

# Improving Health Through Transformative Biomedical Research

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**Biomedical research is moving forward at an astonishing speed. The world has never witnessed a time of greater promise for making medical breakthroughs.**

Biomedical research is moving forward at an astonishing speed. In fact, the pace of progress is so swift that it is extremely difficult for anyone to predict the potential for catalyzing improvements in health over the next decade, let alone the next century. Yet, as leader of the world's largest biomedical research agency, I can guarantee one thing: The exceptional opportunities being pursued by today's scientists will transform tomorrow's medicine in many extraordinary ways, some beyond our wildest dreams. So, allow me to share just a few of the opportunities now before us that will lead to a healthier future for humankind, both in the near and long term.

First, many recent advances in health have stemmed from the steady, sustained commitment of resources for basic science. Such fundamental research is generally not supported in the private sector, yet it has served over the decades as the foundation for a wide array of medical breakthroughs. A current example with this potential is the Brain Research through Advancing Innovative Neurotechnologies (BRAIN) Initiative®. The aim of this initiative is to, by 2020, develop tools and technologies that will enable researchers to explore how the brain's roughly 85 billion neurons, each with about 1,000 connections, interact in real time to produce an amazingly complex array of human thoughts and behaviors.

As the 21st century moves along, this foundation of understanding will open new avenues to treat, cure, and prevent Alzheimer's disease, autism, schizophrenia, depression, epilepsy, traumatic brain injury, substance abuse and many other brain disorders.

Scientific advances are also accelerating progress toward a new era of personalized medicine. For example, the president's new Precision Medicine Initiative® (PMI) will capitalize upon the unprecedented alignment of opportunities created by the recent revolution in genomics, the widespread adoption of electronic health records, innovations in mobile health technologies, and the emergence of new computational tools for analyzing large biomedical data sets. As part of PMI, the National Institutes of Health (NIH) is launching a national research cohort of 1 million or more volunteers who will agree to share their electronic health records and other data, including genomic and environmental exposure information. Over the next decade, the pioneering resource provided by PMI cohort database will enable researchers to identify trends and understand health and disease on a much larger scale than is now possible. And, a bit farther down the road, research grounded in this vastly improved understanding will lead to more individualized strategies for diagnosis, treatment and prevention of a broad range of acute and chronic diseases.

A third major area of exceptional scientific opportunity targets one of humankind's most feared diseases: cancer. During his 2016 State of the Union Address, the president announced the establishment of a national cancer "moonshot" — a renewed research surge against a leading killer. The time is right for

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such an ambitious effort because of a coalescence of new scientific insights and technological innovations. One of the most important of these is the transformative realization that cancer is a disease of the genome — that knowing what mutations are present in a person's tumor is often more critical than knowing the organ from which it arose. Another sphere of expanding promise, which will be accelerated by the "moonshot," is the ability to activate the immune system to assist in the eradication of a cancer, even in cases of advanced disease.

With the aim of catalyzing new ways of diagnosing, treating, and, ultimately, curing all of the hundreds of types and subtypes of cancer, current plans for the "moonshot" initiative include accelerated support for cutting-edge research opportunities in cancer vaccines, early detection of cancer, single-cell genomic analysis of tumors, cancer immunotherapy, pediatric cancer and data sharing. While the initiative's bold list of potential deliverables is still unfolding, one goal is certain: to inspire new generations of scientists to push the boundaries in our ongoing fight against cancer in all of its many forms.

Clearly, the world has never witnessed a time of greater promise for making medical breakthroughs in

these and a great many other areas. Given a strong, stable trajectory of support for biomedical research, we can look forward to a bright horizon filled with countless opportunities for improving the health of humankind — whether 10, 50, or even 100 years from now.

#### SCIENTIFIC OPPORTUNITIES

1

**Continuing the commitment of resources for basic science**

2

**Accelerating progress toward a new era of personalized medicine**

3

**Maximizing the renewed research surge against cancer**