62 Sunday, September 10th (9:50)
Concurrent Symposium XIII: Pharmacological Nanomedicine

Summary of the pharmacology nanomedicine symposium

Gilbert S, Department of Biological Sciences, University of Pittsburgh, Pittsburgh, Pennsylvania, USA

Nanomedicine is at the cutting edge of science, pushing the frontiers of chemistry, engineering, materials science, biochemistry, and molecular biology. Because the research and technology development are on the nanometer scale, small molecules are the most obvious tools to use to manipulate molecular events. In the Pharmacology Nanomedicine Symposium, we will present four talks that represent the newest advancements in drug discovery and delivery. In the first talk, Dr. Jeanne Hardy will discuss her approach to exploit allosteric sites on proteins for drug discovery. Dr. Wafik El-Deiry will discuss his development of imaging technology to monitor molecular events relevant to tumor progression and therapeutic response. Dr. Scott Diamond will present the strategies being used at the Penn Center for Molecular Discovery to develop microarrays and screens against proteases, kinases, and phosphatases on a nanoliter scale. The last talk of the session by Dr. David Needham will present a novel approach for drug delivery at sites of tumors using "nano-soccerball" liposomes to control drug release temporally and spatially.

Susan P. Gilbert (Ph.D. Dartmouth College) is an Associate Professor of Biological Sciences at the University of Pittsburgh. Her research focuses on the remarkable nanoscale kinesin motors that drive cellular movement and remodel the microtubule cytoskeleton. Rapid mixing instrumentation (stopped-flow and chemical-quench flow) plus state-of-the-art fluorescence techniques are used for millisecond time resolution to define that structural transitions that are driven by ATP turnover. In addition, these experimental approaches are also applied to define the mechanism of inhibition by small molecule inhibitors and to tease apart engineering principles that are not experimentally accessible by traditional approaches.

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63 Sunday, September 10th (10:00)
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Discovery and exploitation of allosteric sites for control of protein function

Hardy J, University of Massachusetts, Amherst, Massachusetts, USA

In large part, proteins are the nano-machines of biology. Regulation of these nano-machines allows diverse activities to be performed by these nano-machines in a controlled manner. One of the most promising mechanisms of regulation of protein function is via allosteric regulation, which is regulation at a distance from the active site. To date, most regulation of protein function has occurred through active-site interactions, however the number of new, serendipitous allosteric sites in a diverse group of proteins is on the rise. Using Tethering, a site directed method of drug discovery, we have discovered a new allosteric site in caspases, cysteine proteases that regulate apoptosis (programmed cell death). Based on crystal structures of the allosterically inhibited caspases we can see the mechanical coupling of the active and allosteric sites and have generated a movie that clearly demonstrates how this inhibition occurs. This allosteric site, like others, is at the bottom of a deep cavity. This finding suggested that other cavities on protein surfaces could likewise be exploited as allosteric sites. We have interrogated cavities on other nano-machines, such as kinesins, and demonstrated that allosteric sites and serendipitous allosteric sites may be a tractable means of drug discovery and nano-machine regulation in the future.

Jeanne A. Hardy is an Assistant Professor of Chemistry at the University of Massachusetts, Amherst, whose work focuses on the development of an "allosteric switch technology" for proteins related to human disease. This technology will ultimately aid target validation for drug discovery. Hardy obtained a joint BS/MS from Utah State University, and a Ph.D. in Molecular and Cellular Biology from the University of California Berkeley. She was an NIH post-doctoral fellow at Sunesis Pharmaceuticals where she and coworkers discovered a novel allosteric site caspases, the proteins that control cell death in cancer and many other diseases. Hardy has recently received the Beckman Young Investigator Award and the Smith Family New Investigator Award.

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64 Sunday, September 10th (10:30)
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Optical imaging approaches for molecularly-targeted drug discovery and development

El-Deiry WS, University of Pennsylvania School of Medicine, Philadelphia, Pennsylvania, USA

The ability to optically image molecular events relevant to tumor progression and therapeutic response is providing new opportunities to accelerate the discovery and development of targeted therapy for cancer. We have introduced genetic alteration in human cells along with bioluminescent reporter genes in order to determine the role of specific oncogenes and tumor suppressor genes in controlling tumor progression and therapeutic response. Molecular beacons are being developed to image specific molecular alterations within cells or tissues that may have predictive value in terms of toxicity of chemotherapy or likelihood of response. Reporters that sense molecular events have been introduced into human tumor cells and these have been used in high-throughput screening for small molecules that can modulate signaling leading to tumor cell death. Animal experiments involving use of bioluminescent tumors are being performed for drug-target validation as well as therapeutic efficacy. These efforts supported in part by the NCI Network for Translational Research in Optical Imaging are leading to new approaches in drug screening and target validation which is accelerating the pre-clinical phase of anti-cancer drug development to bring new agents into clinical trials. Efforts in the area of molecular imaging and probe development are in progress to further facilitate the clinical testing of new therapeutic agents.

Dr. El-Deiry is a Professor of Medicine at the University of Pennsylvania and Co-Program Leader of the Radiation Biology Program at the Abramson Cancer Center. He holds appointments in the Departments of Genetics and Pharmacology and an Adjunct appointment at the Wistar Institute. Dr. El-Deiry was recognized in 2005 by the Institute for Scientific Information (ISI) as a highly cited researcher in Molecular Biology and Genetics. He earned his M.D./Ph.D. degrees from the University of Miami School of Medicine and completed a medical residency and a clinical oncology fellowship at Johns Hopkins prior to joining the faculty at the University of Pennsylvania in 1994.

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