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The 1st International Congress on Biophotonics - ICOB 2008- Sacramento, CA; February 3-7, 2008

The NSF Center for Biophotonics Science & Technology (CBST) of UC Davis hosted the 1st International Congress on Biophotonics (ICOB) on February 3-7, 2008 in Sacramento, California. The purpose of the meeting was to gather thought leaders from around the world, representing academia (researchers and educators), industry, medicine, and government agencies to create a strategic roadmap for the future of biophotonics research, technology development and education. The rationale for the meeting was the need for a strategic roadmap to provide guidance and direction to further biophotonics science and technology development into those areas of greatest need for creative and innovative solutions to “grand challenges” in the life sciences and medicine. ICOB was also a venue to present and expand upon www.BioPhotonicsWorld.org , a web-based portal to serve as a virtual community for all biophotonics ‘stakeholders’, that was developed and launched in September 2007 by CBST and the Canadian Institute for Photonic Innovations, (CIPI),

The co-organizers of ICOB were Dr. Dennis Matthews, Professor at UC Davis and Director of the NSF-funded CBST, and Dr. Brian Wilson, Professor at the University of Toronto and Head of the Division of Biophysics and Imaging at the Ontario Cancer Institute. The Congress Scientific Secretary, Dr. Joanna Albala, Associate Professor at UC Davis, worked with the national and international organizing committees to put together a diverse program of plenary and invited speakers, panelists and poster presentations, as well as industry and educational exhibitors.

During the 4-day Congress, some 120 invited participants from Australia, Canada, China, Denmark, Germany, Great Britain, Ireland, Israel, Latvia, the Netherlands, Taiwan and the United States shared recent seminal scientific achievements in biophotonics, as well as current and projected clinical needs in key healthcare areas. They outlined the focus of future advances and discussed strategies to achieve these goals. These efforts were documented in a real-time strategic roadmap for biophotonics research, technology development and education. Input was sought from invited representatives of funding agencies from around the world on how the Congress and resulting roadmap could lead to new funding initiatives to fuel growth in strategic areas of interest to medical and bioscience researchers in both academia and industry.

There were three themes of ICOB - Advanced Microimaging; Probes, Sensors & Assays; and Clinical Biophotonics - with each day devoted to a single theme. There were also five topic areas on specific clinical applications: cancer, cardiovascular biology, infectious disease, neuroscience, and

regenerative medicine. Each day began with a keynote address from a “biophotonist”, i.e. an active researcher using or developing biophotonic tools, followed by presentations from an industry perspective and then plenary talks given by end-users in the clinical applications areas. Each afternoon brought participants together to be addressed by an expert panel in the theme area of the day, followed by small-group breakout sessions and report-back discussions from the entire ICOB community. Following this, a ‘college of writers’ met with the charge to synthesize and document the key issues of the day.

The scientific highlights from the 4-day Congress included work from Dr. Stephen Hell, Professor at the Max-Planck Institute of Biophysical Chemistry in Germany, describing how non-linear stimulated emission depletion (STED) microscopy techniques may lead the way for nanoscopic imaging. Dr. Yves DeKoninck, Professor of Psychiatry at Laval University, detailed his cutting-edge work in neurobiophotonics using intravital micro-imaging techniques to study neuronal structure and function. He challenged the microscopy community to develop new biophotonic techniques that could capture images at the speed of an action potential, about 1 millisecond or less! Other challenges for optical microscopy were raised in panel discussions and breakout groups emphasizing the need for label-free techniques. On the subject of fluorescent labels, Dr. Roger Tsien, Professor at UC San Diego and Investigator at the Howard Hughes Medical Institute, gave an inspiring presentation on the use of a variety of probes including recent advances in the development of fluorescent proteins. Dr. Marco Molinaro, Chief Education Officer at CBST, presented Biophotonicsworld.org and participants had the opportunity to go on-line to this new biophotonics portal and to provide feedback on its functionality. The participants learned about the various features of the site including a directory of people, institutions, and industry engaged in biophotonics; a survey of relevant courses around the world; a conference and meeting database; and course-related videos, just to name some of the available on-line resources. The intersection of biophotonics and medicine was presented by Dr. Bruce Tromberg, Director of the Beckman Laser Institute, as well as in a keynote address from ICOB co-organizer, Dr. Brian Wilson, who stressed the need for greater integration of new biophotonics tools with current medical instruments and strategies. Further discussion arose around deep tissue imaging, point-of-care diagnostics and battlefield medical devices. Finally, ICOB gathered strong support for a large-scale international partnership toward a major biophotonics initiative. The community now seems poised to focus biophotonics technologies on the advance healthcare around the globe.

Next Steps:

As a result of the Congress, the basis for a strategic roadmap for the field of biophotonics, as well as individual position papers on each of the daily themes of (1) Advanced Microimaging, (2) Probes/Sensors/Assays, and (3) Clinical Biophotonics, will be shared with the global community through the BiophotonicsWorld website, www.BiophotonicsWorld.org. Details of the road map are not yet formulated, but a potential major worldwide initiative, named “*Biophotonics for Life*”, is anticipated. This strategic roadmap will be dynamic, such that it will be updatable and expanded on a regular basis, for example, after future iterations of the Congress and by the worldwide community in order to reflect significant changes and new opportunities.

A clear message from the Congress, however, was the need to focus biophotonics on some very major challenges in bioscience and medicine. Medical challenges such as non-invasive measurement of blood glucose, non-antibiotic treatment of infections, revolutionizing pathology by bringing laboratory diagnostics to the point-of-care, the creation of better methods of treating presbyopia, providing therapies for metastatic cancer and devising new strategies for emergency medicine for rapid diagnosis and field portable imaging, are just examples identified at ICOB. Another clear and repeated message was the need to develop funding initiatives that encourage large-scale international partnering on major biophotonics initiatives. At present, International scientist exchange programs are readily available, but the time is right for internationally funded research partnerships and international biophotonics theme-based Centers of Excellence or Research Networks.

Finally, a path for funding the translation of technology from bench to bedside was identified as one of the greatest barriers to creating new medical devices and tools. On the technology readiness levels (TRL scale of 1 – 10, with 1 being concept and 10 being marketable device), most fall victim to the “valley of death”, a place of unachievable technology, TRL ~3-7. Although there are many reasons for this, the biggest hurdle is the lack of NIH-style government or private funding available for advancing technology to the commercialization forefront at the appropriate, industry-driven pace. The biophotonics community now hopes to focus on developing initiatives to mitigate this substantial barrier to innovation and for greater human-health impact.