Testimony of Duane Roth, CEO of CONNECT

before the House of Representatives Committee on Oversight and Government Reform

regarding "Federal Policies Affecting Innovation and Job Growth in the Biotech and Pharmaceutical Industries."

April 21, 2011

Chairman Issa, thank you for this opportunity to testify to the Committee regarding "Federal Policies Affecting Innovation and Job Growth in the Biotech and Pharmaceutical Industries." I have submitted more extensively written testimony but I'd like to briefly comment on a few issues that are critical to this Committee's review of this important topic.

First, the Committee must remember that the federal government, through its many science and technology related agencies, is the largest single investor in research in the United States, currently at almost $150 billion annually. Over the past 30 years, these federal investments in research have led to the formation of innovative product-focused start-up companies that translated technology discoveries into commercial products. These products have been exported around the world and have contributed to better healthcare, increased security, more nutritious food, a cleaner environment and better communications. In the process, these companies also transformed the U.S. innovation economy and provided the majority of new high-paying jobs. The start-up model was financed primarily by venture capital (VC) investments in early-stage development with follow-on financing (often pre-revenue) from the public equities market through initial public offerings (IPOs).

Recently, this financing model has been challenged, especially in the biotech and pharmaceutical industries, primarily due to the disappearance of the IPO market for pre-revenue stage companies. The long, uncertain and expensive FDA approval process is a significant contributing factor in this financing challenge. As a result, it is increasingly difficult to fund start-ups to develop new innovative therapies since the VCs now have to

fund these entities to profitability or to an exit through merger and acquisition. Therefore, many innovative discoveries end up in the so-called "Valley of Death," where there is no funding source available to support the early translation of research discoveries into products. To address this gap, foundations, advocacy groups and even government funding agencies have stepped in to try to provide this funding, but these investments are generally inadequate to bridge the discovery to follow-on VC funding. If this investment gap is not addressed, the U.S. could lose its competitive advantage in commercializing innovation due to increasing global competition. To address this issue, it is imperative that the U.S. develop new financing and business models that provide incentives to bring investment into this pre-venture. Roth and Cuatrecasas recently described one such financing model in a publication by the Kauffman Foundation which is attached to my written testimony. I will focus my comments today on 1) capital formation for early-stage investments 2) addressing the regulatory challenges for innovative new medical products.

Capital Formation

Congress needs to aggressively look at various capital formation policies and quickly move to modernize them to support our changing innovation economy. These include among others, modernizing the SBA Loan program and continuing support of the SBIR and STTR programs. The recent Start Up America program has several helpful features including re-instating the small business investment companies (SBIC) and creating SBA-guaranteed bonds which will match private capital raised by privately-owned and managed investment funds. However these programs will not provide the massive infusion of capital we will need for America to remain the number one innovation economy in the world. Our global competitors have created clever economic development strategies that capitalize on our innovations, tax policies and shortages of certain skilled workers such as engineers. Countries such as Singapore and Malaysia have become proficient at enticing American manufacturing and production in their countries.

Multiple sources have noted that U.S. companies are sitting on over a trillion dollars in foreign profits that are subject to an additional tax if these funds are repatriated to the U.S. Presently, these profits are subject to an incremental tax equal to the U.S corporate tax rate of 35% minus the tax rate they paid in the country where they earned the profit. Since the U.S. has the second highest corporate tax rate in the world, this policy acts as a deterrent to bringing that capital back to the U.S. and expanding research and development or manufactuirng facilites which create jobs. Not only is the repatriation tax a bad policy on its face, but the policy is anti-competitive as it encourages American companies to build new facilities and develop new products overseas to avoid the high tax rate, thus allowing jobs and innovation to be created outside the U.S. This policy in effect serves to directly finance our competitors.

Congress should incentivize the investment of those foreign profits back to the U.S. in a way that will infuse capital into early-stage innovation and emerging technologies, which have especially struggled in the sputtering economy. Fortunately, there is a bill in Congress that will do this and it was introduced by San Diego Congressman Brian Bilbray. H.R. 1036, the Job Creation and Innovation Investment Act of 2011, allows the repatriation of foreign profits back to the U.S. at a 0% tax rate IF those funds are used for the following limited purposes:

- Research & Development—internal, sponsored or purchased
- Expansion of facilities
- Funding Proof of Concept Centers
- Early-stage VC investment (including original investment)
- Manufacturing start-up costs (including plant, equipment, infrastructure and contract manufacturing).

The bill allows the return of repatriated funds at a 5.5% rate otherwise.

Bringing this money back to the U.S. will move American profits out of places like Singapore, Malaysia and South Korea and into places like San Diego, Maryland and Utah. Congress CANNOT wait for comprehensive tax reform legislation to move before

bringing this money back to the U.S. and creating a private sector stimulus that creates no new federal program and creates no new burdens on taxpayers.

FDA Reform

The current regulatory system for approval of medical products creates a "no win" situation as the parties in the room negotiating approval cannot objectively assess risk and benefit. The regulator is inherently influenced by the risk that the drug or device may not be safe, while the maker of the drug or device is inherently influenced by the benefits that can be realized by the patients. Numerous attempts have been made over the past several decades to try to address these built in biases through new rule making including the Prescription Drug User Fee Act (PUDFA I) of 1992 and follow on renewals (PDUFA II-IV) and the FDA Modernization Act of 1997. The results of these attempts have not been successful to date in that it takes longer, costs more and fewer new innovative products have reached the market despite an explosion of investment in research form both government and industry.

Recently, the Hastings Center Report, a trusted authority on ethics in medicine and bioethics, published an article I drafted based upon my over four years' service on the oversight board of the California Institute of Regenerative Medicine where the board of twenty-nine members includes ten patient advocates. My remarkable experience of working with these advocates led me to suggest a new paradigm on how the regulatory approval process may be re-engineered to remove the inherent biases and build trust into the system through a shared responsibility.

What I realized is those directly impacted by the disease or impairment have a unique perspective in evaluating risk and benefit. It is their disease, not the industry's nor the FDA's. I suggest that it is unethical to exclude them from the room in which literally life and death decisions are made in a two-way, biased negotiation between the FDA and the company. There is precedent for direct patient involvement in the regulatory process.

Following the unfolding of the HIV epidemic in the early 1980s, patient advocates persuaded the FDA and industry to include their perspective in the approval process for anti viral medicines by allowing their input into the approval process. These efforts lead to the first protease inhibitor approval in 1995 in just 97 days, a drug that changed AIDS to a chronic disease from a fatal one. To this day if you talk with those directly involved in the review they will tell you it worked remarkably well and all are extremely proud of what they together accomplished. Unfortunately instead of institutionalizing this shared responsibility as a formal part of the approval process for innovative therapies, it became a “one-time” event.

I suggest that we should consider incorporating patient mediators in the review process for innovative new products as a routine. The FDA review team would remain, as now, the final decision maker in all review processes. The company team would, as now, have responsibility to generate the data to prove safety and efficacy. The patient team would help both parties view risk and benefit through their lens. In my paper I suggest that we create a pilot program to test this process. The patient mediator team would need to be directly impacted by the disease (they or their immediate family) and be certified that they have the appropriate background and experience (knowledge of regulatory law, statistics, clinical trial design, manufacturing and controls, etc.) Such a three way shared responsibility would have the potential to change everything for U.S. led innovation that would directly benefit patients providing a higher quality of life and lower overall healthcare costs.

My written testimony includes the full text of the Hastings Center Report article and provides more extensive discussion and analysis of this proposal.

Thank you.

The DISTRIBUTED PARTNERING MODEL for Drug Discovery and Development

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KAUFFMAN
The Foundation of Entrepreneurship

The Distributed Partnering Model for Drug Discovery and Development

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Abstract: The major contributors to therapeutic innovations in the 20th century have been the pharmaceutical companies, with biotechnology companies adding significantly over the last twenty-five years. However, these models increasingly have failed in translating the advances of biomedical sciences into innovative products. We suggest a modern-day paradigm for efficiently advancing new therapeutic products. This "distributed partnering" approach would involve four distinct, independent organizations to collaborate in a risk-adjusted manner to discover, define, develop, and deliver innovative products.

The new model would feature the formation of companies called product definition companies (PDC), which would focus solely on advancing innovation through the initial definition research phase. PDCs would consist of a team of experienced professionals who would raise funds to manage several projects simultaneously. PDCs would acquire early stage discoveries from research institutions and invest in defining product applications with a goal of selling the successful ones to pharmaceutical companies for further development and delivery.

The Fully Integrated Pharmaceutical Co. (Pharma) Model

Once upon a time, the United States pharmaceutical industry was prolific in developing new and innovative medicines. One of this paper's authorsrecently described the conditions that made this model so successful over many decades. Throughout the 1970s, most large pharma companies had a president of research or vice president of research and development, who oversaw basic research (i.e., discovery). This person was given a budget and great freedom to pursue the science wherever it might lead. Once a discovery was made with the potential for becoming a new product, a development team was formed to better define a product under the supervision of the vice president of research and development. The development team had representation from all relevant disciplines, including marketing. These teams focused on accomplishing all the steps necessary to bring the product to market.

As the product moved through early clinical trials and the Food and Drug Administration process, the delivery team developed the marketing plan for sales teams to launch the product around the world. This model was productive by any measure and resulted in a steady stream of innovative products. However, this model, for many reasons, now is failing, resulting in a major threat to new drug innovation.[3, 4]

What went wrong?

In the 1970s, industry leadership began to shift toward an emphasis on strict business practices.3 Many large pharmas began to borrow these new business principles (e.g., management by objectives, etc.) from non-research-intensive corporations to manage discovery, product definition, and development. These management tools included rigid scrutiny and tight controls of research projects through quarterly reviews, timelines, and Gantt charts. However, this approach is inappropriate for basic scientific research in the biomedical sciences. Pharmas truly are unique research-intensive matrix organizations, ultimate adhocracies 6, that operate through complex collaborations between professionals from multiple and diverse disciplines, such as chemistry, biology, development, regulatory affairs, patenting, marketing, information technology, statistics, manufacturing, finance, and many others. Furthermore, these professionals must function in dynamic, changing, and complex environments.

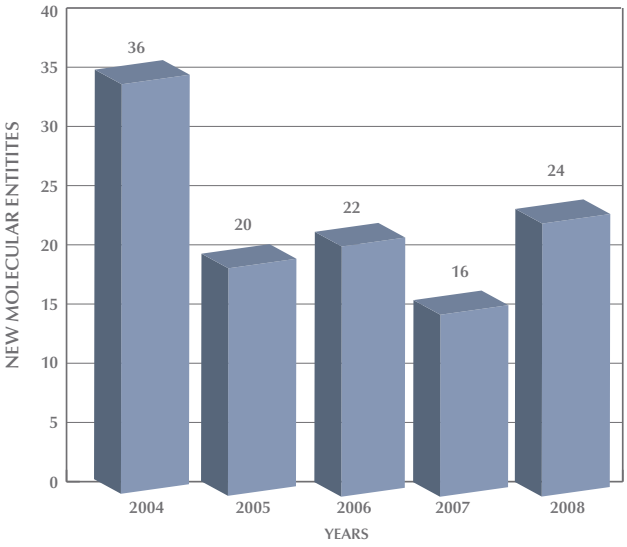
Proper functioning of the discovery/definition/development process requires that its management reside within the scientific staff. However, the increased dominance of the commercial side of pharmas (which demanded impossible degrees of predictability, tight controls of science and technology, and changing "choices" of which projects to pursue) ultimately led to a shift of control from research to marketing and commercial personnel. As suggested[3], managing the research and development process in this way is counterproductive. Virtually every project is "killed" for one reason or another along the way, often rather arbitrarily. Thus, most pharmas essentially have become development companies managed by unimaginative marketing departments. Today, few would make the argument that the current pharma model of drug discovery and development is a productive model for advancing innovation. Despite billions of dollars of investment and numerous attempts to institute systems to encourage innovation, the current state of pharma discovery continues to decline (Figure 1).

The Biotech Model

Biotech began in the late 1970s when leading scientists began to explore innovations in biology to develop new therapeutics. The concept became a reality with discoveries of the methods of producing proteins through genetic engineering (recombinant DNA) and of cloning antibodies (monoclonal antibodies).

In the early days, investments in biotech were made almost instinctively, based on the excitement of potentially applying new biological methods to produce therapeutics. Tom Perkins (founding partner at Kleiner Perkins Caufield & Byers) described his investment in Genentech Inc. as being based largely on the enthusiasm of Bob Swanson, an excited associate partner. Swanson proposed to start a new venture in an entirely new industry based on the discovery of Herb Boyer, a creative young academic scientist at the University of California, San Francisco. Perkins stated that after meeting with Swanson and Boyer, he and his partner, Eugene Kleiner, decided to fund a study to determine the feasibility of gene splicing (to produce proteins) and, if that worked, to fund Genentech. It did, and they did.

Figure 1:
R&D Expenditures are Increasing While FDA Approvals are Decreasing



Source: Burrill & Company, US Food and Drug Administration

R&D SPENDING

2004	$47.8
2005	$51.8
2006	$56.1
2007	$58.5
2008	$65.2

An important concurrent development was the passage of Bayh-Dole Act by the U.S. Congress in 1980. This legislation allowed research institutes to own the intellectual property derived from federally funded research (e.g., National Institutes of Health (NIH), National Science Foundation (NSF), etc.). This accelerated the formation of biotech startups to exploit the product definition and development of university-derived discoveries. Further enthusiasm for funding biotech startups was spurred by Genentech's very successful initial public offering (IPO) in 1980.

The biotech model generally operated when entrepreneurs and venture capitalists organized to form a new company (i.e., a biotech) to pursue commercialization of a licensed scientific discovery that arose from publicly funded research. Much of the initial funding was used to recruit technical personnel and build infrastructure (i.e., laboratories, instrumentation, vivariums, pilot plants, etc.) similar to those existing in pharma, but on a smaller scale. These companies initially focused on product definition and development. As they advanced their lead product(s) through development, they raised additional funds from venture capitalists or sold equity in the company through IPOs. As the product development advanced into late-stage clinical trials and the prospects of an FDA approval became realistic, most biotechs simply did not have the more extensive infrastructure or resources to conduct such studies or to market the product. Thus, the early biotechs partnered with large pharmas to advance the potential of their lead product(s). This model became known as copartnering.

More than half a trillion dollars have been invested in the biotech model over the past twenty-five years and, as detailed by Pisano, the overall return on investment has been negative.

The goal of transitioning into an independent, fully integrated pharma rarely was achieved and copartnering with—or acquisition by—pharmas became the prevalent outcome.

During the past twenty-five years, the biotech model produced a number of successful products and companies. However, the evolution of biotech has been so drastic that, as described below, the existing model has become ineffective and anachronistic in modern times. More than half a trillion dollars have been invested in the biotech model over the past twenty-five years and, as detailed by Pisano, the overall return on investment has been negative.[7]

What went wrong?

The very early product definition and development success stories in biotech were nearly all based on the recombinant DNA protein engineering and monoclonal antibody technologies. In nearly all cases, the potential products were genetically engineered human proteins (some with slight variation) of known function and role in the pathophysiology of diseases and all had high potential for medical utility. The major challenge (other than intellectual property) was the large-scale production of a highly purified human protein or antibody. Thus, the successes were known hormones or growth factors, such as insulin, growth hormone, interferon, tissue plasminogen activator, erythropoietin and, later, monoclonal antibodies for transplant rejection and cancer.

The early successes of these products and companies created much enthusiasm in the investment and academic communities, which fueled hundreds of startup biotech companies. Over time, the general definition of biotech evolved to include a broad scope of technologies involving small molecules and diagnostics. The larger profitable companies are referred to as "big biotechs" and function similarly to pharmas. The term "biotech" describes a small (usually a startup), innovative company focused on a single (or limited) biological or technology product.

In more recent times, the technologies, discoveries, and potential novel products have been of a totally different nature in terms of "probability of success" when compared with the early biotech products. The projects have been highly innovative and, thus, unpredictable, risky, and very likely to involve long-term commitments. Many of the projects focus on small molecules, not proteins or antibodies. In effect, the research and development projects have become similar to those with which pharma deals. However, the small biotechs only can tackle one project (or a few) at a time and within limited time horizons. The venture capitalists and investors do not have the resources or patience for these longer time horizons and the inevitable setbacks and delays. Pharma, on the other hand, has, in principle, the capabilities and resources [although currently not the right organizational procedures or willingness 3] to handle many of these kinds of long-term projects simultaneously, to pursue most things that look viable, and to re-work research when they experience impediments or delays. Virtually every major successful product has been afflicted with serious problems or setbacks during development.[3] The biotech model simply does not allow for such difficulties.

Today, even the most promising discoveries made in research institutes are seen by venture capitalists as being too early and too risky for investing. Considerable efforts must be expended in analytical and upscale chemistry, safety pharmacology, toxicology, formulations, metabolism, and many other disciplines (preclinical development) before a specific candidate can be deemed ready to proceed to human testing or to pharma licensing. Therefore, today's venture capitalists prefer to invest in technologies possessing well-identified lead compounds with high probabilities of success that are not far from entering clinical testing. Unfortunately, such opportunities almost never exist.

A New Model for "Distributed Partnering" in the 21st Century

The future of financing life science innovations will require new, more efficient, sustainable models than those of the current pharma and biotech models.[2, 4] We propose a new model that involves the concerted collaboration of multiple and varied organizational partners. Here, the economic and technical risks along the discovery and development paths are distributed and shared by independent partners that contribute differing but complementary expertise, culture, and value in a sequential process. The distributed partnering model includes four distinct, independent spheres that collaborate in a risk-adjusted manner to discover, define, develop, and deliver innovative products.

Discovery research

As suggested by one of this paper's authors and recently documented by Block and Keller[1], federal and state research funding have become the primary sources for discovery research. Fortunately, in the United States, the importance of funding such research through federal agencies, such as the NIH, NSF, and Defense Advanced Research Projects Agency, now is accepted policy. In addition, many initiatives also are rising at the state level. For example, beginning in 2000, California was the first state to fund basic discovery research with the establishment of four publicly and privately financed institutes at the University of California and the

Governor Gray Davis Institutes for Science and Innovation. This investment was followed by voter approval of Proposition 71 in 2004, a $3 billion effort led by Robert Klein to establish the California Institute for Regenerative Medicine to fund stem cell research. Currently, more than a dozen states are investing in biomedical innovation and infrastructure.

Numerous departments and centers of translational medicine and drug discovery now exist throughout the country. The nonprofit research community has responded with enthusiasm and energy. The seeds for the future exploitation of scientific advances for drug discovery already have been planted and the existing culture in academic settings is perfect for this type of work[3], although the funding will have to be expanded significantly.

Once a grant has been awarded in a given area of research, the recipient essentially is free to pursue the science regardless of where it leads, unlike the pharma and biotech models. The "management" of the science by nontechnical managers and the administrative formalities are both minimal. Instead, the scientists are in charge. Oversight occurs primarily, as it should, through peer review and the granting agency. This culture cannot be duplicated in pharma or biotech. The unrestricted pursuit of basic science is essential to discovering the knowledge that can be the basis for new product innovation.

Academic laboratories, successful in making potential new drug discoveries, eventually are faced with technical and financial problems similar to those in biotechs when proceeding to the next stages of development, as described under *"What went wrong?"* NIH translational grants have helped, but their scope is too limited, too focused, and these grants rarely have extended to advance preclinical development needs. As described, venture capitalists simply will not fund this kind of early stage work. Academic laboratories have limited access to the funds or lack the expertise needed to do the advanced research and the early product definition required to move the project further. In addition, most academic researchers do not have the experience, temperament, or even interest in undertaking most of this work. Unfortunately, pharmas, like biotechs, usually are not a reasonable option for handing off the work. They rarely are interested in pursuing these early discoveries in the absence of greater product definition. As a result, these potentially important early stage scientific discoveries are stifled by the absence of viable mechanisms for advancement.

Definition research

Several approaches have been attempted to address a means of providing product definition and early development work (i.e., definition research) for innovative academic discoveries. A recent report from the Ewing Marion Kauffman Foundation described two academic models that have been successful in advancing early stage discoveries, the Deshpande Center for Technological Innovation at the MIT School of Engineering and the William J. von Liebig Center at the University of California San Diego Jacobs School of Engineering.[5] Other approaches to fund early stage discoveries have been tried. They include incubators, accelerators, and virtual companies, most of which have the primary goal of starting new companies that face the same challenges and funding risks described above in the *"What went wrong?"* biotech model.

The PDC combines an experienced management team with investment capital to advance a portfolio of discoveries through the product definition stage.

Similar opportunity needs for definition research also occur frequently in small biotechs. Here, potentially important discoveries are abandoned because the biotech's limited resources must be focused on clinical-stage or other advanced programs. Even in pharma, important discoveries are abandoned when they are not in sync with the current strategic plan. To fulfill these unmet needs for early product definition, we propose a new type of innovation organization called a product definition company (PDC).

The PDC combines an experienced management team with investment capital to advance a portfolio of discoveries through the product definition stage. An ideal example of a PDC would be one involving a small team of professionals highly experienced in areas, such as pharmaceutical research, clinical sciences, regulatory affairs, operations, and marketing. Some of these individuals would have extensive contacts and knowledge of universities' early therapeutic discoveries for potential

acquisition. The combination of expert personnel, specific possible projects, and the unique business model for the PDC would be the basis for raising sufficient initial capital to launch the operation. Much of the work could be done on a virtual basis, contracting the development tasks to Professional Service Providers (PSP) to perform the key tasks rather than building new infrastructure. The use of ad hoc scientific experts and consultants would be standard practice.

The PDC business model focuses on identifying and licensing promising discoveries from research institutes (and biotech/pharma). Licensees would receive traditional up-front fees, milestones, royalties, and equity ownership. The PDC then would progress by undertaking (via PSPs) and supervising the required product definition research for the acquired projects. The ultimate intention would be to **sell** the risk-reduced "asset packages" to third parties for further product development and delivery. Acquirers would include venture capitalists, pharmas, and big biotechs. The venture capitalists most likely would continue to fund advanced product development in a virtual mode, using PSPs rather than starting new biotech companies as in the previous model.

The PDC business model focuses on identifying and licensing promising discoveries from research institutes (and biotech/pharma).

Typically, a PDC might invest between $2 million and $10 million in a given project, depending on the cost required to achieve proof of relevancy[8] for any given discovery within an average of three years. Proof of relevancy would be defined on a case-by-case basis when third parties judge progress to be sufficiently attractive for acquisition. Given the early stage nature of most discoveries under initial study, frequent technical failures during definition research would be expected; many would probably occur early and, thus, be less costly. Even product definition failures could create value through generation of valuable intellectual property.

The PDC would require initial investment funds sufficient to address multiple projects (i.e., ~ $50 million to $100 million). Depending on the funding and investment model selected, PDCs could be either private or public companies. Potential investors would include high net-worth individuals, hedge funds, strategic partners (including pharma/big biotech, PSPs, etc.) and venture capitalists. The investment basis would value the expertise of the management team and its ability to evaluate and secure appropriate discoveries and translate them into potential products. The return on successful projects could range from two times to ten times that of invested funds upon completion of adequate definition research, making this a potentially profitable model. (See appendix A).

PDCs certainly would locate in regions that have significant concentrations of biomedical research institutions, such as San Diego, the San Francisco Bay area, and Boston, but they also could locate near state universities and private institutes with major research efforts and funding. PDCs in these regions could assist in advancing a culture that is compatible with commercializing innovation. In the recently published book, *Start-Up Nation*, Dan Senor and Saul Singer describe Israel's remarkable success in technology innovation. They suggest the creation of an innovative culture is key to success on commercializing technology.[9]

Today, there are a multitude of excellent PSPs that can perform the required technical work, as well as or better than biotechs and pharmas, at greater efficiency and lower cost. Furthermore, many of these PSPs are so large, versatile, and experienced that they could tackle several different aspects of the same project. Plus, all of the technical and development work for the PDC projects would be supervised and coordinated by experienced project managers.

Importantly, with the PSPs doing the development, technology transfer would occur in real-time as the knowledge would reside in the entities performing the work. Thus, these technologies or products could be even more valuable to those potentially interested in acquiring the asset in the future. In the pharma and biotech models, the data for advancing a technology/product come primarily from the company's assets (e.g., personnel, equipment, and facilities), which are expensive and inefficient. Today, the data could come from anywhere in the world, and the costs are only for the required technical work. Lastly, many other PDC functions can be performed on a virtual basis today, reducing unnecessary and expensive infrastructure and increasing organizational nimbleness and flexibility.

Development

To complete the "development" of a new product, delivery to the market still would require a number of additional tasks before marketing approval could be sought. Additional tasks include formulation and dosage-form development, advanced clinical trials, upscale chemistry, long-term toxicology, manufacturing technologies, and complex regulatory submissions, among other requirements. Venture capitalists could fund these activities either by forming a biotech, as in the existing model, or by operating in a virtual mode by use of PSPs as described above. For example, a venture capitalist may choose to fund advanced clinical trials (i.e., phase 2b, which is broadly described in the industry as proof of concept) before **selling** the asset to pharma or big biotech for final product development. Specialty funding companies, such as Symphony Capital, also could acquire PDC assets[10] and would develop them in a manner similar to the venture capitalists. Alternatively, pharma and big biotech would acquire the PDC asset at this stage and, in a similar approach, fund the PSP to the proof of concept stage.

Delivery

Subsequently, among the activities required are marketing, manufacturing final product, distribution and sales, reimbursement arrangements, education of medical and health professionals, consumers (patients) and payers (insurance companies and government agencies), formulary registrations, global registrations, and post-marketing monitoring for safety and efficacy. These tasks already are conducted effectively and managed by pharmas and big biotechs. In fact, these tasks are the areas in which these corporations possess their greatest strengths.[3, 4] The proposed model assumes that these types of companies would acquire the potential new products arising from PDCs and introduce the products into their delivery pipelines.

Conclusion

The proposed new distributed partnering model offers the potential for a more productive and efficient advancement of innovation and will be applicable in any region with excellent research; it does not require legions of experienced entrepreneurs or local established venture capitalist firms to enact. The United States is well represented in each of the disciplines and cultures required in the model:

- *Discovery research* (federal, state, and philanthropic funding)
- *Product definition and early development* (large number of PSPs, vast industry experience, and entrepreneurial spirit)
- *Advanced product development* and *delivery* (extensive infrastructure, venture capitalists investment funds, and some of the best pharmas and big biotechs in the world)

This model focuses on advancing "products" as opposed to "companies" (i.e., we need thousands of products not thousands of companies). By combining the expertise of these distinct cultures and organizations, innovative products could be advanced efficiently, making the risks and investments more proportional to—and rational for—each partner. If successful, the United States might continue, and even accelerate, its global dominance in innovative medical products.

Finally, while this manuscript discusses the innovative biomedical sector of innovation, the model may well apply to other innovation sectors, including high-tech, information technology, cleantech, etc. As this early phase of innovation investment is crucial to the U.S. economy and to addressing the nation's most important challenges (e.g., higher quality, affordable healthcare; a cleaner environment; better security, etc.), the federal government should consider a follow-on matching investment to PDC private sector investors. The private sector limited partners would set the terms and conditions with the federal government serving as an additional limited-partner investor. The federal investment covenants would be that the investments be the first funding after seed, grants, etc. (i.e., pre-venture) in the technology and that a high percentage of the investments (~80 percent) be made in intellectual property technology that has a foundation in federal- or state-funded research project grants.

These investments will serve to grow our economy by immediately creating jobs in the crucial innovation economy sector. Furthermore, while investors may do well, society will be the greatest beneficiary in terms of better health care, a cleaner environment, a more plentiful food supply, better communications, and a safer world.

Appendix A

The table below depicts potential Limited Partner economics for illustrative purposes. Actual results may vary.

Accelerator Fund 1 *(LP Economics at 32 percent return)*

($ in thousands)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Capital Related							
GP	$ 167	$ 167	$ 167	$ -	$ -	$ -	$ -
Outside LPs	49,500	-	-	-	-	-	-
Total Capital Related	**$ 49,667**	**$ 167**	**$ 167**	**$ -**	**$ -**	**$ -**	**$ -**
Fund Performance							
LP Capital Invested	$ (14,500)	$ (14,500)	$ (14,500)	$ -	$ -	$ -	$ -
LP Capital Returned	-	-	-	8,250	16,500	16,500	8,250
LP Profit	-	-	-	8,425	22,185	22,185	13,761
Total Capital Returned/ (Invested)	**$ (14,500)**	**$ (14,500)**	**$ (14,500)**	**$ 16, 675**	**$ 38,685**	**$ 38,685**	**$ 22,011**
Management Fees	(2,000)	(2,000)	(2,000)	(2,000)	(2,000)	(400)	(400)
GP Incentive Fees				(1,685)	(4,437)	(4,437)	(2,752)
Institution Incentive Fees				(1,264)	(3,328)	(3,328)	(2,064)
Total Fees	**$ (2,000)**	**$ (2,000)**	**$ (2,000)**	**$ (4,949)**	**$ (9,765)**	**$ (8,165)**	**$ (5,216)**
Total Cash Inflow/(Outflow)	**$ (16,500)**	**$ (16,500)**	**$ (16,500)**	**$ 11,726**	**$ 28,921**	**$ 30,521**	**$ 16,794**

IRR	**17%**
Cash Inflow	**$ 38,462**
Multiple of Capital Invested	**1.8x**

Assumptions

- Assumes that all funds are raised in Year 1.
- Management fee is reduced by 80 percent of the original amount (i.e., by $1.6 million) beginning with the first fiscal quarter commencing six years from the initial closing, and continuing each year for the balance of the fund's term.
- Assumes total fund is invested in all investee companies by the end of Year 3 and dollars are invested ratably over the three-year investment period.
- Assumes that investments will be exited as a percentage of the aggregate as follows: 16.67 percent in Year 4, 33.3 percent in Year 5, 33.3 percent in Year 6, and 16.67 percent in Year 7.
- Compensation to fund employees assumes competitive market rates.
- Assumes fund makes twelve investments and realizes a gross IRR of 32 percent.
- GP incentive fees realized as carried interest equal to 20 percent.
- Institution incentive fees realized as carried interest equal to 15 percent.

The table below illustrates the support for the fund gross IRR assumption of 32 percent.

Accelerator Fund 1 *(Assumptions for Gross IRR)*

Multiple	Number of Portfolio Companies Exited at Multiple	Gross Blended Return	Years	Invested/ Returned	Gross IRR
10.0x	1	0.7x	1/1/2010	(16,500)	32%
7.5x	1	0.5X	1/1/2011	(16,500)	
5.0x	2	0.7x	1/1/2012	(16,500)	
3.0x	2	0.4x	1/1/2013	21,725	
2.0x	2	0.3x	1/1/2014	43,450	
1.0x	2	0.1x	1/1/2015	43,450	
0.0x	5	0.0x	1/1/2016	21,725	
	15	2.6x			

References

1. Block, F. and Keller, M. July 2008. Where do innovations come from? Transformations in the U.S. National Innovation System, 1970-2006. The Information and Innovation Foundation 1-22.
2. Burrill, G. Steven. December 2007/January 2008. Dead meat. *The Journal of Life Sciences* 79-81.
3. Cuatrecasas, P. 2006. Drug discovery in jeopardy. *The Journal of Clinical Investigation* 116 (11): 2837-2842.
4. Cuatrecasas, P. 2009. Audience With. Drug discovery. *Nature Reviews* 8:446.
5. Gulbranson, Christine A., and David B. Audretsch. Jan. 2008. Proof of concept centers: Accelerating the commercialization of university innovation. Ewing Marion Kauffman Foundation, http://www.kauffman.org/uploadedFiles/POC_Centers_01242008.pdf.
6. Mintzberg, H. 1983. *Structure in fives: Designing effective organizations.* Prentice-Hall Inc.: 253-281.
7. Pisano, Gary P. 2006. Science business: The promise, the reality, and the future of biotech. *The Science-Based Business, A Novel Experiment.* Harvard Business School Press.
8. Saltzman, E. April 1, 2009. On a dime in very little time: Biotech's new value creation challenge. Lecture given at the Defined Health's Therapeutic Insight Conference, New York.
9. Senor, Dan, and Saul Singer. 2009. Start-up nation: *The story of Israel's economic miracle.* New York: Hachette Book Group.
10. *Symphony Capital LLC,* http://www.symphonycapital.com/index.htm (accessed January 14, 2010).

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A Third Seat at the Table:
An Insider's Perspective on Patient Representatives

BY DUANE ROTH

As the nation takes a fresh look at all aspects of medical care, advances in the health sciences—from genetic sequencing to stem cell technology—may give us opportunities to make health care better, faster, and more cost-effective. But first we must transform our approach to health care innovation, particularly in the regulation of new products that may signal clinical breakthroughs.

These issues intersect at the table where federal agencies, particularly the Food and Drug Administration, and innovative product development companies negotiate the regulatory approval process. At present, both parties are overly constrained. The agencies face too many "but what if?" disincentives: potential and unknown safety risks and the specter of adverse publicity. The sponsors are wary of investing time and resources in the absence of a defined regulatory pathway. Too often, inaction seems the safest course.

But for the people most directly impacted by disease, inaction is irresponsible, even unethical. Patients and their families have the greatest stake in the approval process. Their lives, and their quality of life, hang in the balance. They are in the best position to weigh actual risks and benefits. It is time to give patients, through carefully selected representatives, a seat at the regulatory approval table. If they serve as mediators, not just advisers, they can help regulators and companies identify new pathways for fostering innovation, building public trust, cutting costs, and addressing quality-of-life issues.

Three decades of experience demonstrate that informed and dedicated patient representatives can break through development impasses. And since 2005, designated "patient advocates" on the governing board of the California Institute for Regenerative Medicine (CIRM), which I have served on for the last four years, have shown that patients are uniquely qualified and motivated to help decide how medical products should be delivered responsibly and expeditiously.

Duane Roth, "A Third Seat at the Table: An Insider's Perspective on Patient Representatives," *Hastings Center Report* 41, no. 1 (2011): 29-31.

AIDS and the FDA Sea Change

The concept of the patient representative came to prominence in the 1980s AIDS epidemic, which galvanized patient communities to unprecedented levels of scientific and political involvement. In the San Francisco Bay Area, patient advocates organized their own studies of HIV/AIDS drugs with local doctors and volunteer subjects. They conferred with pharmaceutical manufacturers and exerted pressure on the FDA and the National Institutes of Health. Their efforts helped bring about a sea change in AIDS clinical trials and drug regulation. The FDA revamped its approval criteria, and community advisory boards began working with institutions that received NIH AIDS-related grants.

Starting in the 1990s, the FDA invited patient representatives to serve on advisory committees that review products for life-threatening diseases. But patient members typically occupy less than 10 percent of the slots on those committees, and they continually struggle to exert real influence on product decisions.

After the FDA approved the multiple sclerosis drug Tysabri in 2004, manufacturers withdrew it when some patients in clinical trials developed a rare brain disease. Prolonged efforts by MS patient groups helped bring about the 2006 FDA reintroduction of the drug and a new government-industry program to educate patients about risks. As John Richert of the National Multiple Sclerosis Society said, "We just have to learn . . . how to balance those risks and benefits for each individual person who needs to be treated for their MS."[1]

In 2007, an FDA advisory committee studying the prostate cancer drug Provenge endorsed its safety by a vote of seventeen to zero and its efficacy by a vote of thirteen to four. But the agency felt that it needed more data on safety and efficacy. Additional clinical studies resulted in several years of delay before approval was granted this past April. While the FDA may have been exercising due diligence in asking for further study, the delay caused an outcry from the national cancer patient community and was a key factor in the bipartisan introduction of the Access, Compassion, Care, and Ethics for Seriously Ill Patients (ACCESS) Act, legislation that is still pending in Congress.

The CIRM Experience

There is a longstanding ethical argument that patients afflicted with illnesses should be able to participate in the search for treatments and cures. I have gained new respect for that principle during my service on the CIRM governing board, known as the Independent Citizens' Oversight Com-

mittee, where I currently serve as its vice chairman representing industry.

The twenty-nine members of the ICOC are distinguished Californians who represent academic science, industry, and patients. The ICOC makes decisions about research funding, clinical applications of emerging products, and legislative proposals. The committee also is responsible for shepherding new projects to advance stem cell research. Ten ICOC members, in addition to the chair and vice chair—more than one-third of the total—are "patient advocates" who speak for ten major disease groups with a stake in stem cell science. They are respected leaders from diverse professions in the public and private sectors. They have had direct personal experience with life-threatening illness as patients, survivors, or caregivers. They have no allegiance to and they do not accept funding from any interest groups. As with all ICOC members, their formal charge from CIRM is to "represent the expertise and passion of the people of California."

In my estimation, the patient advocate members have a keen grasp of the issues the ICOC must decide, including governing polices and procedures, scientific data, and intellectual property rights. They are acutely aware that many basic biological mechanisms often yield useful information across a wide spectrum of diseases, and therefore, they often act in concert with advocates from other disease areas to explore common pathways for broader overall benefit. Perhaps most importantly, patient advocates understand and articulate better than anyone that seriously ill patients will accept risks associated with new products in exchange for benefits that might not happen immediately. As Jeff Sheehy, the ICOC patient advocate for HIV/AIDS, explained it in a recent conversation with me, "There may be high risks, and the reward may be far down the road. But in many diseases, that's critical, and for many patients, that's valuable."[2]

These representatives speak with authority about patients' experiences with existing therapies and their willingness to tolerate side effects from new therapies. "Those aren't always scientific decisions because they often aren't based on scientific evaluation," said Sheehy. "These are ultimately decisions that patients make in consultation with their families and their health care providers. And after patients and their families and providers are fully informed of the real or potential consequences, regulators should allow them the autonomy to make their own decisions."

And ICOC patient advocates bring trust and accountability to discussions of new products because they can raise questions about any aspect of development, including regulators' intransigence and companies' inflated claims. "We question the grants in a respectful way, and we almost always defer to the scientists," said Sherry Lansing, the ICOC patient advocate for cancer. "But because we are the face of the disease, we convey the urgency of getting products to clinical trials."

Since I joined the ICOC in 2006, I have seen numerous examples of how patient advocates clarify our deliberations and guide us to render judicious decisions. Two examples offer striking lessons in the unique value of patient mediators.

Intellectual Property Management

One of our first policy decisions for the ICOC involved management of the intellectual property derived from CIRM grants. This was assigned to an Intellectual Property Task Force, a subcommittee of the ICOC led by Ed Penhoet, a biochemist who had served as chief executive officer of a biotech company, Chiron Corporation, as dean of the University of California at Berkeley School of Public Health, and as president of the Gordon and Betty Moore Foundation. I was a member of his task force, which held more than twenty public meetings and seventeen rounds of public comment.

The California Stem Cell Research and Cures Initiative that established CIRM mandated an intellectual property policy that would achieve three goals: (1) assure that the state of California would benefit from patents, royalties, and licenses; (2) enable essential research to advance to product development without obstacles that might arise from IP agreements; and (3) disseminate scientific data and advanced knowledge through timely publications.

Public opinion ran the gamut. Some stakeholders, including consumer watchdog groups, favored high royalties and quick payback to the state. Others, including industry trade groups, wanted no payback at all, in keeping with the policy of the NIH. Some wanted CIRM to oversee the price of new products; others wanted CIRM to leave that completely open to the market. Publication and data sharing were supported by the scientific community and consumer groups but opposed by industry.

The ten-member IP Task Force included three patient advocate members. A reading of the task force meeting transcripts shows that, amid this swirl of perspectives, the patient advocates worked toward a compromise that would not have been reached by scientists and industry representatives alone. With a focus on the desire for access to new therapies, the patient advocates argued persuasively that such products would not come to market if industry had to face a low return on investment and poorly defined future obligations. With equal passion, they agreed with scientists and consumer groups, in the face of industry apprehension, that widespread and timely scientific data dissemination was imperative.

The resulting policy has been accepted by CIRM grantees, industry, and consumer groups, and it has even been praised by public policy watchdog groups. In a letter to Penhoet, John M. Simpson, stem cell project director for the Foundation for Taxpayer and Consumer Rights, hailed the IP task force as a "perfect model for soliciting and considering input from all stakeholders."[3]

"Biosimilars" and Exclusivity Periods

The second example of the value of patient mediators involves the Patient Protection and Affordable Care Act passed by Congress in January. A provision in the bill, the "Biologics Price Competition and Innovation Act," sought to

establish a regulatory pathway for generic biologicals, or "biosimilars," something the biotech industry has long opposed.

At an ICOC meeting, I suggested that CIRM should consider taking a position against this legislative provision. I argued that generic biologicals would create a disincentive for investment in early-stage, high-risk therapeutics including stem cells. At the time, there were two competing legislative proposals, one for a seven-year innovator product "market and data exclusivity" period, and the other for a twelve-year exclusivity period.

The initial discussion at the board meeting did not produce a consensus. Industry members either believed that all follow-on biosimilars should continue to provide a full battery of preclinical and clinical trial data prior to FDA approval, or they wanted a twelve-year exclusivity period before a competitive product could rely on the innovators' data for approval.

Scientist and patient advocate members all supported a pathway to biosimilars, but they were divided on implementation. Some favored the shorter exclusivity window; others, the longer. A few did not think CIRM should even be involved in the issue.

Eventually, the patient advocates tipped the scales in favor of the longer, twelve-year period. They concluded that the need for significant investment and the greater financial risk in unproven therapies outweighed the need for a shorter path for lower-cost "biosimilars." Their influence led the board to a unanimous decision in support of the twelve-year period.

Senator Dianne Feinstein, a member of the Senate Health Committee, followed up with a compelling letter that echoed the board's concerns and added her own support for the longer exclusivity period. The CIRM position has since been cited as a pivotal event in the debate leading up to the final 2010 health care legislation.

Moving Forward: A First Step

If patient representatives participate in negotiations as mediators, they can serve to balance risks and benefits and determine the appropriateness of any approval plan. Think of this approach as engineering out biases and building in trust. Patient mediators will be a catalyst for making real progress on urgently needed products. And perhaps most importantly, they will provide support for regulators and sponsors when unforeseen complications arise that could spark political pushback.

Traditional patient advocacy has been criticized as inherently biased because patients may be so desperate for cures that they will disregard most or all risks. The current system has safeguards to preclude such bias: individual patients and their doctors, institutional review boards at each clinical site, and the FDA Advisory Board at the national level. The CIRM model offers another safeguard: collaborative decisions that are made after open and vigorous debate. Patient advocates engage fully with scientists, consumer representatives, and industry leaders. Our board deliberations are made public. We are keenly aware that our primary stakeholders—Californians—scrutinize our work, and we welcome that scrutiny.

Patients and their families have the greatest stake in the approval process. Their lives hang in the balance. They are in the best position to weigh actual risks and benefits.

How to implement that? The FDA could take a first step by agreeing to a pilot project in which patient mediators would be invited into negotiations for a specific innovative new product. The patient mediators would be best represented as a team whose qualifications would include a direct relationship to the disease area either as a patient or as an immediate family caregiver. And collectively, team members would need knowledge of the regulatory process, statistical analysis, clinical development, and the manufacturing process.

If the FDA is unable to legally implement this process—or unwilling—patient mediators could be legislated into the process of new product regulation, with the FDA retaining final authority for the approval process.

The time is right and the stage has been set for a national model that incorporates patient mediators into the approval process. The costs would be negligible, and the payoffs in therapeutic efficacy, procedural efficiency, and public confidence could be enormous.

Acknowledgments

I would like to acknowledge the contributions of Kate Callen to this essay.

1. The National Multiple Sclerosis Society, *MS Learn Online: Tysabri, What You Need to Know, Part 1*, http://www.nationalmssociety.org/multimedia-library/webcasts--podcasts/tysabri/index.aspx.
2. All quotes from ICOC patient advocate members are from recent interviews with the author.
3. Letter cited in *The California Stem Cell Report*, September 25, 2006, http://californiastemcellreport.blogspot.com/2006/09/watchdog-group-praises-cirm-ip-task_25.html.

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Duane J. Roth is Chief Executive Officer and member of the Board of CONNECT. CONNECT is the globally recognized public benefits organization fostering entrepreneurship in the San Diego region by assisting new business formation of technology and life sciences companies. CONNECT has been directly involved with over 2,000 companies since its inception in 1985 and these companies have secured over $10 billion in funding.

Prior to joining CONNECT, Mr. Roth founded Alliance Pharmaceutical Corp., where he currently serves as Chairman of the Board. Prior to Alliance, he held senior management positions at Johnson & Johnson and American Home Products (now Pfizer) operating companies. He has served as a member of the Board of Directors and executive committees of the Biotechnology Industry Organization (BIO), the California Healthcare Institute (CHI) and BIOCOM (past Chair).

Mr. Roth was appointed to the Independent Citizens Oversight Committee for the California Institute of Regenerative Medicine (CIRM) in 2006 by Governor Arnold Schwarzenegger, and was elected Vice Chairman in 2009. He also serves as a member on the Governor's Commission for Jobs and Economic Growth. He is a member of the Board of Directors of SAIC-Frederick, Inc., the contractor to the National Cancer Institute.

Mr. Roth serves on a number of advisory committees and boards of the University of California, including the President's Board on Science and Innovation, the UC San Diego Sulpizio Cardiovascular Center (past Chair), the Skaggs School of Pharmacy and Pharmaceutical Sciences, the California Institute for Telecommunications and Information Technology (Calit2), the Health Sciences advisory board and the UC San Diego Foundation Board of Directors (past Chair). He also serves on the San Diego State University College of Business (past Chair) and the Sciences & Engineering advisory boards. Mr. Roth is a member of the Executive Board for the California State University (CSU) Professional Science Masters Program.

Mr. Roth is active in the San Diego community serving as co-Chair of the Affordable Housing Working Group, a member of the Advisory Council for Math for America, Chairman of the Founders Circle of the UC San Diego Preuss Charter School, and co-Chair of the advisory board to the National Conflict Resolution Center. Mr. Roth earned a B.S. from Iowa Wesleyan College, where he served as a trustee.

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DUANE J. ROTH

EMPLOYMENT HISTORY

CONNECT 2005 – present

- Chief Executive Officer and member of the Board of CONNECT**.** CONNECT is the globally recognized public benefits organization fostering entrepreneurship in the San Diego region by assisting new business formation of technology and life sciences companies. CONNECT has been directly involved with over 2,000 companies since its inception in 1985 and these companies have secured over $10 billion in funding. CONNECT promotes the commercialization of technology from basic research institutions in the San Diego region. CONNECT's programs include direct assistance to inventors, investment and promotion of innovation, community awareness, and innovation advocacy. Mr. Roth assumed leadership of CONNECT in 2005 and has grown the membership from 20 members to over 200, the operating budget from $500K to over $3M and the number of programs from five programs to over 25. In 2009, over 300 meetings and events have been held with attendance of over 10,000. The Springboard program graduates over one new company every week on average.

Alliance Pharmaceutical Corp. 1985 - present

- Chairman and Chief Executive Officer – merged Otisville Biotech, Inc. (Otisville, NY) and Fluoromed Pharmaceutical Corp. (San Diego, CA) to form Alliance Pharmaceutical Corp. in 1989
    - Key accomplishments – built company from a virtual organization to ~300 people, raised over $600M (approximately half from corporate partners and half from equity and debt) to fund technologies – developed four drug products and a medical device – two drugs and the device were FDA-approved and marketed in the imaging field (*Imagent*® for intravenous use as an ultrasound contrast agent, *Imagent*® *GI* for use as an oral contrast in MRI, and *Sat Pad*™, a device used to decrease tissue susceptibility with MRI imaging. *Oxygent*™ (blood substitute), achieved significance in the first of two Phase 3 studies: however, the second study was interrupted due to unexpected safety imbalance – as a result, Alliance had to be restructured and is currently developing *Oxygent* in China with its partner Double-Crane

American Home Products (now Pfizer) 1983 - 1985

- 1984-1985 - President Analytab Products and Sherwood Medical Products (~500 people in three locations)
    - Key accomplishments – developed and introduced automated systems for microbial identification and antibiotic susceptibility testing – increased profitability and top-line revenue by double digits each year
- 1983 - Senior Vice President – responsible for sales, marketing and technical services

Johnson & Johnson (Ortho Division) 1973 - 1983

- 1981-1983 - Director Worldwide Transfusion Products and Therapeutics Business Unit
    - Key accomplishments – built the business unit to over ~$100M in worldwide revenue; from 1979-1983 oversaw development and introduction of more than 20 FDA-approved products, including the first ever monoclonal antibody product in the U.S. – organized world leaders in Rh hemolytic disease of the newborn and developed new standard for administration of immunoglobulin therapy (*RhoGam*™)
- 1980 - Product Director Transfusion Products and Therapeutics
- 1979 - Product Manager Transfusion Products
- 1977-1978 - Division Sales Manager Southwest U.S. (Los Angeles, CA) – responsible for 10 sales territories
    - Key accomplishments – built division from worst-performing of 10 divisions in U.S. in 1976 to #1 division in 1977 and 1978
- 1974-1976 - Sales Representative Iowa Territory (Des Moines, IA)
    - Key accomplishments – built sales territory from bottom 10% in U.S. to top 10% in first year (1974) and then to #1 territory in 1975 and 1976

INDUSTRY AFFILIATIONS

BIOCOM

- Member Board of Directors and served two terms as Board Chairman – recruited and installed first full-time director, served as Chairman of CalBio Summit and of the Capital Formation Committees, honored as Life Director in 2008

Biotechnology Industry Organization (BIO) – Washington, DC

- Former member Board of Directors and Executive Committee; past Treasurer – served as Chairman of BIO 2001 international meeting in San Diego and as member of the Steering Committee for BIO 2004 in San Francisco and again in San Diego in 2008

California Healthcare Inc. (CHI)

- Founding Member and former member Board of Directors and Executive Committee – past Chairman of the Nominating Committee

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CORPORATE BOARDS (IN ADDITION TO ALLIANCE)

SAIC Frederick Inc., Frederick, MD contractor to the National Cancer Institute, a Federally Funded Research and Development Center

Deep Sky Software Inc., San Diego, CA. software program for Biotech/ Pharma to meet GMP compliance

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REGIONAL AND COMMUNITY AFFILIATIONS

CleanTECH San Diego

- Founder and Member Board of Directors – a non-profit organization formed to accelerate San Diego as a world leader in the clean technology economy

CALIT2

- Advisory Board member of the innovation institute (UCSD, UCI) for information technologies and telecommunications

Preuss Charter School at UCSD

- Member, Board of Directors; Founding Member and current Founders Circle Board Chairman – Chairman of fundraising Gala (November 2004)

Math for America

- Advisory Council for Math for America San Diego. Math for America San Diego is an educational consortium which provides comprehensive support for new math teachers (MfA Fellows) in the San Diego region. CSU San Marcos, SDSU, UCSD and five school districts constitute this consortium

SANDAG's Regional Housing Working Group

- Co-Chairman of San Diego Association of Governments 20-person community board to advise local government on affordable housing policy – members include advocates for the homeless, environmentalists and the building industry

San Diego Regional Chamber of Commerce

- Member Board of Directors – in the early 90s helped focus the Chamber on supporting the emerging San Diego technology clusters

San Diego Regional Economic Development Corp.

- Member Board of Directors (past Chairman) – helped lead the effort to focus EDC on rebuilding the San Diego economy from the early 90's recession by supporting the emerging technology clusters - served as

Chairman of the Partnership for the New Economy, a blueprint for focusing the region on the technology cluster issues

San Diego State University School of Business

- Member Advisory Board (past Chairman) – helped establish new joint MBA and science degrees to support biotechnology cluster in San Diego – recruited key board members from life science and business communities

UC San Diego Health Sciences Advisory Board

- Member Advisory Board – responsible for advising the Vice Chancellor for Health Sciences on programs and resources that will position UCSD to be in the top tier of health sciences programs in the United States (2008)

UC San Diego Foundation Board

- Member Board of Directors (past Chairman) – responsible for advising the Chancellor of the University on campus initiatives including fundraising activities, investment policy, audit and $1B capital campaign - served as the representative of the Foundation on search committee for UCSD Chancellor (2004)

UC San Diego Sulpizio Cardiovascular Center

- Founding Chairman Advisory Board and current member of the Board and Executive Committee – recruited donor of the lead gift of $10M and supported the Dean's initiative for $60M financing for construction of $90M facility recently approved by UC Regents

UC San Diego Institute of Engineering in Medicine

- Advisory Board member to combine the expertise of the Jacobs School of Engineering with the School of Medicine and the Skaggs School of Pharmacy and Pharmaceutical Sciences.

Skaggs School of Pharmacy and Pharmaceutical Sciences

- Member Board of Directors and industry advisor – helped bring industry support for Chancellor and UC President to establish new school to support the emerging biotechnology cluster

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STATE AFFILIATIONS

California Institute for Regenerative Medicine (CIRM)

- Appointed to 29-person Independent Citizens Oversight Committee (ICOC) by Governor Schwarzenegger as a representative for the biotechnology industry - CIRM was established in 2004 with the passage of the California Stem Cell Research and Cures Act - the institute is responsible for disbursing $3B in state funds for stem cell research to California universities and research institutions over the next 10 years and is overseen and governed by the Independent Citizens Oversight Committee. In 2009 he was elected as Vice Chair of the Board.

California Commission for Jobs and Economic Growth

- Appointed by Governor Schwarzenegger as the representative for the biotechnology industry – mission is to recommend polices and initiatives that will eliminate unnecessary and duplicative regulation and to develop incentives to promote growth to revive and strengthen the California economy

UC Office of the President's Board on Science and Innovation

- Advisory Board Member of general oversight group responsible for advising the President of UC on the four California Innovation Institutes (QB3, CALIT2 CNSI, CITRIS) – the Institutes were established in 2002 with over $1B committed in state and private funding to expand research and assist in transferring technology to the private sector – lobbied the State Legislature for operating budgets

California State University Professional Science Master's Programs

- Executive Board Member to advise the nationally recognized innovative master's degree through which professionals are afforded the science and business skills needed in today's workforce

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POLITICAL AFFILIATIONS

Lincoln Club of San Diego

- Past Chairman of the Board of Republican business leader's organization – led initiative to focus the membership exclusively on education and economic policy – this change has resulted in adding approximately 200 new members in the past two years and raising over $500K to support endorsed candidates from school board to local, state and federal legislators.

Proposition 211

- San Diego Chairman of the statewide business coalition for the defeat of the security trial lawyers' initiative to make it easier to sue public companies on behalf of shareholders – raised ~$4M of the statewide $42M to support the campaign – served as the spokesperson in San Diego, including debating the principal trial lawyer (William Lerach) behind the initiative – initiative polled 80% approval when it qualified for the ballot and was defeated by over 70% of the voters

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OTHER AFFILIATIONS

Iowa Wesleyan College

- Past Trustee and past Chairman of the Development Committee

US Council on Competitiveness

- Served on the Executive Committee chaired by Michael Porter of Harvard Business School to map the innovation clusters in the U.S. – Co-Chairman of national meeting held in San Diego where findings were presented

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CHARITABLE AFFILIATIONS

American Heart Association

- Served as Chairman of the American Heart Walk for three years and as Chairman of the Annual Gala

Children's Hospital

- Served as Chairman of the Annual Miracle Maker's Gala

Scripps Health Employee Advisory Panel

- Served on Advisory Panel representing biomedical industry

Sharp HealthCare Community Board

- Served on Advisory Board representing biomedical industry

AWARDS

- **LEADERSHIP VOLUNTEER OF THE YEAR** – American Heart Association
- **ECONOMIC OPPORTUNITY VISIONARY AWARD** – LEAD San Diego
- **LIFETIME ACHIEVEMENT AWARD** – San Diego's Most Admired CEOs
- **PUBLIC SERVICE AWARD –** Sidney Kimmel Cancer Center
- **SERVICE TO THE BIOTECHNOLOGY COMMUNITY AWARD** – PriceWaterhouseCoopers
- **JAMES MCGRAW DISTINGUISHED CONTRIBUTION AWARD** – BIOCOM
- **MAKING A DIFFERENCE AWARD** – Citizens Against Lawsuit Abuse
- **AT&T INTERNATIONAL LEADERSHIP AWARD** – World Trade Center San Diego
- **OUTSTANDING LEADERSHIP AWARD** – American Heart Association
- **HERB KLEIN CIVIC ENTREPRENEUR AWARD** – SD Regional Economic Development Corp.

SHARED AWARDS WITH TED ROTH (BROTHER)

- **HALL OF FAME LIFETIME LAUREATE** – Junior Achievement
- **MS HUMANITARIAN AWARD** – MS Society
- **DIRECTOR OF THE YEAR FOR CORPORATE CITIZENSHIP –** Corporate Directors Forum
- **CIVIC TRIBUTE HONOREE –** Copley YMCA
- **PUBLIC SERVICE ACHIEVEMENT AWARD –** SDSU Ambassadors for Higher Education

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EDUCATION

Iowa Wesleyan College – Bachelor of Science Degree 1972

Post Graduate Courses/Certificate Programs

- Rutgers University – FDA regulatory affairs/principles of accounting
- Columbia Business School – "Arden House" executive business course
- Wharton Business School – financial management

Committee on Oversight and Government Reform
Witness Disclosure Requirement – "Truth in Testimony"
Required by House Rule XI, Clause 2(g)(5)

Name:

1. Please list any federal grants or contracts (including subgrants or subcontracts) you have received since October 1, 2008. Include the source and amount of each grant or contract.

I have not received any federal grants or contracts since October 1, 2008.

2. Please list any entity you are testifying on behalf of and briefly describe your relationship with these entities.

I will be testifying on behalf of CONNECT. I am the Chief Executive Officer of CONNECT.

3. Please list any federal grants or contracts (including subgrants or subcontracts) received since October 1, 2008, by the entity(ies) you listed above. Include the source and amount of each grant or contract.

September 20, 2010 - CONNECT is a subcontractor for the grant awarded by the Small Business Administration entitled "Advanced Defense Technologies (ADT) Clusters - Autonomous Systems and Cyber Security" (SBAHQ-10-C-0024). San Diego State University was the primary awardee of this grant. CONNECT was awarded $50,000 as a subcontractor for this grant.

I certify that the above information is true and correct.

Signature: [signature]

Date: April 15, 2011