



MIT Massachusetts Institute of Technology
Program on the Pharmaceutical Industry (POPI)

The Future of the Pharmaceutical Industry Symposium
"Pharmacogenomics, Drug Development and the Cost of Health Care"

December 9 - 10, 2003

New technologies are shifting the terrain of drug discovery and development. The world of healthcare is undergoing the first part of a major revolution. But will the tremendous advances in science and technology that have unfolded in recent years serve the goal of greater human health? What are the key challenges and issues facing scientists and the pharmaceutical industry? What might the future look like?

The 2003 symposium sponsored by the MIT Program on the Pharmaceutical Industry - "Pharmacogenomics, Drug Development and the Cost of Health Care" - brings together distinguished representatives from varying perspectives, including industry, science, government, and academia, to explore this revolution.

The concept of "personalized medicine" - the use of molecular markers to develop drugs targeted to serve the individual patient's particular condition and side effects profile, will be the framework for the symposium. In three sessions over two days, participants will join in an examination of some of the major advances that are changing the face of pharmaceutical R&D, including SNPs, complex biology, imaging, and tissue engineering. Distinguished experts will discuss what these developments mean for the future of pharmaceutical innovation. A session on disease mechanism and models will put the advances in the specific contexts of diabetes, cardiovascular disease, cancer, and infectious diseases, drawing from these examples important lessons that participants will be able to apply to situations in their own work.

Clinical trial design and health economics will be key topics in the session on "Driving Forces and Barriers," which will include a panel discussion that brings together the perspectives of consumers, the FDA, healthcare payers, and the biotechnology industry.

This important symposium will be a unique opportunity to gain deep insights into how the industry and society can realize the promise of more effective and better-tolerated therapies, and thus of more efficient use of society's healthcare resources.

**Massachusetts Institute of Technology
Program on the Pharmaceutical Industry (POPI)**

**The Future of the
Pharmaceutical Industry
Symposium**

*Pharmacogenomics, Drug
Development and the Cost
of Healthcare*

December 9-10, 2003

Wong Auditorium, Tang Center • MIT Campus

Revised Agenda

(as of November 5, 2003)

Tuesday, December 9, 2003

Session Chair: *Charles L. Cooney, Ph.D., Professor of Chemistry & Biochemical Engineering, Department of Chemical Engineering, Executive Officer & Co-Director, Program on the Pharmaceutical Industry (POPI), Sloan School of Management, Massachusetts Institute of Technology*

8:00 Introduction

Keynote Address

8:10 The New Biology and the Future of the Pharmaceutical Industry

Anthony J. Sinskey, Sc.D., Professor of Microbiology & Co-Director, Program on the Pharmaceutical Industry (POPI), Sloan School of Management, Massachusetts Institute of Technology

There is an increased awareness that the number of new chemical entities (NCE) being launched by the pharmaceutical industry has significantly decreased, while R&D expenditures have steadily increased. In addition, a large number of patented pharmaceutical products are going off patent. There is increasing pressure from consumers and insurance companies to reduce healthcare costs. This presentation will review these issues in the context of the new biology in order to answer the questions: Can new biology research and development reverse the trends in the pharmaceutical industry? How will the transition for incorporating new biology approaches into the pharmaceutical sector take place? Is there a need for a paradigm shift in order to improve the quality of the pharmaceutical pipeline? What will be required for the shift to occur? An important challenge will be how to deal with the business and marketing issues in healthcare during the



transition phase to new science approaches for the pharmaceutical industry. Where and how value can be generated by new biology approaches in the pharmaceutical industry will be discussed.

8:45 Pharmacogenomics and Cancer Treatment

David E. Housman, Ph.D., *Ludwig Professor of Biology, Center for Cancer Research, Massachusetts Institute of Technology*

This talk will address the direct application of pharmacogenomics to cancer treatment. The speaker will consider the impact of pharmacogenomics on current cancer therapies and discuss the interaction between pharmacogenomics and the development of novel therapeutic interventions.

9:20 The Multiple Dimensions of Systems Biology

Douglas A. Lauffenburger, Ph.D., *Whitaker Professor of Biological Engineering, Biology, and Chemical Engineering & Director, Biological Engineering Division, Massachusetts Institute of Technology*

Biological systems are complex in multiple dimensions, including the number of components considered, the kinds of properties measured for the components, and the level(s) of contextual physiological hierarchy. The Computational & Systems Biology Initiative at MIT seeks to pursue understanding and manipulation across these dimensions in integrated fashion. We will describe example efforts manifesting this integrative perspective, focusing on design and development of molecular therapeutics.

9:55 Applying Systems Biology to Drug Discovery

Peter K. Sorger, Ph.D., *Associate Professor of Biology and of Biological Engineering & Co-Chair, MIT Computational and Systems Biology Initiative, Massachusetts Institute of Technology*

Systems Biology, as it is being developed at MIT, combines systematic experimentation and computational modeling to describe complex biological networks. As an integrative discipline, systems biology promises to knit together data from diverse sources including genomics, proteomics, target identification and small molecule screening into a Disease Management System. We will discuss this idea with reference to our work on understanding the mechanisms of action of drugs that target EGF receptor signaling. These chemotherapeutics are becoming increasingly important in the clinic but we do not yet understand how to vary their use to optimize treatment strategies.

10:30 Break

10:45 The New Biomedicine: How Emerging Biomedical Technologies Are Changing the Medical Paradigm

Martha L. Gray, Ph.D., *Director, Harvard-MIT Division of Health Sciences & Technology (HST), Edward Hood Taplin Professor of Medical & Electrical Engineering, Massachusetts Institute of Technology*

For updated program information, visit: <http://ilp.mit.edu/ilp/conferences/current.html>.

11:20 Tissue Engineering - From the Bench to the Bedside and Back

Linda G. Griffith, Ph.D., *Associate Professor of Biological and Mechanical Engineering & Director of Biotechnology Process Engineering Center (BPEC), Massachusetts Institute of Technology*

The most well recognized applications of tissue engineering involve new therapies for an array of clinical problems, from diabetes and liver failure to bone and cartilage repair. The goal is to create new tissue either directly in the patient via cell transplantation or directed growth from nearby healthy tissue, or by growing tissue outside the body for transplantation into the patient. In the future, engineered tissues "on a chip" could greatly accelerate the development of new drugs that may cure patients, eliminating the need for organ transplants altogether. This talk will highlight the integration of molecular and macroscopic design principles in tissue engineering, with an emphasis on the new frontiers of bench-scale physiological models of human tissue using liver as a paradigm.

11:55 Discussion with Speakers

12:30 - 1:20 Lunch

1:25 Introduction

Session Chair: Robert H. Rubin, M.D., *The Gordon & Marjorie Osborne Professor of Health Sciences & Technology, Massachusetts Institute of Technology, Professor of Medicine, Harvard Medical School*

1:30 Clinical Applications of Pharmacogenomics: Initial Disease Targets and Early Drivers of Change

Kip Martha, M.D., *Chief Medical & Regulatory Officer, Interleukin Genetics, Inc.*

The technology for studying the relationships among genetic variation, disease risk and drug response has now matured to the point where its cost, availability, accuracy and reliability are no longer the obstacles preventing its use in clinical medicine. Furthermore, on the surface the integration of pharmacogenomics into our healthcare system has huge potential benefits at several levels from the individual patient to society broadly. So why is it taking so long for it to become a reality?

2:05 Diabetes Mellitus: Technology Implications from Drug Discovery to Patient Application

Alan C. Moses, M.D., *Professor of Medicine, Harvard Medical School, Senior Vice-President & Chief Medical Officer, Joplin Diabetes Center, Member of the faculty of Harvard - MIT Health Sciences & Technology*

- a. The epidemics of diabetes and obesity are interrelated and create both a challenge for effective intervention and an imperative for social action. Technology is beginning to help on the discovery front but not on the health policy side.
- b. While the phenotype of diabetes is well understood, the difficulty of identifying specific genetic defects that play a primary role in pathogenesis has hampered drug development and has contributed to the inability to achieve target levels of glucose control in the majority of patients.
- c. The impact of diabetes complications on the health of individuals and the cost of healthcare delivery require a renewed effort to target specific biochemical pathways and to refine the molecules that target these pathways. Importantly, technology delivered through point of service diagnostics may be particularly important in creating the rationale for pharmacological intervention to prevent these complications early in the course of disease.
- d. Continuous glucose monitoring holds the promise of revolutionizing diabetes care but places some unique burdens on the companies that are developing these technologies from the standpoint of data handling and the presentation to patients of automated clinical recommendations. This area provides a unique example of enabling patient care through technology that will reside directly in the hands of the consumer.

2:40 Personalized Medicine: Changing the Paradigm of Patient Care in Cardiovascular Disease

Geoffrey S. Ginsburg, M.D., Ph.D., *Vice President, Molecular and Personalized Medicine, Millennium Pharmaceuticals, Inc.*

We are already in the Era of Personalized Medicine in cardiovascular disease. The Personalized Medicine approach has been developed in part out of the need for a more effective strategy in pharmaceutical R&D for developing novel cardiovascular therapeutics. This strategy takes advantage of the genome and allied technologies (expression profiling, proteomics, molecular imaging) that together provide an unprecedented means to probe disease mechanisms and pathways in atherosclerosis, heart failure, and thrombosis and will provide important biomarkers for these diseases as well as for their risk stratification and treatment. Pharmacogenomic biomarkers that predict patient responses to therapies are an imperative in cardiovascular therapies where the treatment benefits are imparted on only a few of the patients treated. Yet, despite the availability already of many such markers, significant challenges exist in the translation of the results of

clinical research into clinical practice.

3:15 Break

3:30 The Impact of Molecular and Imaging Technologies on Phase I Cancer Trials
George D. Demetri, M.D., *Center for Sarcoma and Bone Oncology, Dana-Farber Cancer Institute*

(and)

4:05 Thomas G. Roberts, Jr., M.D., *Instructor in Medicine, Harvard Medical School, Thoracic Oncology Unit, Massachusetts General Hospital, Visiting Scientist, Massachusetts Institute of Technology*

There has been an explosion in the number of molecules under investigation to treat cancer. Despite enormous public and private investment in cancer drug discovery and development, clinical progress remains slow. One of the major efforts underway is to apply correlative science and advanced imaging technologies to evaluate the potential of an agent at its earliest phase of clinical development; the presenters will review the field's experience with these efforts over the last ten years.

4:40 Discussion with Speakers

Wednesday, December 10, 2003

Session Chair: Thomas J. Allen, Ph.D., *Howard W. Johnson Professor of Management, Professor of Engineering System, MacVicar Faculty Fellow & Co-Director, Program on the Pharmaceutical Industry (POPI), Sloan School of Management, Massachusetts Institute of Technology*

8:00 Introduction

8:05 Economic and Policy Implications Occasioned by Advancing Science and Technology of Drug Development

Stan N. Finkelstein, M.D., *Senior Research Scientist & Co-Director, Program on the Pharmaceutical Industry (POPI), Sloan School of Management, Massachusetts Institute of Technology*

Bringing innovative new therapies to market that are based on advancing science and technology of drug discovery and development represents a huge challenge but is only the beginning of the challenge. If these new drugs are to be considered "cost effective," likely that will result from their being both much more effective, but also more costly. Health care payers are already taking steps to limit access to some of the newest therapies. This presentation will review and comment on how the barriers to accessing drugs based on the "new biology" may affect medical practice and the future of drug development.

8:40 Panel - Industry Perspectives

Systems Biology and the Pharmaceutical Value Chain

Robert N. McBurney, Ph.D., *Chief Scientific Officer & Senior Vice President, Research & Development, Beyond Genomics, Inc.*

(and)



Challenges towards the Implementation of Pharmacogenomics in Mainstream Pharmaceutical Drug Development

Donald C. Anderson, M.D., *Global Head of Pharmacogenomics Programs & Clinical Affairs, Aventis Pharmaceuticals, Inc.*

The acceptance and successful implementation of pharmacogenomics into major pharmaceutical R&D programs has been impeded by: a) a limited critical mass of human genetics science in the industry, b) a general lack of identified pharmacogenomic markers of use in guiding clinical medicine, c) a poor understanding of commercial strategies to exploit pharmacogenomic data, d) perceived or real risks involved in conducting clinical genetics research, and e) a short sided vision of the ultimate rewards of personalized medicine based on genetic diagnostics.

(and)

Title – To Be Announced

Mark J. Enyedy, *Oncology Department, Genzyme Corporation*

9:40 Biomarkers to Optimize Clinical Drug Development: Use and Process

Irving H. Fox, M.D., C.M., *Medical Advisor, Millennium Pharmaceuticals, Inc., & Clinical Professor of Medicine, Harvard Medical School*

Biomarkers are an integral part of the clinical development strategy. They are used when necessary and as they are available to optimize drug development in early and late stage clinical trials. In addition, biomarker discovery research may be performed during clinical trials to optimize the development of the next products or enhance the value of new drugs after approval by improving the benefit-to-risk ratio for patients. Biomarkers must be planned and developed to meet the needs of clinical drug development and product approval as appropriate. A beneficial way to implement biomarker strategy is to form a biomarker development subteam during the discovery phase of research. This subteam plans and executes biomarker research and coordinates strategy and timelines with the product development project teams.

10:15 Health Economics and Personalized Medicine

William H. Crown, Ph.D., *Vice President, Outcomes Research & Econometrics, The MEDSTAT Group, Inc.*

For updated program information, visit: <http://ilp.mit.edu/ilp/conferences/current.html>.

10:40 Break

10:45 Will Pharmaceuticals Lose Pricing Power in the United States?

Norman C. Payson, M.D., *Former Chairman & CEO, Oxford Health Plans, Inc.*

Pharmaceutical companies face two great risk factors in pricing their products in the next decade. First, employers will be offering less first dollar coverage in their employee health benefit plans creating significant consumer price sensitivity. Second, if the government becomes a major buyer of pharmaceuticals for seniors, it may demand favorable pricing. Capacity and pricing power for insurers and healthcare providers has evolved as employer-based financing moved from indemnity to HMO to “managed indemnity” and as governmental payers required progressively more price shifting. Loss of pricing power by big pharmaceuticals will have significant effects on the capital markets and economics of discovery.

11:30 FDA Policy on Pharmacogenomic Data in Drug Development

Janet Woodcock, M.D., *Director, Center for Drug Evaluation & Research, U.S. Food & Drug Administration*

This talk will cover the major issues related to the use of pharmacogenomic data during preclinical and clinical drug development, and the resulting regulatory issues.

12:15 Creating Proactive Environments for Healthy Living

Kent Larson, *Principal Research Scientist & Director, Changing Places*, **Massachusetts Institute of Technology**

A multi-disciplinary team of researchers from the MIT Changing Places/House_n Consortium is studying how to create pervasive computing environments for the home that promote healthy living. They are developing sensor technologies that can be easily installed in places of living and that can be used to infer information about activities of daily living in non-intrusive, non-stigmatizing ways. They are investigating how environmental sensors and wearable sensors can be used together to create user interfaces that motivate health-related behavior changes, from medication adherence, healthy diet, stress reduction, and increased exercise. Kent Larson will discuss the capabilities of the PlaceLab - a unique residential observational laboratory under construction in Cambridge that will be used to study proactive health technologies for the home.

12:30 Discussion with Speakers

1:00 Close of Event

