UNIQUE
UN I Q U E

(ju′nīk) A. adj. 1. Of which there is only one; one and no other; single, sole, solitary.

2. a. That is or forms the only one of its kind; having no like or equal; standing alone in comparison with others, freq. by reason of superior excellence; unequalled, unparalleled, unrivalled.

Oxford English Dictionary
HSCI is a unique scientific enterprise

The Harvard Stem Cell Institute is a unique scientific enterprise; nowhere else in the world are as many leading scientists gathered together to specifically focus on what today is one of the most important basic questions in the life sciences:

What is the property that allows stem cells not only to differentiate into any cell type in the body, but also makes it possible for them to reprogram other cells?

And perhaps as significant, the Harvard Stem Cell Institute is a unique scientific enterprise because it is dedicated to bringing the answers to these questions to patients’ bedside in the form of new treatments for conditions such as Parkinson’s disease, heart disease, cancer, blindness, and even dementia.
E.O. Wilson

Just as the 20th century was the century of the gene, so the 21st century promises to be the century of the cell. By focusing on development and disease at the cellular level, we have a real chance at unraveling the mystery of degenerative conditions such as Parkinson’s disease, Alzheimer’s disease, diabetes, and cancer, and other heretofore incurable conditions that revolve not just a few genes. And to paraphrase E.O. Wilson, the new field of stem cell science offers such immense promise because in their embryonic form, these cells can be transformed into every other cell type in the body. Thus the 21st century promises to be the century of the cell and the imaginable unknown. For the first time, the really important questions are asked in a form that can be answered — E.O. Wilson

Researchers believe that in as little a decade it may be possible to use embryonic stem cells to replace damaged nerve cells in the brains of patients with Parkinson’s and Alzheimer’s diseases, replace missing insulin-producing cells in diabetics, and replace damaged heart cells in patients with cardiovascular disease — and the list of potential uses goes on and on. These projections are not all theory; stem cell transplantation has already proven tremendously successful, as any researcher who has had a successful bone marrow transplant for leukemia knows. But to fulfill the promise of stem cell science, we first must learn how to direct stem cells to become specific cells, or heart muscle cells, or neural cells, or neurons. What makes HSCI’s search for these answers unique is that it is focused not only on stem cell science per se, but also on all the areas of basic biology, including normal development and disease progression. While the laboratories of HSCI are already at the forefront of stem cell research, rather than support stem cell investigators to work independently, HSCI has established collaborative platforms with other Harvard scientists, bringing together experts from multiple disciplines and areas of research to focus on one goal. Advancing the science to the point where the break-throughs in basic stem cell biology can be turned into treatments and cures for presently intractable diseases and conditions. Thus it is no coincidence that Douglas Melton and David Sabatini are HSCI’s scientific directors. Melton is a developmental biologist; Sabatini is a physician scientist who treats cancer patients. Building research programs around groups of related diseases (blood disease, cancer, cardiovascular disease, diabetes, and nervous system disease) pools the knowledge and resources across HSCI and all of Harvard University and its affiliated hospitals. From this basic function of stem cells in the progression of diseases (blood disease, cancer, cardiovascular disease, diabetes, and nervous system disease) pools the knowledge and resources across HSCI and all of Harvard University and its affiliated hospitals. At this early stage in HSCI’s evolution, 70 faculty members are already actively involved in the work of the institute. With two very generous donations in hand, HSCI has established two major disease programs, the Cancer Stem Cell Program and The Howard and Stella Heffron Diabetes/Embryonic Stem Cell Program. Both seek complex questions about the basic functions of stem cells in the progression of cancer and diabetes. One part of the Heffron Program, in Douglas Melton and Kevin Eggan’s laboratory, is using somatic cell nuclear transfer (SCNT) to create human embryonic stem cell lines that carry specific disease genes, such as, Parkinson’s, diabetes, and Alzheimer’s. Working with collaborator Maria Cardoso, at Harvard’s University’s Dana Farber Cancer Institute, for instance, HSCI investigators will obtain skin biopsies from patients with diabetes. The genetic information contained in the nucleus of a skin cell will be injected into an unfertilized egg cell, whose own genetic material has been removed. The engraftment of the skin cell nurtures the skin cell DNA to react its biological clock to an embryonic stage. From this beginning, a human-embryonic stem-cell line that carries a specific disease can be created. Such work will provide stem cell researchers with valuable new material with which they can study human diseases using a human model.

In 2005 HSCI provided its first dozen seed grants, totaling $1.8 million, to launch innovative work by researchers at six different Harvard institutions and affiliates, in nine different areas of stem cell research. These grants were awarded to Kevin Eggan, in the Faculty of Arts and Science; Alan Davidson, Nita Agnihotri, Joanne Lu, and Nabeel Bardeesy, at Massachusetts General Hospital; Amy Wagers and Rohit Kulkarni, at Joslin Diabetes Center; M. William Jensch, at Children’s Hospital Boston, Hanna Mikolas, at Dana Farber Cancer Institute; Drag Mitchell, at Harvard Medical School; Rosario Sancho Pardo, at McLean Hospital; and Fang Deng Chen, at Scheperiu Eye Research Institute.

Also, the institute has begun establishing core facilities that will be shared among all its affiliated laboratories; stem cell research requires access to cutting-edge technologies that are financially out of reach for many any individual laboratory. Initial plans call for the establishment of three such facilities that will allow researchers “intoxicated with a mix of the newly discovered and the imaginable unknown” will make the swiftest progress possible towards understanding human development and degenerative disease, and ultimately, the development of therapies and cures.

Your name

May 2006
HSCI is a unique community

The Harvard Stem Cell Institute is an integral part of Harvard University, which means that it is far more than just a community of the world’s leaders in stem cell science. HSCI is also a community whose leadership and membership includes cutting-edge academics and practitioners in the fields of ethics, theology, business, government, and politics; it is a community of leaders in translational and clinical medicine. And it is a community of students who are future leaders in these fields. Because of the breadth, depth, and integration of its community, HSCI is, to quote the Oxford English Dictionary, “unequalled, unparalleled, unrivalled.”
The breadth and depth of HSCI positioned it to be able to cogently present the case for stem cell research to their colleagues in other research areas, and summary that feature stem cell scientists from outside the HSCI community. Already, the institute has featured talks by, among others, Anthony Atala, of Wake Forest University; Elaine Fuchs, of Rockefeller University; Janet Rossant, of Mt. Sinai Hospital, in Toronto; and Freda Miller, of The Hospital for Sick Children, also in Toronto. One of the most important scientific features of the HSCI community is its inclusion of world-renowned scientists who are not specifically focused on stem cell science, but rather are asking questions about basic human development and the progression of the diseases that stem cell scientists hope to someday eliminate. Experts in the biology of vision, hearing, cardiac function, cancer, neurodegenerative diseases, insulin production – in fact, in the biological formation and function of every human organ system – are collaborating with stem cell scientists to better understand both normal function and diseases. Further, all of these scientists are collaborating with patients with diseases and conditions ranging from cancer to Alzheimer’s to diabetes to ALS to spinal cord injuries to blindness to heart failure.

In collaboration with Harvard’s Humanities Center, HSCI is sponsoring a program titled “Between Two Cultures.” Chaired by Michael Sandel, a professor of government who directs the HSCI program on ethics, “Between Two Cultures” centers on a series of discussions designed to explore the ethical and social aspects of scientific advances. The first of these discussions featured Leon Kass, former director of the President’s Council on Bioethics, and proponent of limiting embryonic stem cell research. In introducing the event, Harvard Provost Steven Hyman put in sharp perspective the value of HSCI’s uniquely multifaceted community. The ethical issues that have been raised by stem cell research, he said, are “just the tip of the iceberg” of important social and ethical questions related to scientific advances. “Ultimately, these are questions about our very humanity,” Hyman said.

Because the HSCI community is so uniquely intellectually diverse, it is able to grapple with scientific and nonscientific issues alike, and is able to meaningfully participate in the ways in which stem cell research will be conducted, and the uses to which its findings will be put.
HSCI is a unique educational endeavor

The Harvard Stem Cell Institute is not just a scientific institute, nor is it simply a community, a collaboration of scientists, clinicians, and thought leaders in all the fields related to stem cell research, the deep questions it raises, and the societal and medical issues that touch upon it. HSCI is also a unique educational endeavor that involves Harvard students at every level—and members of the greater world community—in this challenging effort.
HSCI is a unique educational endeavor, built around scientific seminars and educational events designed to further knowledge of stem cell science and provide thoughtful consideration of the perplexing scientific, ethical, and social policy questions raised by this research. Under the umbrella of Harvard University, members of the HSCI community serve as educators, mentors, and advisers to under- graduates, graduate students, postdoctoral fellows, and scholars in other fields interested in stem cell research. HSCI encourages and seeks to answer demanding questions, whether about basic and applied biology, stem cell law, or the potential impact of scientific research on health care and society as a whole.

How can such a large community – with almost 800 scientists, students, policymakers, faculty, ethicists, and technical personnel – successfully create an educational environment that will meet the needs of this diverse group? In today's highly competitive environment, how can prospective students, staff, and postdoctoral applicants be best educated to carry this complex science forward? What are the best methods for engaging the public and contribute to critical thinking about stem cell science?

The Harvard Stem Cell Institute is responding to these challenges with undergraduate and graduate courses, inter-lab meetings, scientific symposia, internships, and ethics discussion series:

- By the fall of 2005, HSCI faculty at Harvard Medical School, Harvard College, and the Harvard Extension School were teaching 18 separate undergraduate and graduate-level courses related to stem cell research in subjects ranging from the biological sciences to history to ethics and society.

- The inter-lab meeting series is a less formal, but extremely intense teaching tool. These bimonthly gatherings bring together HSCI members and other interested scientists to focus on the work of junior investigators, postdoctoral fellows and graduate students, and newly appointed faculty. These inter-lab meetings highlight shared scientific problems and commonality, and generate discussion between researchers with widely varied areas of interest.

- To maintain vital connections with the stem cell research community beyond Boston, HSCI and the Massachusetts General Hospital Center for Regenerative Medicine hold a monthly seminar series featuring guest speakers from around the world. It is a testament to the intellectual and scientific power of HSCI that scientists with limited time available are eager to share their work in this series.

- HSCI also hosts the annual Tony & Shelly Malkin Stem Cell Symposium at the Harvard Club of Boston. This scientific symposium attracts many of the world’s leading stem cell scientists, developmental biologists, and tissue engineers, all of whom share HSCI’s vision and passion for the future of stem cell research. A centerpiece of this symposium is a dinner presentation chosen to inform scientists about some non-scientific areas as business modeling, commercialization of stem cell science, and bioethical issues related to the science.

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- To encourage students to consider work in the field of stem cell science, HSCI established the Undergraduate Summer Research Internship Program, which in 2005 gave 26 of the 70 Harvard students who applied the opportunity of summer full-time work in HSCI labs. The program includes a seminar series that introduces the students to topics ranging from ethical issues surrounding stem cell research to the policy implications of this research. At the end of the 10-week program, each student presents his or her research results at a scientific conference.

- In seminars, lectures, and informal discussions, HSCI scientists and their colleagues in law, the social sciences, government, and ethics must share ideas and deepen their understanding of the ways in which this new science is impacting society. For example, HSCI co-sponsors the seminar series with the Humanities Center. And since 2004, scientists have been gathering regularly under the sponsorship of George Q. Daley’s laboratory for a series of discussions about the ethical and societal issues related to stem cell research. This dialogue, led by Harvard Medical School faculty, is providing young scientists with a framework within which to consider the ethical and philosophical implications of their own work.
The Harvard Stem Cell Institute provides donors with an opportunity to invest in the most important scientific and medical quest of the 21st century. If we are to succeed in fulfilling the promise of this challenging new science, we will need the support of private individuals and foundations as excited by the possibilities and future of stem cell science as the researchers working in the laboratories. If we are to eliminate from our grandchildren’s vocabularies the names of many of the diseases that today resist medical treatment, we will need individuals to fill the fiscal gap left by a government that views science through a political lens. And that indeed provides a unique philanthropic opportunity.
Stem cells have the ability to become every other human development, both normal and abnormal. Researchers a unique window into all aspects of potential arises because stem cell science is giving host of degenerative diseases and conditions. This may ultimately help people suffering from a whole area of medical treatment, it is, unfortunately, almost every advance in one area of stem cell disease being funded.

Medical and life science philanthropy has traditionally been disease directed, driven by what might be personal stories or life experience. People have chosen to donate to cancer centers, or hospitals known for their cardiac programs, or institutes mentioned in newspaper articles about stem cell research, Jesse Furman is already familiar with the devestation wrought by degenerative diseases: a grandparent has diabetes and an uncle has battled Parkinson’s disease. At 13, Jesse Furman is already familiar with the devastotion wrought by degenerative diseases: a grandparent has diabetes and an uncle has battled Parkinson’s disease. This kind of cell in the body; therefore, understanding how they differentiate and how that differentiation may go away provides information that may lead to treatments for numerous diseases. Thus a gift to fund stem cell research in the area of Parkinson’s disease may also advance attempts to control dementias; a gift underwriting stem cells and cancer research may advance understanding and treatment of heart disease.

Medical and life science philanthropy has traditionally been disease directed, driven by what might be personal stories or life experience. People have chosen to donate to cancer centers, or hospitals known for their cardiac programs, or institutes known for their cardiac programs, or institutes for some fourteen years. “If I magnify my own personal experiences with friends and family and apply them to people around the country,” he says, “I couldn’t think of a better cause to support. I also couldn’t think of a better place than Harvard with its myriad first rate research resources.” One reason he feels this way, he says, is the presence of Harvard’s Scientific Directors Douglas Melton and David Scadden. “I’ve been to Melton’s lab, met some of Scadden. “I’ve been to Melton’s lab, met some of

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Recently, Jesse also suggested that his school consider supporting stem cell research when the students were trying to decide where to give money they had raised. School administrators rejected his idea because it was too controversial. “It really bothers me,” he says about the decision. “I think this is a great way to help people.” Ruthe B. Cowl Rehabilitation Center recently decided that she wanted to become involved in helping to realize the promise of stem cell science, and she asked the computer about strong programs in stem cell research. After reviewing the information she found on the Internet, Mrs. Cowl chose to support the research of HSCI, because she believes the work being done at the institute will eventually lead to new ways to approach paralysis, Parkinson’s disease, and diabetes.

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May 2004   Dor V, Melton DA, et al. Nature. Adult pancreatic beta-cells are formed by self-duplication rather than stem cell differentiation 
June 2004   Ogawa K, Vacanti JP, et al. Transplantation. The generation of functionally differentiated, three-dimensional hepatic tissue from two-dimensional sheets of progenitor small hepatocytes and non-parenchymal cells 
July 2004   Anneren C, Cowan CA, Melton DA. J Biol Chem. The Src family of tyrosine kinases is important for embryonic stem cell self-renewal 
Sandel MJ. N Engl J Med. Embryo ethics—the moral logic of stem-cell research 
Chen J, Macklis JD, et al. Proc Natl Acad Sci USA. Neurogenesis of corticospinal motor neurons extending spinal projections in adult mice 
Renaud EJ, Donahoe PK, et al. Proc Natl Acad Sci USA. Endometrial cancer is a receptor-mediated target for Mullerian Inhibiting Substance 
Dor V, Melton DA, et al. Nature. Embryo ethics—the moral logic of stem-cell research
Selected publications

T. Keith Blackwell Joslin Diabetes Center
Susan Bonner-Weir Joslin Diabetes Center
Joseph Bonventre Brigham and Women’s Hospital
Constance Cepko Harvard Medical School
Kenneth Chien Massachusetts General Hospital
George Daley Children’s Hospital Boston
Alan Davidson Massachusetts General Hospital
Patricia Donahoe Massachusetts General Hospital
Kevin Eggan Harvard Univ. Molecular & Cell Biology Dept.
Niels Geijsen Massachusetts General Hospital
Gary Gilliland Brigham & Women’s Hospital
Konrad Hochedlinger Massachusetts General Hospital
Daniel Kunkel Children’s Hospital Boston
Thomas Kupper Brigham & Women’s Hospital
Jeffrey Kreidberg Children’s Hospital Boston
Louis Kunkel Children’s Hospital Boston
Thomas Kupper Brigham & Women’s Hospital
Diane Mathis Joslin Diabetes Center
Andrew McMahon Harvard Univ., Molecular & Cell Biology Dept.
Richard Mulligan Harvard Institutes of Medicine
Bjorn Olson Harvard School of Dental Medicine
Stuart Orkin Dana Farber Cancer Institute
Daniel Podolsky Massachusetts General Hospital
Jerome Ritz Dana Farber Cancer Institute
Anthony Rosenzweig Massachusetts General Hospital
Michael Sandel Harvard Univ., Dept. of Government
David Scadden* Massachusetts General Hospital
Leslie Silberstein Children’s Hospital Boston
Daniel Tenen Beth Israel Deaconess Medical Center
Jay Vacanti Massachusetts General Hospital
Amy Wagers Joslin Diabetes Center
Christopher Walsh Beth Israel Deaconess Medical Center
Gordon Weir Joslin Diabetes Center
Ralph Weissleder Massachusetts General Hospital
Leonard Zon Children’s Hospital Boston

* Scientific Directors

principal faculty of HSCI

Emsley JG, Macklis JD, et al. Prog Neurobiol. Adult neurogenesis and repair of the adult CNS with neural progenitors, precursors, and stem cells


Honczarenko M, Silverstein LE, et al. Stem Cells. Human bone marrow stromal cells express a distinct set of biologically functional chemokine receptors


Burns SJ, Zen Li, et al. Genes Dev. Hematopoietic stem cell fate is established by the Notch-Run pathway

November 2005. Duffield JS, Bonventre JV, Kinking KH. Kidney tubular epithelium is restored without replacement with bone marrow-derived cells during repair after ischemic injury

Clark RA, Kupper TS, et al. J Clin Invest. Human skin cells support thymus-independent T cell development

potent hematopoietic reconstitution

selected publications
Harvard Stem Cell Institute Launch Symposium, April 2004

Morning Session “Harvard, Stem Cells, and the Public Lens”
Lawrence H. Summers, President, Harvard University
Douglas A. Melton, Harvard University
David T. Sabatini, Massachusetts General Hospital
Michael J. Sandel, Harvard University
Debora L. Spar, Harvard Business School

Afternoon Session “Stem Cell Science: into the 21st Century”
Thomas Jessell, Columbia University
Rudolf Jaenisch, Whitehead Institute for Biomedical Research, MIT
Alain Fischer, Necker Hospital, Paris
Fred H. Gage, The Salk Institute, La Jolla, California

First Annual Tony and Shelly Malkin Stem Cell Symposium, November 2004
“Stem Cells and Their Microenvironment in Development and Disease”
Robert Weinberg, Whitehead Institute for Biomedical Research, MIT
Rakesh Jain, Harvard Medical School
Linheng Li, Stevens Institute, Kansas City
Mark Kessel, Children’s Hospital Boston
Alan Spradling, Carnegie Institution of Washington, Baltimore
Azim Surani, Wellcome Trust/Cancer Research Institute, University of Cambridge, UK
Susan Crockin, Massachusetts attorney specializing in reproductive technologies

Second Annual Tony and Shelly Malkin Stem Cell Symposium, December 2005
“Stem Cell Biology and Therapy in Organ Systems: Challenges and Opportunities”
Susan Morrison, University of Michigan
Robert Benezra, Memorial Sloan-Kettering Cancer Center, New York
Fiona Watt, London Research Institute, UK
Richard Young, Whitehead Institute for Biomedical Research, MIT
Sangeeta Bhatia, MIT
William A. Sahlman, Harvard Business School

Annual Symposia

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