NIH Opportunities Bring Nanomedicine Closer to Patients

http://grants.nih.gov/grants/guide

By targeting specific cells, tissue, and biological systems, engineered nanostructures have the capacity to aid in the diagnosis, treatment, and prevention of many diseases. Realizing its transformational potential, the National Institutes of Health (NIH) supports a number of nanomedical research efforts and is currently soliciting ideas for solving critical biomedical challenges.

NIH offers many opportunities for materials scientists and engineers to contribute their insights and expertise to biomedical problems, while at the same time potentially breaking new ground in their field, according to Jeff Schloss, a program director at the National Human Genome Research Institute, NIH. The programs within which some of the current opportunities are available are described in more detail as follows.

Nanoscience and Nanotechnology in Biology and Medicine *(R01) (R21).* Understanding biological systems at the nanoscale and the process of cell assembly could revolutionize the medical field with applications such as monitoring systems capable of detecting disease progression in real-time. Nanoscience and nanotechnology research related to biology and medicine is of interest to numerous NIH centers and institutes, as evidenced by the wide-ranging examples of research projects in the funding opportunity announcements. A few of the research examples include

- nanostructured surface coatings to reduce the formation of clots on devices,
- nanomaterials or probes for detecting biological processes that change with age,
- techniques to characterize the properties of nanostructured materials, and
- new materials to aid in the repair of tooth decay.

Funding opportunities under these Program Announcements are available using the NIH Research Grant (R01) and the NIH Exploratory/Developmental Research Grant (R21) mechanisms. These announcements are set to expire January 8, 2011.

Bioengineering Research Partnerships/Bioengineering Research Grants *(R01).* The Bioengineering Research Partnership aims to encourage interdisciplinary bioengineering research that could make a significant impact on human health. This opportunity supports research groups encompassing expertise in physical, computational, biological, and engineering science that are working to prevent, detect, diagnose, or treat disease or to understand health and behavior. The Bioengineering Research Grants program has a similar focus, but it is intended for individual laboratories or small research teams. The partnership opportunity expires on May 8, 2010, and the grant opportunity on January 13, 2013.

Exploratory/Developmental Bioengineering Research Grants (EBRG) *(R21).* Recognizing that developments often come from unexpected places, the EBRG supports innovative research that could lead to major breakthroughs in biomedical science. Applications are encouraged from high-risk, high pay-off projects. In addition, projects aimed at exploring new approaches, concepts, technologies, methods, and techniques can be supported by this opportunity. The opportunity is set to expire January 8, 2013.

More information on these and other NIH opportunities is available on the NIH Guide to Grants and Contracts Web site (http://grants.nih.gov/grants/guide). NIH encourages potential applicants to contact the relevant program director to discuss their research before submitting an application.

Through programs like these, NIH is aggressively working to realize the potential of nanomedicine to improve public health. NIH nanotechnology efforts are directed by the NIH Nanotechnology Task Force, established in 2006 to help set the course for nanotechnology research related to health and medicine. Most, but not all, of the NIH efforts in nanomedicine occur at the individual laboratory level. Significant work has also been done at specific nanomedicine centers created by NIH.

In 2004 NIH made a large-scale, 10-year investment in nanomedicine research by establishing eight Nanomedicine Development Centers (NDCs). The NDCs form the central piece of the NIH Nanomedicine Roadmap Initiative, which aims to (1) obtain a comprehensive set of measurements on molecules and assemblies of molecules, and use those measurements to understand molecular pathways and networks, and (2) use that knowledge to drive the design and development of new nanomachines and technologies to improve human health.

During phase one of the initiative, the NDCs focused primarily on studying the physical and chemical properties of naturally occurring nanosystems in cells, tissue, and biological systems. The recently approved phase two of the initiative calls for the NDCs to apply what they have learned to the precise manipulation of biomolecular events in pre-clinical models, aimed at treating specific diseases.

Although the program was not explicitly focused on materials research, a number of the centers used approaches involving or closely related to materials research. According to Wah Chiu, director of the Center for Protein Folding Machinery (an NDC), the conceptual thinking is very similar. "Once we understand how we can characterize the materials…then we can begin to modify them," said Chiu.

Funding for the NIH Nanomedicine Roadmap Initiative will continue for its 10-year lifetime, but there will be no new solicitations through this program.

KENDRA RAND

NRC Reports Natural Gas Supplies Could Be Augmented With Methane Hydrate

www.nap.edu

Naturally occurring methane hydrate may represent an enormous source of methane, the main component of natural gas, and could ultimately augment conventional natural gas supplies, according to a report from the National Research Council. Although a number of challenges require attention before commercial production can be realized, no technical challenges have been identified as insurmountable. Moreover, the U.S. Department of Energy's Methane Hydrate Research and Development Program has made considerable progress in the past five years toward understanding and developing methane hydrate as a possible energy resource.

"DOE's program and programs in the national and international research community provide increasing confidence from a technical standpoint that some commercial production of methane from methane hydrate could be achieved in the United States before 2025," said Charles Paull, chair of the committee that wrote the report, and senior scientist, Monterey Bay Aquarium Research Institute in California. "With global energy demand projected to increase, unconventional resources such as methane hydrate become important to consider as part of the future U.S. energy portfolio and could help provide more energy security for the United States."

Methane hydrate, a solid composed of methane and water, occurs in abundance on the world's continental margins and in permafrost regions, such as in the Gulf of Mexico and Alaska's North Slope. Although the total global volume of methane in methane hydrate is still debated, estimates yield figures that are significant compared with the global supplies of conventional natural gas. The existence of such a large and untapped energy

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resource has provided a strong global incentive to determine how methane might be produced from methane hydrate safely, economically, and in an environmentally sensible way.

Some of the remaining challenges to production identified by the committee include developing the technology necessary to produce methane from methane hydrate and understanding methane hydrate's potential to behave as a geohazard. For example, industry practice is to avoid methane-hydrate bearing areas during drilling for conventional oil and gas resources for safety reasons. However, avoidance will not be possible if methane hydrate is the production target. In addition, the committee recommended research and development areas for DOE's program, such as designing production tests, appraising and mitigating environmental issues related to production, and determining with greater accuracy the methane hydrate resources on the Alaska North Slope and in marine reservoirs.

The committee also recommends that the investigation of the role of methane hydrate in the global carbon cycle should be done in collaboration with other agencies.

Copies of the report, *Realizing the Energy Potential of Methane Hydrate for the United States,* are available from the National Academies Press at Web site www.nap.edu.

METI to Submit Bill to Develop Energy and Environmentally Friendly Products

Japan's Ministry of Economy, Trade and Industry (METI) has announced that it will submit the "Bill on the Promotion of Businesses to Develop and Manufacture Energy and Environmentally Friendly Products" to the 174th session of the Diet, the legislative branch of Japan. The session began in January and runs until June 2010.

The bill will serve as a means of early implementation of the "New Growth Strategy (Basic Policies)," which was approved by the Cabinet in December 2009, and aims to establish a framework of support for the development of new industries in the energy and environment fields.

Among the highlights of the bill is a low-interest, long-term financing (two-step loans) for companies developing or manufacturing energy and environmentally friendly products such as electric vehicles, storage batteries, and photovoltaic panels. Financing will come from Japan Finance Corporation (JFC). Support will target projects using advanced technologies and having the potential for raising technical standards and creating new businesses.

According to METI, in order for the Japanese economy and society to achieve powerful growth into the future, it is essential to cultivate new markets and develop new industries in the energy and environment fields, where Japan excels in technology. Considering that many countries around the world are enhancing public support for industries in these fields, thus intensifying international competition, METI said the Japanese government should also expand its support measures, including facilitating financing for companies. With this bill, METI is supporting the development of low carbon industries as a new driver of economic growth, with a mission of making Japan the world's center of low carbon industries.

South Africa Analyzes R&D Spending

www.dst.gov.za
www.hsrc.ac.za

The latest national survey of research and development (R&D) activities in South Africa shows a decline in the R&D intensity from 0.95% of gross domestic product (GDP) in 2006–2007 to 0.93% of GDP in 2007–2008. The survey, undertaken by the Centre for Science, Technology and Innovation Indicators (CeSTII) of the Human Sciences Research Council (HSRC), was commissioned by the Department of Science and Technology (DST).

Much like with the previous surveys, most R&D in South Africa is performed in the research field of the engineering sciences, which accounts for 22.5% of the total R&D, followed by the natural sciences with 20.4% and the medical and health sciences and information and communication technologies, both at 14.0%.

The proportion of business sector R&D has grown from 55.9% to 57.7%, and is still the major performer of R&D in the country. The government, which includes the science councils, performs 21.7% of the total R&D, followed by the higher education sector with 19.4% and the non-profit sector with 1.2%. About 10.7% of South Africa's R&D is financed from abroad.

Highly competitive countries are found to spend more on R&D, the Ministry of Science and Technology reported. With the R&D spending of 3.60% of GDP in 2006, Sweden is among the highest of the Organization for Economic Co-operation and Development (OECD) member countries with high R&D intensity. Other such countries are South Korea with 3.47%, Japan with 3.44%, and the United States with 2.68%.

The European Union has set a goal of achieving an average R&D expenditure of 3% of GDP by the year 2010. In 2007, the average for the 27 European Union member states was 1.77%, reported the South African Ministry of Science and Technology.

In comparison with other middle and lower-middle income countries, South Africa spends proportionately more on R&D than Argentina (0.51%) and India (0.80%) but less than China (1.49%) and the Russian Federation (1.12%).

With a total of 31,352 full-time equivalent (FTE) R&D personnel, there is a marginal growth to an already small quantity. This category comprises researchers, technicians, and other support staff. About 62% of these personnel comprise the 19,320 FTE researchers or academically qualified people who perform, manage, and guide the process of undertaking research that leads to new knowledge and novel research findings. This number has grown by 4% from 18,527 in 2006–2007.

Based on a report produced by the UNESCO Institute for Statistics in September 2009, South Africa is among the countries with the highest proportion of women researchers. About 40.3% of the total researchers in South Africa are women, comparing favorably with countries such as Japan (13.0%) and Norway (33.3%). In developing countries, Argentina leads the way with 51.5% women researchers. According to the report, data are lacking for many countries with significant numbers of researchers, such as Australia, the United Kingdom, and the United States.

The South African survey was carried out according to the guidelines provided by the OECD *Frascati Manual* and in consultation with Statistics South Africa, and international experts in the field. Detailed reports on the 2006–2007 survey will be hosted on the DST and HSRC Web sites: www.dst.gov.za/publications-policies/r-d-reports and www.hsrc.ac.za/CCUP-RnD-7.phtml. The UNESCO report, *Global Perspective on Research and Development,* is available on Web site www.uis.unesco.org under "Fact Sheets and Periodicals." □

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