

Wisconsin's Stem Cell Climate in 2008: Public Sector Support from the Laboratory to the Global Marketplace

The supportive environment for stem cell research in Wisconsin has been critical in helping this new research flourish and further develop. By fostering a climate in which stem cell research is encouraged and supported, Wisconsin has established itself firmly among the worldwide leaders in stem cell science, and the benefits of this research to people at home and abroad can only be expected to grow and multiply over time. Governor Jim Doyle knows that stem cell research holds the promise to save lives and improve the outlook for those suffering from debilitating diseases, while also stimulating economic activity and creating significant numbers of jobs. Time and again, the Governor has used his position to encourage support for stem cell research in Wisconsin and nationally, even when other actors in the political community in Wisconsin have attempted to impede the progress of this research, and has constantly lobbied the public and Legislature to nurture this important new industry in Wisconsin.

To keep our state at the pinnacle of ground-breaking research and new life-saving innovations, Governor Doyle has outlined an ambitious but achievable goal to capture 10 percent of the national stem cell market by 2015.

To meet this goal, we are working to harness talent and innovation from every corner of the state. Key partners in the public and private sectors, such as the University of Wisconsin's researchers, University Research Park, the Wisconsin Alumni Research Foundation, WiCell Research Institute, patient advocate groups, and the many private businesses that work in the stem cell area are working with state government to continue to blaze the future of stem cells and biotechnology. The work we do in our state represents the next frontier of hope for patients and the next generation of business for Wisconsin. The state's goal is to use these vital stem cell technologies to better the lives of citizens both within our state and worldwide.

From the Laboratory

Since Dr. James Thomson's groundbreaking work to isolate and culture human embryonic stem cells in a UW-Madison laboratory in 1998, the field of human embryonic stem cell research has grown dramatically. Since that first discovery, with the support of state government, the work and investment at our public universities has resulted in scientific leadership in the field of stem cell science. Institutions such as the University Research Park, WiCell Research Institute, UW-Madison Stem Cell and Regenerative Medicine Center, and WARF all contribute to the success of stem cell research in Wisconsin. For instance, with approximately 120 affiliated scientists working on stem cell research projects today, the nonprofit WiCell Research Institute has facilitated efforts to attract more than \$38 million in federal research funding and other contracts to Wisconsin since publication of Thomson's initial discovery in 1998. Consistent with its mission to expand the frontiers of science and medicine by unlocking the potential of stem cells, WiCell also provides training to help stem cell researchers from around the world. WiCell's in-depth courses provide detailed, hands-on instruction in human embryonic stem cell culture methods and the first steps toward differentiation. Through 2006-2007, the estimated value of training that has accrued to the Wisconsin knowledge base as a result of the WiCell course offerings totals \$940,000, according to estimates developed by NorthStar Economics of Madison. As part of a significant effort to nurture and expand Wisconsin's scientific knowledge base and technical skill capacity, UW-Madison's Stem Cell and Regenerative Medicine Center and WiCell also engage in educational and outreach programs with K-12 public schools statewide.

The technologies developed at UW-Madison and patented through WARF range from novel laboratory tools and methods to medical therapies. The investment in human embryonic stem cell research at UW-Madison has resulted in a significant number of patents related to human embryonic stem cell lines with 36 technologies available for licensing. To date, development of Wisconsin's intellectual property portfolio related to human embryonic stem cells has resulted in 31 commercial licensing agreements and numerous academic licensing agreements.

The success of our researchers and the value they provide through outreach and training is paying dividends for our state's economy. According to a research study by NorthStar Economics, the overall annual economic impact of human embryonic stem cell research and commercial activity in 2006-2007 was \$44.5 million. This economic impact was generated from research activities at UW Madison and the commercial activity and research of a number of stem cell start-up companies. In addition to the overall economic impact, stem cell research and commercial activity created hundreds of high paying jobs throughout the state.

Wisconsin Governor Jim Doyle has been the driving force behind the Wisconsin Institutes for Discovery, a public-private partnership that is truly a role model for innovations in 21st century scientific endeavors. He made this facility possible by committing \$50 million of state funds to the project and led the effort to secure the necessary legislative support. The \$150 million Institutes for Discovery, slated to open in 2010, will bring together our best researchers to collaborate and create commercially viable new applications for their discoveries. The Institutes will create the potential for a fundamental transformation of human biology and medicine, and will foster new approaches to biological and medical problems at the convergence of biology, information technology and engineering. The facility will be the only one of its kind in the midwest region. Already, Dr. Thomson has agreed to join the private side of the institutes, the Morgridge Institute for Research, and will move his research team to this remarkable new lab space within the unique state-of-the-art facility. The resources of this facility will allow Dr. Thomson to continue his international leadership in stem cell research.

To the Global Marketplace

To advance Wisconsin's stem cell discoveries from our universities' laboratories to the marketplace, our state has developed essential partnerships with private companies that have the expertise and the resources to transform ideas into products the public will purchase. In an effort to further support entrepreneurs eager to tackle this difficult challenge of commercializing medical treatments and other stem cell technologies, the Governor has made it a priority to provide every stem cell start-up company in Wisconsin with state grants and loans. In addition, the State launched the Grow Wisconsin plan, which provides tax incentives for angel and venture capital investors that invest in Wisconsin start-ups.

Much of the commercialization of UW-Madison's pioneering stem cell research is happening at the University Research Park near the University of Wisconsin - Madison. The Research Park, a community of science and technology companies started 25 years ago, accommodates enterprises spun off from the University's world-class research, attracting companies with an interest in collaborating with our researchers and highly trained graduates. The Park has over 100 companies in 36 buildings, 1.5 million square feet and 4,000 employees.

Stem cell companies formed by university researchers are emerging as a dominate cluster in the Park. Professors Jamie Thomson and Gabriella Cezar, two of Forbes Magazines Top 12 Stem Cell Revolutionaries (May 2008), have rapidly growing companies in the Park. Thomson, along with Professors Craig January and Tim Kamp, started Cellular Dynamics International, which is involved in cardiac drug toxicity testing using both accepted hERG cellular models and human cardiomyocytes derived from hES cells. Thomson and Professor Igor Slukvin formed a second company, Stem Cell Products, to manufacture safe, therapeutic cellular blood products on a large scale. Cezar formed Stemina BioMarker Discovery to discover and validate small molecules as biomarkers for high-throughput drug screening and disease diagnostics.

Not only does the Research Park house stem cell companies, but it also houses organizations supporting stem cell research and commercialization around the world, such as the WiCell Research Institute and the National Stem Cell Bank. The Research Park also attracts and supports companies providing services to

this new cluster. For instance, CellCura, a Norwegian company that located in the Park to collaborate with Madison's leading researchers, develops novel equipment and products for use in Assisted Reproductive Technology (ART) and stem cell research. Another company, Cell Line Genetics, provides end-to-end quality assurance, including characterization, authentication, genotyping and custom products and services focusing on multi-species ES Cell and Cancer Cell Lines.

In addition, Wisconsin's University Research Park collaborates with the major political and business interests in the state to ensure that Wisconsin remains supportive of stem cell research and commercialization. The Wisconsin Technology Council, the science and technology advisory body to the Governor and the Legislature, and the Wisconsin Biotechnology and Medical Device Association, a business association of science and technology companies, are located in the Park; both these groups and Research Park Director Mark Bugher regularly consult with Governor Jim Doyle and other state policy makers on programs and policies that support our universities' world-class research and Wisconsin's attractiveness for science and technology commercialization.

As a result of this close collaboration and to encourage further commercialization of stem cell research, Governor Doyle and the State of Wisconsin have secured targeted assistance for companies like Stemina and Cellular Dynamics, and the Governor has led the way in improving the business climate for early stage science and technology companies with his initiatives designed to encourage investment through Wisconsin's tax structure. With Governor Doyle's leadership, the University of Wisconsin-Madison has evolved into a powerhouse for entrepreneurial activity and technology transfer that contributes to the economic development story here in Wisconsin.

The statewide economic success of the Governor's investments is unmistakable. The five start-up companies that had licensed stem cells and other intellectual property from WARF had an economic impact of \$17.8 million from payroll, capital investment and operating expenditures over the past five years. More recently, a sixth company has licensed human embryonic stem cell technology from WARF and established operations in Dane County, which will only increase the impact of our investments.

Wisconsin-based research using human embryonic stem cells has produced a significant amount of intellectual property, including 36 technologies available for licensing. The worldwide impact can be seen on two major fronts including the geographic distribution and the number of cell shipments that come from Wisconsin. WiCell, and the National Stem Cell Bank it operates, have fulfilled requests from around the world for more more than 1,000 licenses for human embryonic stem cells, providing licenses to researchers in 32 countries and 42 states. WiCell and its affiliates also have shipped more than 500 bottles of a culture medium designed to sustain colonies of human embryonic stem cells and provided training on human embryonic stem cell culture methods to some 583 participants. In addition, as part of its commitment to stimulate human embryonic stem cell research worldwide, WiCell provides cell lines to other academic researchers on a cost recovery-only basis. Academic scientists using these cell lines and methodologies face no restrictions on patenting or publishing their own novel work unless they move into specific areas of commercialization.

Conclusion

From making discoveries to creating jobs, Wisconsin's achievements in stem cell science place the state firmly among the worldwide leaders in the field. At this pivotal time, the leadership of scientists, patient advocates, and government officials has never been more important. Therefore, true to the innovative spirit and intellectual tradition that helped launch this field, Wisconsin's leaders in research, business, advocacy and government remain committed to forging the collaborative partnerships and interdisciplinary programs that will yield benefits for people everywhere.