School of Pharmacy ▪ University of California, San Francisco

pressing ahead in new directions

Strategic Course 2007–2012

dear friends:

Drug therapy has revolutionized human health. From antibiotics that treat infections to cardiovascular drugs that treat high blood pressure and heart disease, the breadth of today's drug therapies is impressive. Yet many conditions, such as some cancers, remain without a cure. Moreover, today's drugs are imperfect. They are made for the "average" person among us, and taking them correctly can be complicated, especially when we must use several in combination for more than one health problem. Drugs end up at multiple places throughout our bodies—not just where they are needed most—and this can lead to troublesome and dangerous side effects. Social, economic, and health care forces influence which drugs are available to us in the marketplace, as well as how much they cost and which we decide to buy. The ways in which we discover and develop most new drugs are time-consuming, expensive, and inefficient. The ways in which we deliver pharmacy care to patients do not always meet our patients' changing needs.

What if this situation changed?

What if… we had a deeper understanding of the biological and chemical processes that give rise to disease?

We could apply this information to develop new drugs that target and block those processes.

What if… we understood how proteins—which are determined by our genes—affect how we respond, or fail to respond, to certain drugs or whether we will experience a side effect?

We could use this knowledge to tailor drug treatments that fit our genetic profiles.

What if… we applied the power of computation and engineering to our drug research?

We could speed the discovery and development of better drugs.

What if… we developed better ways to identify how and why medication errors and adverse events occur in hospitals and in the community?

We could apply this knowledge to create safer health care delivery systems.

What if… we trained our pharmacists to do clinical research and exposed our basic scientists to clinical thinking?

We could hasten the translation of discoveries into patient care.

Work already under way at the UCSF School of Pharmacy will steadily transform possibilities such as these into realities. Our current plans serve as an aspirational compass for the School. They build on past successes and complement larger UCSF campus strategic planning goals, while retaining the flexibility we need to take advantage of new information in the health sciences as it constantly unfolds.

Through 2012, we will:

Create a New Framework for Drug Discovery and Development

Ensure That More Patients Get the Best Results from Their Drugs

Shape the Future of Pharmacy Science, Policy, Education, and Patient Care by Working in Fresh and Collaborative Ways

No single discovery or solitary action will determine our success. Rather, our goals are being met through the relentless determination and persistence of our faculty and administrative leaders who command an exceptional breadth of expertise. In our diversity, we share the common point of view that by pressing ahead in new directions we will improve patient health through drugs and novel therapies.

Sincerely,

Mary Anne Koda-Kimble

Mary Anne Koda-Kimble, PharmD

PROFESSOR AND DEAN
THOMAS J. LONG CHAIR IN COMMUNITY PHARMACY PRACTICE
UCSF SCHOOL OF PHARMACY

DECEMBER 2007

In our diversity, we share the common point of view that by pressing ahead in new directions we will improve patient health through drugs and novel therapies…

OUR FACULTY AND ADMINISTRATIVE LEADERS: Susan Abby Dale Adams Donna Dare Nadav Ahituv Brian Alldredge Judith Alsop Peter Ambrose Dorothy Apollonio Francesca Aweeka Mitra Assemi Patricia Babbitt Leslie Benet Lisa Bero Elizabeth Boyd Frances Brodsky Esteban Burchard Alma Burlingame Lee Cantrell Xin Chen Christine Cheng Jennifer Cocohoba Robin Corelli Charles Craik Christopher Cullander Timothy Cutler Robert Day Cathi Dennehy Ken Dill Betty Dong Robert Duca Shareen El-Ibiary Pamela England Thomas Ferrin Marcus Ferrone Patrick Finley Ronald Finley Maria Friciello Kathleen Giacomini Bradford Gibson Ruth Greenblatt John Gross John Grubbs Shenheng Guan Joseph Guglielmo Su Guo Debra Harris Stuart Heard Nancy Hessol Betty-ann Hoener Yong Huang Anthony Hunt Ogechi Ikediobi Matthew Jacobson Thomas James Brian Jersky Stephen Kahl Steven Kayser Thomas Kearney Donald Kishi Mary Anne Koda-Kimble Sharon Kotabe Tanja Kortemme Jane Kreager Deanna Kroetz Lisa Kroon Andrew Krutchinsky Irwin Kuntz Howard Lee Kirby Lee Andrew Leeds Susan Levings James Lightwood Emil Lin Helene Lipton Daniel Lowenstein Shalini Lynch Conan MacDougall Gerald Matson Susan Miller Joseph McCune Nancy Nkansah Norman Oppenheimer Kathleen Orrico Paul Ortiz de Montellano Marie Parfitt Pattie Lynn Paulsen Deborah Petrie Kathryn Phillips Andrew Pohorille Christie Robinson Lorie Rice Andrej Sali Nancy Sambol Barbara Sauer Richard Shafer Rita Shane Martin Shetlar Jae Kyu Shin Brian Shoichet William Soller Marilyn Stebbins Francis Szoka Chao Tang Candy Tsourounis Davide Verotta Eleanor Vogt Christopher Voigt CC Wang Cynthia Watchmaker Robert Weibert James Wells Leslie Wilson Michael Winter Katherine Yang Glenn Yokoyama Sharon Youmans

…our goals are being met through the relentless determination and persistence of our faculty and administrative leaders who command an exceptional breadth of expertise.

Mary Anne Koda-Kimble, PharmD, Dean

1 create a new framework for drug discovery and development

Drug discovery today focuses on finding a single molecule that can inhibit an errant protein associated with a disease. The pharmaceutical industry scans large numbers of molecules to find those that have this effect, but in recent years this approach has failed to yield growing numbers of unique drug products. In fact, for the past 25 years, a more or less constant level of new drugs has been approved each year by the U.S. Food and Drug Administration (FDA), while drug costs continue to rise.

There are other problems in our current approach to drug development. Animal models in which potential drugs are tested do not accurately reflect how the drugs will work in people. Drug side effects in humans are often unpredictable and not thoroughly understood. Because of their chemical properties, many drugs often do not reach the desired location in our bodies. Drugs are designed for the average person and fail to take into account how we differ as individuals.

We now know that the causes of diseases are surprising and complicated. Who could have imagined that mad cow disease is transmissible through proteins or that ulcers are caused by a bacterium? The details of many conditions—such as obesity, Alzheimer's disease, cardiovascular disease, and asthma—remain to be revealed.

We need a true understanding of what causes a disease if we are to find effective drugs to treat and prevent it. This means we must move beyond our current approach to drug discovery and development by deepening our understanding of the underlying chemistry and biology of disease, and by learning how the full machinery of a cell works, or does not work, as a complex system. We must amplify our drug research through computation and engineering.

The drug industry is ceding ever more of the basic research on drug discovery approaches and technologies to academic centers. This shift in emphasis is hugely important to the chemistry and pharmaceutical science research enterprises in the UCSF School of Pharmacy.

We believe that the wellsprings for advances in drug discovery and development are to be found in the deepest reaches of academic basic science research, untied to marketplace economics. From academia will evolve the approaches, tools, and technologies required to restructure drug discovery and development in the private sector. From academia will emerge young science leaders who will challenge traditional ideas and open the intellectual doors to fresh ways of thinking about how to conquer disease.

Through 2012, we will take the next steps needed to create a new framework for drug discovery and development, from which a new generation of therapeutics will arise. We commit ourselves to achieve the following:

> **"We believe that the wellsprings for advances in drug discovery and development are to be found in the deepest reaches of academic basic science research, untied to marketplace economics."**

Amplify and integrate our expertise in chemistry, physics, and math to more deeply understand health and disease…

Advance our understanding of protein structure and function to learn and predict how proteins and nucleic acids in living organisms interact with one another and with drugs

Discover failures in biological systems that are associated with complex diseases, such as cancer, as an essential first step in developing diagnostic tools and therapeutics to prevent and cure these diseases

Deploy the power of computers with new mathematical approaches to make sense of vast quantities of biological and pharmaceutical data.

Create new research tools…

Apply nanoscience to the development of tools to diagnose and treat disease

Develop small molecules that can probe biological processes and serve as therapeutic agents

Develop advanced computational tools that will transform our understanding of living systems

Use sophisticated physical methods to reveal normal biological, as well as pathological, processes at a detailed molecular level.

Find new approaches to drug discovery and delivery…

Expand our ability to predict which drugs will work best in—or harm—individual patients or patient populations based on their genetic profiles

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2 ensure that more patients get the best results from their drugs

"Take a pill, and everything will be fine." … If only it were that easy.

The true measure of a drug is how well it works in each of us individually. While the drugs we use today prevent, cure, and relieve the symptoms of many diseases, they are not precise. Drugs affect many processes in the body beyond their intended targets. And because we all differ biologically, none of us absorb, respond to, or eliminate drugs in exactly the same way.

Our personal circumstances can also affect how well a drug works. Consider differences in income, education, culture, physical abilities, and diet. Will we be able to take a medication as directed? Some of us take many other prescriptions, over-the-counter, and nontraditional drug products as well. Will these products interact with one another? Will the interactions be beneficial or harmful? This is to say nothing of the cost of medicines, which is limiting access to drugs while straining the budgets of families and the U.S. health care system.

1 CONTINUED

Devise ways to efficiently evaluate how drugs will act in the body, by mimicking biological functions using a chip

Find better ways to deliver drugs and novel therapies to targeted disease sites in the body.

To this already complicated picture, add America's demographic diversity. While the differences are immense, some characteristics cut across the broader population: Americans overall are getting older, heavier, and sicker due to chronic health problems such as diabetes, asthma, high blood pressure, and heart disease.

The marketplace also causes confusion. How do consumers differentiate among the growing number of drugs promoted to lower cholesterol, slow bone loss, or promote a restful night's sleep, for example? Increasing numbers of drugs that were once available only by prescription are now available over the counter. Credible and non-credible statements about medicines appear everywhere, from bus shelters to blogs.

Even when medicines are approved by the FDA for general use, sad experience has shown that they are not always safe for everyone. Furthermore, the systems used to deliver drugs safely to patients, especially in hospitals, are very complex. According to the Institute of Medicine, about 7,000 patients die each year from preventable medication errors and adverse events.

Against this complex backdrop works the pharmacist, the safety net in the medication-use process, who is the trained expert in the management of drug therapies. The pharmacist screens for silent diseases, identifies drug-related problems, manages medication therapies, and coordinates complex medication regimens. The pharmacist also understands the underlying political, social, and behavioral forces that affect drug access and use.

Patients need pharmacists who are their advocates. They need pharmacists who practice in new ways and in nontraditional places.

" Patients need pharmacists who are their advocates. They need pharmacists who practice in new ways and in nontraditional places. "

Patients need pharmacists who remain experts in the safe and effective use of continually evolving therapies. We all need pharmacists who use their knowledge to lead broad structural changes in heath care systems that will ensure medication safety and the best possible medication therapy for us all.

Through 2012 we will take the next steps needed to ensure that more patients get the best results from their drugs. We commit ourselves to achieve the following:

Make the promise of personalized medicines a reality for patients…

Discover genetic factors that affect therapeutic and adverse drug responses

Take what we learn about the effects of genetics on drug response and apply it to patient care and the design of better clinical drug trials..

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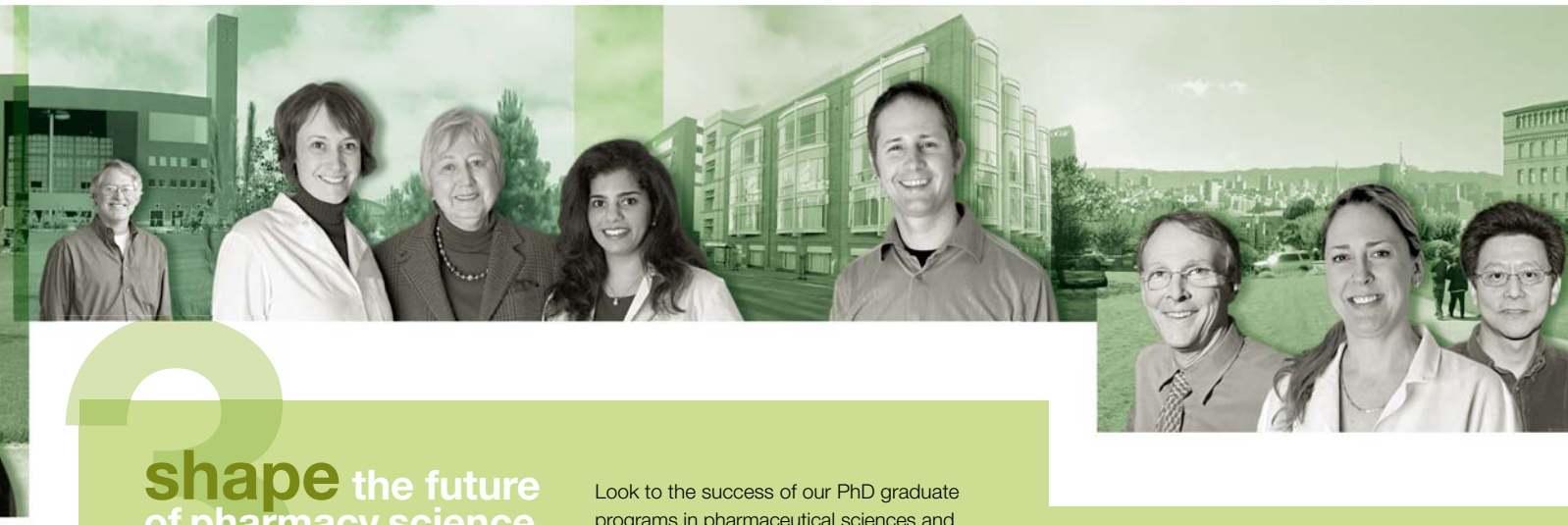

2 shape the future of pharmacy science, policy, education, and patient care by working in fresh and collaborative ways

Our best work comes when we collaborate in unexpected ways where disciplines intersect. We know from experience that this can lead to better ways to train future scientists and answer complex research and policy questions.

Look to the success of our PhD graduate programs in pharmaceutical sciences and pharmacogenomics; chemistry and chemical biology; and biological and medical informatics as examples. We will continue to melt artificial academic boundaries to transform approaches to science, policy, education—and now practice.

It is clear that to succeed in translating basic drug research into patient care, we must prepare more doctors of pharmacy with the skills they need to conduct the essential clinical research that falls between the development of a potential drug and the use of that product in patients. We must also prepare basic scientists to conduct research that is clinically relevant. There is a growing need for this new clinical scientist who can design and carry out clinical drug studies for the National Institutes of Health (NIH), for the pharmaceutical and biotechnology industries, and within schools of pharmacy. Only a few schools of pharmacy in the country are poised to train clinical scientists. The UCSF School of Pharmacy is one of them.

While bridging the divide between scientist and pharmacist, we must also find better ways for pharmacists, physicians, nurses, and dentists to work together. The best care will be delivered by teams of health care providers who work together naturally. This is because the complexity of disease and therapy requires the perspectives of many minds. Currently, student pharmacists, physicians, nurses, and dentists have little opportunity to learn and practice together because they are trained separately. We are one of the few health science centers in the country that house world-class health professional schools in these four disciplines. A coordinated and collaborative approach to the education of our health care professionals is a logical way of fostering safer and more effective care. And it is perhaps the most potent approach we could take in academia to instill collaboration in practice.

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2 CONTINUED

Find new ways for pharmacists to help patients make the best use of medicines…

Design and validate pharmacy practice models that improve patient health

Extend successful pharmacy practice models across the continuum of care, including health systems and community practices

Create ways for pharmacists to improve the health of patients on complex drug therapies.

Help consumers take a central part in caring for their own health…

Educate health practitioners and students about the theory and practice of self care

Share with consumers and health professionals relevant and reliable information on responsible self care and how to distinguish between credible and non-credible information.

Minimize medication errors and adverse events…

Develop leadership in health systems pharmacy

Create and test approaches in the hospital and community to curtail adverse medication events

Evaluate risks associated with the complexity of the medication-use process, and determine the optimal deployment of technology and automation to support safe medication use

Identify genetic variants that make individuals susceptible to severe adverse drug reactions.

Help meet the pharmacy needs of the underserved in our world…

Extend our pharmacy care outreach to underserved seniors throughout California

Find ways to provide pharmacy care to underserved and uninsured people who might not otherwise have access to pharmacists.

Steer policy that affects health sciences research and health care…

Expand our research on national and global policy issues to create an evidence base for sound health policy decisions

Advance our understanding of health care decision making

Engage national, state, and local stakeholders on significant health policy and science issues affecting health care and discovery

Increase our leadership in national and international professional and scientific organizations.

Diversity is as important to our success as new ways of working with our peers in other disciplines. The perspectives of our faculty and students are broadened by the insights and experiences of all our colleagues and patients. Science flourishes when diverse perspectives are brought to bear on complex scientific problems. Healing is more likely to occur when patients and health care providers have a shared cultural context and understanding. We are committed to creating a diverse School community, which signals that we act on our beliefs.

Our public is increasingly a global public. We benefit as much from the different approaches to scientific and clinical problems that various cultures bring to the discussion as we do from the exchange of new knowledge itself. So, to be effective global scientists and clinicians we have to be culturally competent and sensitive. This is evermore true of our students, who are more likely to conduct their science and practice pharmacy beyond our borders. We will model to our students the importance of global citizenship in science and health care. We are committed to exchanging our expertise with colleagues around the world and especially those in developing nations.

Furthermore, to produce the best health results and to apply what we have discovered in our labs to the public good, we must share our expertise and invite the viewpoints of colleagues in academia, industry, and government. Our ability as academics to influence and even lead change rests on the value of our unbiased research and evidence-based opinions.

Through 2012 we will take the next steps needed to shape the future of pharmacy science, policy, education, and patient care by working in fresh and collaborative ways. We commit ourselves to achieve the following:

“Our best work comes when we collaborate in unexpected ways where disciplines intersect.”

Mesh scientific and academic disciplines in new ways…

Fully integrate engineering principles into our work in drug discovery, development, and therapeutics

Participate fully in UCSF’s Clinical and Translational Science Institute by leading programs across the therapeutic, basic, clinical, and social sciences.

Prepare more clinical scientists…

Articulate a clear path for PharmD students who wish to pursue research and an academic career

Establish a post-PharmD clinical pharmacology and therapeutics research training fellowship program

Increase the number of clinical faculty members prepared to do NIH-level research

Develop opportunities for our PhD graduate and postdoctoral students to gain clinical insights.

Advance interprofessional learning and practice among student pharmacists, physicians, nurses, and dentists…

Create and support multiprofessional teams of faculty who are dedicated to designing interdisciplinary curricular opportunities among all four professional schools

Develop opportunities for peer-to-peer teaching among health professional students.

Prepare our doctor of pharmacy students to be leaders and agents of change…

Test and apply new teaching methods

Broaden our students’ experiences in novel health care practice and research settings

Increase our students’ exposure to new ways of thinking, new developments, and new trends

Continually assess our curriculum to ensure it is timely, integrated, and relevant.

Strengthen the diversity of our faculty, students, postdoctoral scholars, and staff…

Incorporate our commitment to diversity into the School’s mission statement

Centralize and coordinate the School’s diversity agenda

Increase the number of individuals on the School’s faculty and staff, in the PharmD and PhD student bodies, and among postdoctoral residents and fellows who come from historically excluded and currently underrepresented populations.

Extend our work globally…

Modernize drug development and regulatory processes worldwide through courses that bring together pharmaceutical scientists and policy makers from around the globe

Establish opportunities for scientific and academic collaboration with international colleagues

Find new therapeutic approaches to treat emerging infectious diseases and common diseases in underdeveloped countries.

Planning Process

Planning for *Pressing Ahead in New Directions: Strategic Course 2007-2012* began in 2004, a year before our last plan was due to conclude. The process was one of advances and retreats, starts and stops, "Eureka!" moments, and moments of intense faculty discussion.

In the end, the process has given all of us at the UCSF School of Pharmacy a better understanding of the forces that influence our work. It has challenged our assumptions and helped us to think differently about how and what we do. The plan was ratified by a full faculty vote in September 2007. It complements the inaugural campus strategic plan, *Advancing Health Worldwide.*

Visit pharmacy.ucsf.edu/go/plans for more information about our planning process.

Plan Implementation

The School's dean and the dean's leadership group are responsible for implementing the plan, revising it as needed, and assessing progress.

Mary Anne Koda-Kimble, PharmD, Dean
Leadership Group:

- Brian Alldredge, PharmD, associate dean, academic affairs
- Robert Day, PharmD, associate dean
- Ken Dill, PhD, associate dean, research
- Robert Duca, MBA, associate dean, finance and administration
- Kathleen Giacomini, PhD, chair, department of biopharmaceutical sciences
- Joseph Guglielmo, PharmD, chair, department of clinical pharmacy
- Thomas James, PhD, chair, department of pharmaceutical chemistry
- Susan Levings, MS, associate dean, planning and communications
- James Wells, PhD, incoming chair, department of pharmaceutical chemistry

School Mission

The School of Pharmacy at the University of California, San Francisco is dedicated to improving human health worldwide and advancing scientific discovery. The School:

- Conducts exceptional *pharmaceutical research,* including basic science, translational science, clinical science, health policy, and health services research.
- Delivers world-class *education* to our Doctor of Pharmacy, graduate, postdoctoral students and others.

  We educate PharmD students to be leaders and effective team members in health care and to be lifelong experts in the safe and effective use of medicines.

  We educate graduate students to be outstanding researchers across the spectrum from the basic to the health sciences.

  We provide strong postdoctoral training.
- Develops and delivers outstanding and innovative *pharmaceutical care.*
- Serves the *community* by sharing our expertise with the public, industry leaders, and policy makers.

We achieve these goals within a culture of understanding, inclusion, equity, and respect. We recruit and support faculty members, staff, and students who are diverse in gender, age, race, ethnicity, religion, sexual orientation, and socioeconomic status. We have a particular commitment to historically excluded populations who are currently underrepresented.

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DESIGN: ROBIN AWES EVERETT

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PRINTING: ESSENCE PRINTING FOR PRESS CHECK

Our past successes signal future success for patients.

Top-ranked pharmacy school in the United States. The UCSF School of Pharmacy is a national leader, as measured by academic quality and perception, funding and publications.

Recipient of more National Institutes of Health (NIH) research funding than any other pharmacy school in the United States, every year since 1979. The success of the School's NIH funding among its peers reflects on its exceptional science faculty.

Recipient of more federal funding for chemical research and development (R and D) than any university in the United States. The success of the School's chemical R and D funding is a direct reflection of the quality of its chemistry science.

Four elected members of the Institute of Medicine, and one elected member of the National Academy of Sciences. The School is well represented in prestigious national professional organizations.

First to train pharmacists as drug therapy specialists and not simply drug dispensers. This philosophical and academic shift positioned pharmacists as "clinical pharmacists" who, as active members of the health care team, began to work side by side with physicians and nurses to provide direct care to patients and consultation to patients' families.

Innovators today of a three-pathway Doctor of Pharmacy (PharmD) curriculum. In order for pharmacists to meet today's changing health care needs, pharmacy school curricula must be farsighted and continually refreshed.

Leader in establishing how to critically evaluate and make the best use of health care information and scientific research. The best practices by physicians and other health care providers are based upon applying accurate, unbiased information.

First to develop computer-based molecular docking software program, called DOCK, that calculates and displays in three dimensions how potential drugs might attach to target molecules. Computer-based approaches speed drug development by more efficiently "sorting out" or "screening" from millions, and billions, of chemicals those compounds that have the best potential for drug development.

First to establish a physiological basis for describing drug distribution in the body by introducing the concept of drug "clearance." Accurate calculations of how rapidly a drug is cleared from the body are key to understanding how much drug is active in the body at a given time and hence the most effective dose for a patient.

Described, through the application of sophisticated nuclear magnetic resonance (NMR) techniques, important protein structures in AIDS and fatal neuro-degenerative diseases, such as mad cow disease. The power of NMR and other techniques to "see" the architecture of molecules involved in disease makes it easier to determine how to rationally design drugs that bind to, or incapacitate, those molecules.

Revealed a deeper understanding of the principles of how proteins adopt their structures. The ability to predict protein shape will speed the pace of scientific discovery and drug development.