DOE/NIH WORKSHOP ON THERMOGRAPHIC APPROACHES TO MEDICAL DIAGNOSIS AND THERAPY

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Introduction

Recognizing the potential benefits that can be obtained from applying technological resources and capabilities at Department of Energy (DOE) national laboratories to biomedical research programs at the National Institutes of Health (NIH), a joint DOE/NIH Workshop on Thermographic Approaches to Medical Diagnosis and Therapy was held at the Hyatt-Bethesda Hotel on December 3-4, 2001. Objectives of this workshop were to (1) identify applications of thermographic approaches to medical diagnosis and therapy using optical, acoustic, and magnetic resonance (MR) modalities; (2) facilitate communication and related research collaborations among DOE laboratory, NIH intramural, and academic investigators; and (3) communicate opportunities for funding related research. Approximately 40 researchers and program staff from academia, DOE Headquarters and laboratories, and NIH intramural and extramural programs participated in this meeting. The program consisted of (1) presentations from invited academic experts, DOE laboratory researchers, and NIH intramural investigators on current research and problems; (2) presentations from DOE and NIH extramural program staff on funding opportunities and related agency programs: and (3) discussions on how problems in medical diagnosis and therapy can be addressed using represented capabilities and programs.

Research Areas and Problems

General research areas that need to be investigated to facilitate the potential benefits of thermographic approaches to disease diagnosis and therapy include:

1. *Instrumentation.* This item includes both basic technology development and equipment for specific clinical applications. An important aspect of this area is matching technology capabilities to clinical needs. Instrumentation issues can be partly addressed by technologists communicating directly with NIH and academic investigators and attending NIH program meetings.
2. *Computational modeling and analysis.* Particular areas of emphasis include models that predict effects at high temperatures (50 to 100 degrees C) and models that consider anisotropic properties of tissue. Models are needed to accurately predict temperature changes, tissue damage, effects of energy transfer to implanted materials, and subtle changes in surrounding tissue.
3. *Materials toxicity and nano/micro-particle applications*. Items for investigation include specific materials to enhance temperature changes when exposed to energies from non-invasive modalities, related manufacturing methods, material delivery mechanisms, and physiological and metabolic properties.
4. *Multi-modality approaches to thermography.* Areas of emphasis include combining imaging modalities (e.g., optical and acoustic, MR and PET, etc.) for image location and

therapeutic intervention, and modeling aimed at predicting tissue damage and temperature changes.

5. *Animal models and testing*. Particular areas of interest include access to animal colonies and testing facilities, development of animal models and databases for predictive analysis, and collaborations between technologists and animal researchers.
6. *Spatial and temporal resolution*. Items associated with improving resolution include reduction of artifacts, motion compensation, and improvements in equipment capabilities (e.g., probe size, MR magnetic field strength, etc.).
7. *Targeting therapies at the molecular level*. This issue involves the use of proteomics and genomics to develop new therapeutic techniques based on thermographic interactions at molecular levels.

Actions to Support Communication and Collaboration

The following actions were discussed as possible methods to facilitate communication and collaboration among DOE laboratory researchers, NIH intramural investigators, academic researchers, and DOE and NIH extramural program staff:

1. *DOE and NIH staff details and inter-agency research.* This item involves support of research staff at DOE laboratories or NIH intramural programs to conduct collaborative research at the other agency for short terms (6 months to two years). This program could be conducted by IPA-type assignments coordinated through programs supported by one or both agencies.
2. *DOE office at the NIH.* The establishment of a real or virtual DOE office at the NIH would facilitate (l) communication and transmittal of information on biomedical research programs to DOE investigators; (2) nurturing of and developing contacts for research partnerships; and (3) coordination of inter-agency activities including workshops, collaborative funding programs, and joint research initiatives.
3. *Joint DOE and NIH funding initiatives.* By developing research opportunities that include both DOE and NIH funding, costs associated with laboratory collaborations and associated technology transfer could be mitigated.
4. *Future workshops*. Additional small, technically focused workshops would facilitate communication and research collaborations on specific biomedical topics between DOE and NIH staff. Consideration should be given to holding some workshops at DOE sites with unique technological capabilities applicable to the biomedical project being considered.

The importance of collaboration and communication at the investigator and program staff levels was emphasized as the most effective approach to developing research collaborations. Several opportunities for funding research associated with applications of thermographic methods to disease diagnosis and therapy were identified. Although NIH intramural investigators cannot receive NIH extramural funds to support their work, they can participate as partners in collaborative research with non-NIH organizations eligible for extramural funding. The necessity for principal investigators and research teams to (1) identify the most appropriate funding mechanism and program and (2) communicate with the extramural program staff prior to preparing their applications was also emphasized. Appropriate DOE and NIH extramural research funding protocols must be followed during pursuit of research support.

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