Briefing Paper: Key Elements of the NIH Molecular Libraries Initiative - The Molecular Libraries Screening Center Network and PubChem

In 2004, the National Institutes of Health (NIH) began a series of initiatives under the banner of the **NIH Roadmap for Medical Research**. The Roadmap seeks to accelerate the development of new research and medical treatments. As noted by NIH, "future progress in medicine will require a quantitative understanding of the many interconnected networks of molecules that comprise our cells and tissues, their interactions, and their regulation." It was the unanimous opinion of the directors of NIH's Institutes that the number one priority of the NIH Roadmap be the **Molecular Libraries initiative**. This initiative is focused on "small molecules" that are instrumental in the treatment of diseases. In fact, most medicines currently in the market are small molecules.

In order to identify those small molecules that will have the greatest effect on a disease or biological process, NIH will soon be awarding grants to a number of academic centers throughout the United States that will constitute the Molecular Libraries Screening Center Network (MLSCN). Members of the MLSCN will utilize robotic systems to screen molecular targets that are produced by 25,000 human genes against hundreds of thousands of chemicals. The resulting information constitutes an essential step towards the more rapid development of research tools, better diagnostic methods, and disease treatments.

Critical to the success of this initiative and the work of the Centers is PubChem, a publicly available database that includes information about the biological activities of chemical compounds. PubChem, a new database of chemical structures and their biological activities, provides an important new way to link the biomedical information resources at NIH. It is a "chemical index" into all biomedical literature, genes and proteins from the Genome project and more. In addition to playing a critical role in the soon-to-commence MLSCN, these biomedical resources are already used by over 1.5 million users each day.

In addition, two critically important characteristics of PubChem are that it will be comprehensive in scope and will be publicly available. PubChem will capture the enormous flow of information from the Screening Centers in addition to including information from disparate public sources. These disparate public sources are pulled into one database and then linked with related resources (e.g. chemistry, genome, protein and biomedical) so that a scientist can find needed information within a family of databases, share the data with others and build on prior science. PubChem reflects how the scientific and research communities conduct research though computational methods such as the mining of scientific literature and data.

Over the past several years, Congress has significantly increased NIH funding and has recognized the enormous value in targeting research dollars in support of the NIH Roadmap. It is now understood that the integration of chemistry with biomedical information will stimulate new science, lead to new discoveries and breakthroughs. Because the Molecular Libraries initiative is comprised of several independent yet interdependent elements, weakening or eliminating one facet, reduces the effectiveness of the whole. For example, if there is a change in scope or direction of PubChem, the effectiveness of the Centers will be greatly diminished. This, in turn, reduces the opportunities for accelerating the development of new medical treatments.

Moreover because PubChem is a public resource accessible to everyone, researchers and scientists throughout the country, indeed the world, can collaborate and engage in cutting edge research. Such availability acts as a "leveler," expanding the potential user base, allowing for greater sharing of information and the spurring of medical advances. The Molecular Libraries initiative presents enormous opportunities to achieve significant strides in biomedical research, improve the health of the American public, and greatly increase the participation of researchers focused on the development of new therapies.

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