a new, nonprofit foundation that provides a database on the human brain using standardized methods.

The Mayflower Action Group advocates the following actions to make personalized medicine for the brain a reality:

1. Integrate

Study the brain as a system. The brain is highly connected and enormously complex, so it must be studied as a system. Studying genes alone is not enough. Multiple levels of information – from genes to brain structure, brain function, cognitive performance and symptoms— must be brought together. Ultimately, the brain’s actions must be captured in real time.

Look at variables in combination. Study composite effects rather than factors in isolation. For example, studying variations in multiple genes will better explain the long-term molecular effects of early childhood trauma and how innate biology interacts with the environment to heighten individuals’ predisposition to depression.

Dismantle silos. In addition to bringing together data, it is urgent to bring together people: geneticists and neuroscientists, clinicians and the pharmaceutical industry, funders of healthcare and funders of research, regulators and policy makers, and crucially, patients. Much more can be achieved by aligning all stakeholders.

2. Standardize

Collect and bring together standardized data. Standardized measurement methods allow data to be pooled and compared. Making aggregated information accessible can reveal how to make real differences now. Consistent, standardized measurements will shed light on the defining characteristics of disorders and for the first time allow researchers to compare the basis of seemingly disparate disorders.

Reconsider diagnostic classification systems. Disease will increasingly be defined at the level of genes and brain biology and may lead to whole-scale changes in the categorization of disorders.

3. Represent real populations

Clinical studies should represent patients as a whole, not just “pure” cases, so that results in fact apply to real people. In brain disorders, co-morbidity is the norm. Yet studies on depression, for

example, routinely leave out those who abuse substances, have post-traumatic stress or anxiety disorders, a known risk of suicide, or physical ailments, like diabetes or heart disease.

4. Meet real-world needs

Distill information for clinical practice. Massive amounts of heterogeneous information must be translated into specific guidelines and measurement tools for health care and done so rapidly. Patients should benefit from the efficacy and safety that the full range of existing knowledge can support. For example, genetics can identify who will benefit from medications for addiction, and heart rate variability training can be used to reduce stress and chronic pain, but such knowledge is rarely put into practice and when it is, the transition is slow.

Meet the consumer revolution. While doctors, politics, and health care agencies are slow to change, consumers have already harnessed the power of instantaneous and widespread access to knowledge through the internet and increasingly demand treatments that will work best for them with the least side effects. In the case of depression, for example, there is no way to predict which patient will respond to which therapy the first time. That needs to change.

5. Harness the power of numbers

Use databases. Databases should bring together complex information obtained in rigorously controlled and standardized ways. Large pools of layered data, made widely accessible, reveal connections in information. Data, gathered well and replicated, becomes the arbiter of what works and how well. For example, cognitive problems in schizophrenia predict disruptions in patients' lives, but treatments rarely cure these problems. Variations in illness course and treatment response may well reflect differences in gene expression, and large-scale analysis is needed to drill down to that level of understanding.

Solutions. We need to implement the current solutions that have demonstrated significant potential to screen for risk and predict treatment outcomes. Solutions providing benefits now need to be more clearly delineated from those requiring more research. A move to electronic health records can be paired with new tools and solutions. Web-based screening measurements and treatment algorithms should be integrated with health records.

Personalizing medicine in brain research must be a long-term commitment. The brain is too important not to have the collective attention of those who understand aspects of this enormously complex system and care about the great human toll of its disorders. The path to more effective treatment is the rigorous collection of information about the brain at every available level of knowledge.

The BRAINnet database is one effort toward this goal. It collects data using highly standardized methods agreed upon by a group of expert users. Researchers are invited to obtain free access to data about the human brain at BRAINnet.net. BRAINnet currently includes 200 collaborators and data from 10,000 people and is growing rapidly. Researchers can use BRAINnet data to answer their own questions and its standardized methods to acquire new data. BRAINnet is one approach to encouraging large, strategically-designed studies that will help speed the translation of basic science into medicine that makes a personalized difference in human lives.

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BRAINnet Foundation is grateful to Brain Resource Ltd. for sponsoring this meeting and delivering the consented data and database to BRAINnet Foundation for transparent governance and use by the scientific community.

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