

The Sheikh Khalifa Bin Zayed Al Nahyan Institute for Personalized Cancer Therapy

A TRANSFORMATIVE VISION FOR DELIVERING ON THE PROMISE OF PERSONALIZED CANCER THERAPY THROUGH PUBLIC, PRIVATE, AND INDUSTRIAL COLLABORATIONS TO MAKE PERSONALIZED CANCER THERAPY THE STANDARD OF CARE.

The MD Anderson Cancer Center Sheikh Khalifa Bin Zayed Al Nahyan Institute for Personalized Cancer Therapy was created to support preclinical research and clinical trials in which a patient's tumor biopsy is assayed for abnormal genes and gene products to select therapy with agents targeting the product of those particular abnormal genes. This integrated research and clinical trials program is aimed at implementing personalized cancer therapy and improving patient outcomes. A number of events have converged creating a "perfect storm" offering the opportunity to make a bold leap forward in personalizing cancer care.

THE VISION OF THE INSTITUTE is to implement personalized cancer therapy for all patients coming to MD Anderson, and ultimately the world, transforming cancer patient management combining improved outcomes and cost containment by making this approach the new standard of care. In doing so, we will establish that personalized cancer therapy is cost-effective; identify new indications for targeted agents for specific patient populations; and develop evidence required to make associated molecular tests reimbursable.

We have made great strides in investigating and implementing personalized cancer therapy at MD Anderson in the past few years. The seminal BATTLE trial in lung cancer demonstrating the practicality of this approach was presented at the plenary session of the 2010 American Association for Cancer Research (AACR) Annual Meeting and the manuscript released as the inaugural paper of the new AACR journal *Cancer Discovery* at the 2011 AACR Annual Meeting¹. A series of Phase I/II trials in which experimental drugs were assigned based on biomarkers detected in the patients' cancers have provided additional evidence for the opportunity to improve patient outcomes through targeted, personalized therapy. Multiple clinical trials based on genetic and molecular biomarkers in patients' cancers are now underway at MD Anderson. Dr. Razelle Kurzrock, Chair of the Department of Investigational Cancer Therapeutics, has had significantly improved response rates in combined targeted therapy/chemotherapy Phase I clinical trials in multiple disease sites in patients with agents matched to the molecular defect when compared to chemotherapy alone or unmatched trials. For example, patients treated with a drug targeting the PI3K pathway was found to have a response rate of 35% in patients with mutations compared to a 4 to 11% response rate generally observed in phase I trials².

LEADERSHIP for the Institute has brought forth an aggressive but achievable plan. Gordon Mills, MD, PhD, Director of the Institute and chair of the Department of Systems Biology at MD Anderson, will be joined by Dr. John Mendelsohn, President of MD Anderson, as Co-Director when he relinquishes his position as President by the end of August 2011. Dr. Mendelsohn has been a leader in the field of targeted cancer therapy since 1980, creating, with his colleagues, the first reported inhibitor of the product of a tyrosine kinase oncogene – monoclonal antibody C225 against the EGF receptor – which ultimately led to the FDA approval of the drug, renamed cetuximab (Erbix), in 2004. Dr. Mills' extensive experience with rapidly evolving technology used in the discovery of biomarkers and their application in clinical trials and patient care, directing the Kleberg Center for Molecular Markers, and his visionary T9 program (*Ten Thousand Tumors, Ten Thousand Tests, Ten Thousand Therapies*) that screens the 40+ most commonly mutationally activated genes, will ensure a timely transition from research to clinic. He designed the T9 program to identify and overcome the hurdles to the first phase of "delivering on the promise of personalized molecular medicine." Indeed, the approaches developed for T9 will drive the first phase of the genetic and molecular analysis in the Institute. He is leveraging the innovation and discovery of the Kleberg Center for Molecular Markers with the refinements necessary for implementation of CLIA-compliant assays, required for clinical decisions. This approach will allow MD Anderson Cancer Center to lead the country in the rapid and efficient implementation of the next generation of technologies in patient care.

The Institute is growing and adding the necessary staff and faculty to implement this bold, dynamic plan. We received a magnificent gift that will enable MD Anderson to build a new facility that will contain the Institute offices, technology development and implementation, and the CLIA-compliant pathology and molecular diagnostics capacity required for the application to patients in real time.

OUR STRATEGIC PLAN for the Institute is focused on the goal of defining the new standard of patient care – making personalized cancer therapy standard over the next 5 years, revolutionizing the way we manage patients. To accomplish this goal, we will:

- ❖ Rapidly implement the expanded molecular pathology laboratories, technology, instrumentation, and infrastructure for personalized clinical trials;
- ❖ Develop best practices for obtaining and managing patient biopsies and specimens to implement personalized cancer therapy;
- ❖ Position MD Anderson to lead the way in therapeutic clinical trials based on the underlying genomic and molecular alterations in individual patient's cancers;
- ❖ Establish broad internal and external collaborations and partnerships to enhance our ability to rapidly transform discoveries into clinical practice and standard of care.

The Institute will implement technologies, concepts and approaches arising from basic science laboratories and translational science programs at MD Anderson and our collaborators' and partners' institutions. Leveraging our vast resources, including, for example, the Department of Investigational Cancer Therapeutics and the Kleberg Center for Molecular Markers, the Clinical Center for Targeted Therapy (CCTT), the Center for Cancer Immunology Research (CCIR), the Center for RNA Interference and Non-coding RNA, and the Center for Advanced Biomedical Imaging Research (CABIR), as well as our experienced Pathology and Laboratory Medicine (led by Dr. Stanley Hamilton) and Clinical and Translational Research Center programs, will enable us to rapidly move technology to the clinic for validation and accomplish our goals. The Institute for Personalized Cancer Therapy will lead a bidirectional and iterative approach with the Institute providing critical genetic and molecular analysis of tissue samples for the clinical investigators in our the Multidisciplinary Care Centers, and the Centers providing patients and innovative clinical trials for implementation. A strength of the Institute is the integration of our Diagnostic Imaging and Interventional Radiology specialists, led by Dr. Marshall Hicks, who develop new approaches to optimize minimally-invasive tools and the processes necessary to obtain quality tissue specimens and images integrated with clinical information and molecular analyses. Bioinformatics, led by Dr. John Weinstein, has developed new approaches enabling rapid analysis of circulating tumor cells and new methods to visualize and interrogate microarray data.

THE CHANGING LANDSCAPE AND OPPORTUNITIES. As a result of 30 years of research, we know today that cancer is caused by the aberrant activity of genes that control cell proliferation and behavior. For most individual cancers, typically 6 to 12 genes, from a list of about 300, are causing the problem. Based on rapidly emerging technologies, we finally have the opportunity to characterize patient tumors to a breadth and depth never before available, with emphasis on approaches at the DNA level and, in particular, in terms of mutational analysis. This is facilitated by the success of the human genome project, rapidly falling costs and improved technologies for next generation sequencing and the extension of the Cancer Genome Atlas (TCGA) to 22 tumor lineages providing an unprecedented trove on information for exploiting. Optimal opportunities will come from integrating information across DNA, RNA, protein and metabolomics as they affect a patient's response to therapy. In addition, it will be necessary to consider the tumor in its context of the immune systems and the microenvironment. We will play a major role in the development and evaluation of emerging technologies as they are needed for the implementation of personalized cancer patient care. Thus, the Institute will develop and implement programs in each of these areas in terms of translation to changing patient care. With over 800 therapeutics in the pipeline designed to target the products of many of the genes that are known to cause cancer, the rate limiting factor is linking the "driver" aberrations in each patient's cancer to the right therapy

RENEWABLE COMPETITIVE ADVANTAGE: WHY MD ANDERSON CANCER CENTER? MD Anderson Cancer Center has established a culture that supports the concept of personalized cancer care with large multidisciplinary clinical studies such as BATTLE, BATTLE-2, ATTACC, PREDICT, and IMPACT amongst others. Further, MD Anderson treats more patients and enters more patients on clinical trials than any other Cancer Center in the world. Finally, MD Anderson, through the Institute, plans to change the way we manage patients, leading the way by implementing personalized cancer therapy, demonstrating its cost-effectiveness and enabling reimbursement, making this the standard of care, identifying new indications, opening new markets, and transforming cancer care to be driven molecularly rather than by the site of origin.

¹ Kim ES, Herbst RS, Wistuba, II, Lee JJ, Blumenschein Jr. GR, Tsao A, Stewart DJ, Hicks ME, Erasmus Jr. J, Gupta S, Alden CM, Liu S, Tang X, Khuri FR, Tran HT, Johnson BE, Heymach JV, Mao L, Fossella F, Kies MS, Papadimitrakopoulou V, Davis SE, Lippman SM, Hong WK. The BATTLE Trial: Personalizing Therapy for Lung Cancer. *Cancer Discovery*, 2011, 1(1):43-51.

² Janku F, Tsimberidou AM, Garrido-Laguna I, Hong DS, Naing A, Falchook GS, Wheler JJ, Fu S, Piha-Paul SA, Kurzrock R. PIK3CA, KRAS and BRAF mutations in patients with advanced cancers treated with PI3K/AKT/mTOR axis inhibitors. *Mol Cancer Ther* 2011; 10(3):558-565.