

Singularity University

Preparing Humanity for Accelerating Technological Change

GRADUATE STUDIES PROGRAM





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Welcome

It is our pleasure to welcome you to Singularity University. Our mission is to assemble, educate and inspire leaders who strive to understand and facilitate the development of exponentially advancing technologies in order to address humanity's grand challenges.

Singularity University's Graduate Studies Program brings together a diverse group—the most accomplished experts in academics, business, and government together with the brightest students from across the globe—for an intense ten-week summer program. The program immerses participants in an unparalleled convergence learning environment. We also challenge our students with our 10⁹⁺ Team Projects, asking them how they can positively affect the lives of a billion people within 10 years.

The next few decades will see the transformation of the science and technology tools available to the world in a fashion more profound than any other time in our history. The current technology revolution moves at an exponential pace, and exponential technologies imply a future with capabilities previously unimagined. Singularity University was founded using the standpoint that with more capability comes more responsibility. Our commitment is to not only to teach, but also to act: to view the world's Grand Challenges as opportunities to use advancing technology for the benefit of all.

If you are interested in the world's grand challenges, if you are an entrepreneur passionate about making your dreams materialize, and if you are at the top of your class then we hope you will consider applying to the Graduate Studies Program. If you are invited to participate in this highly selective program, you will experience a life-changing 10-week program and join an incredible community of thinkers and doers. We are pleased to be able to provide a number of full and partial scholarships on a needs and merit basis.

We look forward to challenging you next summer!

Ray Kurzweil

Co-Founder, Chancellor & Trustee

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Peter H. Diamandis, MD Co-Founder & Chairman







Ray Kurzweil on Linear vs. Exponential Growth:The paradigm shift rate (i.e. the overall rate of technical progress) is currently doubling (approximately) every decade; that is, paradigm shift times are halving every decade (and the rate of acceleration is itself growing exponentially). So, the technological progress in the twenty-first century will be equivalent to what would require (in the linear view) on the order of 200 centuries. In contrast, the twentieth century saw only about 25 years of progress (again at today's rate of progress) since we have been speeding up to current rates. So the twenty-first century will see almost a thousand times greater technological change than its predecessor.





Program Overview

Singularity University is an interdisciplinary university whose mission is to assemble, educate and inspire leaders who strive to understand and facilitate the development of exponentially advancing technologies in order to address humanity's grand challenges.

The purpose of Singularity University's Graduate Studies Program is to educate, inform and prepare the next generation of leaders for future disruption and opportunities resulting from exponentially growing technologies and applying these to solve the grand challenges of our time.

During the program participants learn about the various exponentially growing cross-disciplinary technologies in the following 10 tracks:

- AI & Robotics
- Nanotechnology
- Biotechnology & Bioinformatics
- Medicine & Neuroscience

- Futures Studies & Forecasting
- Policy, Law & Ethics
- Networks & Computing Systems
 Finance, Entrepreneurship & Economics
 - Energy & Environmental Systems
 - Space & Physical Sciences





Notable Faculty, Speakers and Advisors



Ray Kurzweil, PhD Author and Inventor; Founder, Kurzweil Technologies; Co-Founder & Chancellor, Sicoularity University



Peter Diamandis, MD Chairman & Founder X PREZE Foundation: Co-Founder & Chairman, Singularity University



Dan Barry, MD, PhD Three-time NASA astronaut: Expert in Robotics and Medicine



Sonia Arrison Senkut Senior Fellow Pacific Research Institute



Vint Cerf, PhD Vice President and Chief Internet Evenyelist, Google Inc.



Neil Jacobstein Al Expert Media X Program Stanford University



Robert Freitas, Jr., JB Sr Research Fellow Institute for Molecular Manufacturing



Ralph Merkle, PhD Sr Research Fellow Institute for Molecular Manufacturing



Bob Metcalfe, PhD Founder of 3Com Co-inventor of Ethernet GP, Polaris Venture Partners



David S. Rose CEO Angelsoft Chairman New York Angels



Andrew Hessel Founding Director & CEO Pink Army Cooperative, Genomic Scientist



Daniel M. Kammen, PhD Energy & Resources Group at UC Berkerley, Lead Author, IPCC



Terry Grossman, MD Founder & Medical Dk, Grossman Wellness Center



Paul Saffo Distinguished Visiting Scholar, Stanford University



Tina Seelig Executive Director Stanford Technology Ventures Program



James Canton, PhD CEO and Chairman Institute for Global Futures



Tim Ferriss Author The 4-Hour Workweek



Will Wright Creator: SimCity, Spore Founder, Maxis (Electronic



Larry Smarr, PhD California Institute for Telecom & Information Technology



Chris DiBona Open Source Program Manager Google inc



Tara Lemmey CEO of LENS Ventures Former President Bectrisnic Frontier Foundation



George Smoot, PhD 2006 Nobel Prize in Physics University of California, Berkelov



Sebastian Thrun, PhD Prof of Computer Science Director Al Lab at Stanford Winner of DARPA. Grand Challenge



Larry Brilliant, MD Physician President, Skoll Global Threats Fund



Michael West, PhD CEO, BioTime Founder, Genron Corporation



Peter Norvig, PhD Director of Research, Google Inc., Co-author of A Modern Approach



John Gage Partner, KPCB Chief Scientist Sun Microsystems



Saul Griffith, PhD MacArthus Fellow (2007) Founder Makani Fower, Syeglasses, Squid Labs. Potence, Instructables.com, MowToons



Daniel Kraft, MD Faculty, Stanford Institute for Stars Cell Biology and Regenerative Medicine



Chris deCharms, PhD Founder, Omneuron



Academics









Students are admitted based on three criteria:





Academic Excellence

Candidates must show academic excellence in their chief area of study.



Leadership

Candidates must show their entrepreneurial and leadership ability demonstrated through past research projects, and through companies or organizations that they have founded or lead.



Passion

Candidates must show thirst and commitment to leverage technology to address humanity's Grand Challenges.

While these are Singularity University's general admissions criteria guidelines, we encourage all candidates to apply if they believe that they will be an exceptional addition to our student body.





Week 1	Weeks 2-5	Weeks 6-10	
A deep understanding of the field	Exponential Technologies Impact Report	Actionable Output	
What has been tried? What has worked, and what has failed? What is the primary challenge? What technology is needed?	Students then learn about all of the fields in exponential growth and strive to understand what is in the lab today. Where we are heading for the next 5 -10 years, and how this technology will be useful to address the Grand Challenge in that timeframe.	The results takes several forms, including a report on how the technology will be applicable to each Grand Challenge over a 10-year period, and a description of what companies, research programs, or non-profits should be started.	





Energy and Environmental Systems

Focus: Future breakthroughs in renewable energy production, storage, transmission and efficiency, as well as, environmental systems monitoring and management.

Main topics:

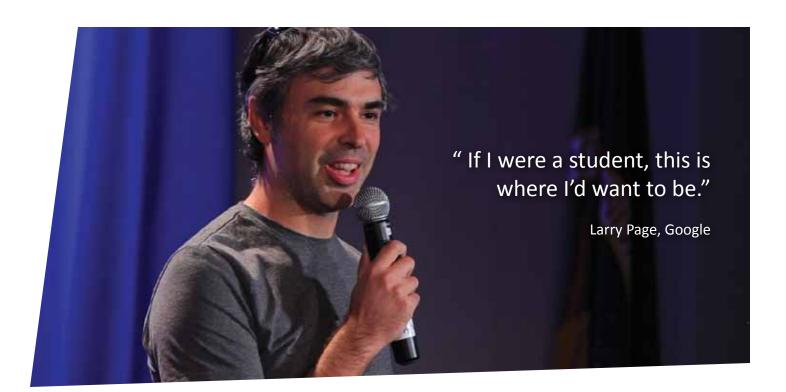
- Energy production from renewable and nonrenewable sources: current and future developments.
- Grid 2.0 & transmission systems; energy storage technology & systems.
- Efficient transportation systems; energy conservation & efficiency, energy for the developing world.
- Earth as an environmental system; cycles (water, carbon, nitrogen, etc.); climate models, climate change strategies; regional and global risks prevention and mitigation strategies.
- The environment and Grand Challenges.

Finance, Entrepreneurship and Economics

Focus: The impact on business of accelerating technologies, the future of finance, and essential entrepreneurial tools for changing the world.

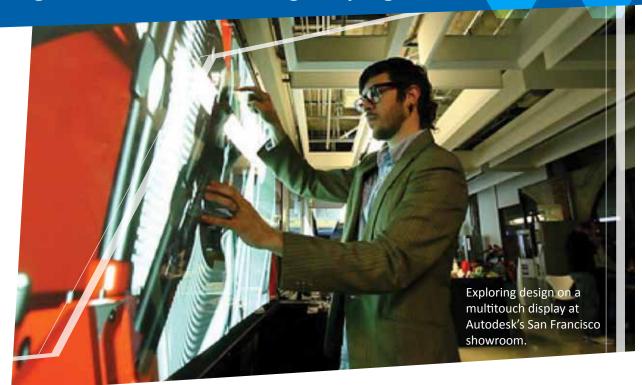
Main topics:

- The dramatic effect of the exponential growth of technology on every facet of the business world. (Long tail, virtual goods, outsourcing, web 2.0, new business models).
- Economics in a globally-integrated world where many resources may no longer be scarce (private financing of space travel, the economics of knowledge, carbon cap & trade, microfinance and peer-to-peer investing, money as information).
- Entrepreneurial tools for changing the world (how to create a business plan, find an angel investor, pitch a VC for funding, form strategic partnerships).





Site Visits: Just a few of the many companies and organizations visited during the program.



Autodesk, Inc., is a world leader in 2D and 3D design, engineering and entertainment software for the manufacturing, building and construction, and media and entertainment markets.

Halcyon Molecular is developing an ultra-high throughput low-cost DNA sequencing.

Bloom Energy is a clean tech company transforming the way the world generates and consumes energy by using new technologies with roots in the NASA Mars space program.

Fluidigm helps power the biotech revolution by developing research and analysis systems based upon integrated fluidic circuits that work to bring down the cost of experiments while allowing larger, more complex studies.

Willow Garage is moving robotics technology towards its paradigm shift, when personal robotics applications will be a part of everyday life.

Steelcase Inc. brands offer a comprehensive portfolio of workplace furnishings, products and services, inspired by nearly 100 years of insight gained serving the world's leading organizations.

ideo is a global design consultancy, creating impact through design.

IBM Almaden is IBM's most important research laboratory. Almaden is an epicenter of technological development in the computer, physical, and material sciences.

BrightSource Energy is a solar company combining the most cost-effective, environmentally-responsible solar thermal technologies.

Kicklabs helps startups thrive by providing a creative and collaborative environment within a network of veteran technology entrepreneurs that are leveraged to fully evolve a company's business.



Policy, Law and Ethics

Focus: The complex interactions between policy, law, and ethics that will emerge with accelerated technologies and their impact on society.

Main topics:

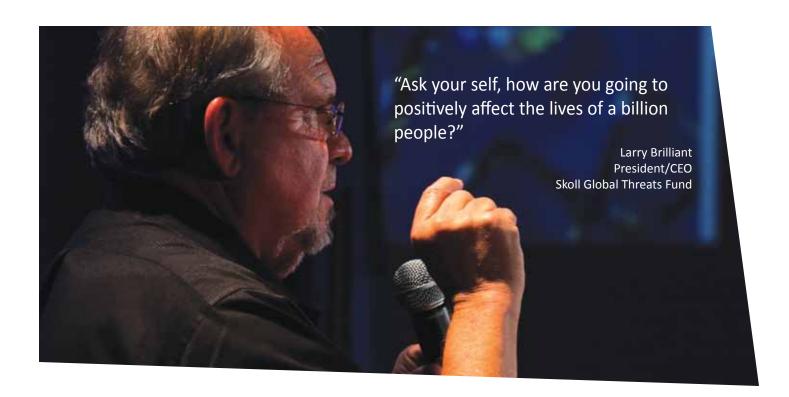
- The implications of technological change; the social and ethical dimensions of science and technology. Policy and legal frameworks and the frontiers of science.
- The effects of new technologies on policy; politics; the law, legal systems, and the legal industry; and decision-making -- open data and public participation, jurisdictions and the definition of community and stakeholders, legal structures, regulatory structures, and more.
- Risk and technologies, the proactionary principle and precautionary principle; PLE and Grand Challenges.

Future Studies and Forecasting

Focus: Anticipating the capabilities of exponentially-accelerating technologies using strategic foresight tools

Main topics:

- Accelerating change, linear vs. exponential perspectives and the impact of extrapolations based solely on linear models, convergence combined with interdisciplinary perspectives on technological change;
- Managing uncertainty, robust decision-making tools; industry, academic, policy and NGO experiences in futures studies;
- Forecasting frameworks and methodologies, foresight strategies and scenarios, creative convergence and prediction markets.









Tesla Motors is the leader in development and serial manufacturing of highway capable electric vehicles.

Cisco Systems is a consummate leader in technological innovation.

23andMe offers a commercial DNA testing service that provides information to consumers to explore their DNA.

Omneuron is a developer of novel MRI technologies that help improve methods for visualizing brain function for researchers and physicians.

Intuitive Surgical is the leading robotic-assisted minimally invasive surgery.

NASA Ames Research Center plays a critical role in virtually all NASA missions in support of America's space and aeronautics programs.

Google site visit focuses on power and energy initiatives.

Zynga is a maker of social network games, and is one of the fastest growing companies ever.

Codexis is a synthetic biology company working on energy, pharmaceuticals, and environmental technologies.

SolarCity is a full service provider of solar energy offering system design, financing, installation, and monitoring on both the residential and corporate levels.

US DOE Joint Genome Institute

conducts research in metagenomics, bioenergy, and comparative genomics, and has assembled a sequencing assembly line for all types of organisms.



Space and Physical Sciences

Focus: Humanity's reach beyond the Earth and the implications for the planet.

Main topics:

- The frontiers of space flight; strategies for future space exploration based on lessons learned from past explorers and new concepts drawn from commercial space flight.
- The possibility of extrasolar Earths within the context of current cosmology and planetary formation theories.
- Partnered with the AI and Robotics track, examining human-robotic interactions and their role in space exploration.

Medicine and Neuroscience

Focus: Advances in medicine and neuroscience, and their impacts on human health and performance

Main topics:

- Stem cells and regenerative medicine: the emerging ability to repair, replace and regenerate tissues.
- Targeted therapies: minimally invasive medical devices, robotic surgery, designer drugs, identification and targeting of cancer stem cells.
- Medical diagnostics and imaging: rapid imaging modalities, point-of-care medical diagnostics, nanomedicine and biomarker technology.
- Neuroscience: neuroprosthetics, neuroplasticity, and brain imaging.
- Wellness: preventative drugs, diet and supplements, proactive regimens, Internet-based medical informatics, and telemedicine.
- Human enhancement: exoskeletons, robotic limbs, neuroenhancing pharmacological agents, gene therapy, and medicine and aging.

"The best way to predict the future is to create it yourself. Singularity University is a place that we can create that future together."

Peter H. Diamandis, MD Co-Founder & Chairman







Nanotechnology

Focus: The science, technology and potential future capabilities of nanotechnology and nanomaterials

Main topics:

- Fundamental scaling laws and their limits.
- The nature of atomically precise structures and computational chemistry.
- Current and proposed manufacturing technologies including lithography, microelectromechanical systems (MEMS), self assembly and positional assembly, DNA nanotechnology, nanomaterials, Scanning Probe Microscopy, mechanosynthesis, and more.
- Molecular computing, molecular logic elements, carbon nanotube electronics and thermal limits in computing.
- Medical nanorobotics and nanomedicine.
- The impact of nanotechnology and nanomaterials on space, energy production and storage, national security, green manufacturing, environmental remediation and other areas.

Networks and Computing Systems

Focus: The impact on business of accelerating technologies, the future of finance, and essential entrepreneurial tools for changing the world.

Main topics:

- The dramatic effect of the exponential growth of technology on every facet of the business world. (Long tail, virtual goods, outsourcing, web 2.0, new business models).
- Economics in a globally-integrated world where many resources may no longer be scarce (private financing of space travel, the economics of knowledge, carbon cap & trade, microfinance and peer-to-peer investing, money as information).
- Entrepreneurial tools for changing the world (how to create a business plan, find an angel investor, pitch a VC for funding, form strategic partnerships).





Autodesk® Innovation Lab



We are proud to have the Autodesk Innovation Lab at Singularity University.

Autodesk has generously provided their complete set of tools and 6-core Intel Xeon-based workstations fitted with state-of-the-art graphics cards to to help you imagine, design, and create a better world.

With Stratasys uPrint, Makerbot 3D printers, Willow Garage's Texai robot, Arduino and PIC microprocessors and a host of other options, you'll never run out of fun tech to dig into.

- Whiteboard an idea, simulate some molecules, and glue the DNA together.
- AutoCAD a robot and 3D print your prototype.
- Design, build, solve a puzzle, make a circuit, add a microprocessor, and sew yourself a wearable computer.

We're here with the tools, robots, computers, and smarts to make it happen! Come have some fun with us!





AI and Robotics

Focus: Intelligent Machines and Robotics Technologies.

Main topics:

- Introduction to intelligent machines: perception, actions, representation, reasoning, learning, dealing with uncertainty.
- Al technology: efficient exploration of state space, planning, logical inference, probabilistic inference, and more. Narrow and strong Al.
- Robotics technology: hardware systems, mobility, localization and mapping, human-robot interactions, multi-agent systems, autonomous vehicles, scaling to micro- and nano-machines.
- Applications in home, transportation, medicine, security, internet, entertainment, space, and other areas.
- Future directions: technology trends, solving the hard problems, AI ethics.

Biotechnology and Bioinformatics

Focus: Exponential growth in biotechnology and bioinformatics.

Main topics:

- Genome technologies (genomics and proteomics, gene sequencing, and large biological databases).
- Personalized medicine (4P medicine: personalized, predictive, preventative, participatory).
- Intelligent design (ultra-rapid, low-cost DNA writing, selective gene manipulation/substitution);
- Microfluidics and single-molecule technologies.





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9th + Team Projects

Each year we select a set of team projects that have the potential to positively impact 1 billion people within a decade, leveraging exponentially advancing technologies. Each team project includes 10-15 international, interdisciplinary students to tackle the challenge.

The five team projects for our 2010 Graduate Studies Program are:



Water



The crisis in water and sanitation is one of the greatest human development challenges according to the UN, NAE, and others. More people die from the lack of clean water than war. According to the UN, one billion people lack access to safe drinking water 2.4 billion, and adequate sanitation. A 2015 UN Millennium Development Goal is to reduce by half the proportion of people without sustainable access to safe drinking water. Household water use accounts for a small fraction of the need for clean water. The water needs of agriculture and industry are 20 times larger than personal water usage. The problems of access to clean water are linked to issues of energy, development, pollution, transportation, industrialization, infrastructure, and policies. This project will examine the opportunities presented by exponentially accelerating technologies such as biotechnology, nanomaterials, sensors, etc. to address needs for clean water. Opportunities will be examined across a variety of scales, from the regional or community scale to the residential level.



Food for Cities

Opportunities in Controlled Environment Agriculture and Vertical Farming

By the year 2050, population is expected to grown by another 3 billion and nearly 80% of the total population will reside in urban centers. In order to feed the increase in population, an estimated 109 hectares of new land (about 20% more land than is represented by the country of Brazil) will be needed to grow enough food if traditional farming continues as it is practiced today. In order to accomplish this dramatic increase in food production, new technologies are needed which increase the efficiency of large-scale food production while simultaneously eliminating current practices which are disastrous to the environment such as the release of CO2, the disruption of the nitrogen cycle, and the contamination of water and ecosystems.





Space -



To Boldly Stay

Extending Humanity into the Solar System

Rapidly and cheaply robotically scout the Moon, Mars, asteroids and other deep-space destinations to find safe and interesting sites for humans to visit. Understand the space-resources available to humans enabling us to one day "live off the land." Understand the hazards that places pose in their local environment, as well as prevent hazardous encounters with Earth. Synthesize robotic and human exploration, exploiting the strengths of each.

Look at new designs, new materials, and new technologies that will transform not just where we can go but what we can do when we get there.

Energy

Home Energy Usage Off-the-Grid, Standalone, Carbon-Neutral, Residential Energy System

Close to 3 billion people, almost half the world's population, do not have continuous and reliable access to electricity in their homes. Almost 90% of the energy produced and sold commercially still comes from three main fossil fuels: coal, oil, and gas. None of these are clean and renewable, nor are they cheap enough to afford by the majority of these 3 billion people. In addition, traditional energy distribution grids require complex electrical networks which are incredibly expensive to install and maintain and which take too long to build. The challenge becomes to rethink traditional and expensive centralized fossil-fuel based energy distribution networks and move to inexpensive decentralized networks (ideally, point of use systems) based on renewable or carbon-neutral energy sources.

Upcycle

Upcycle

Waste Reduction & Reprocessing Waste Into Useful Products

Images of people living and working in a landfill-dominated landscape are a stark reminder that in the next decades the amount of products that human use and discard will grow exponentially. These products are filling our landfills, contaminating our waters, increasing atmospheric CO₂ concentrations, and wasting energy and raw materials. In order for us to make significant reductions in CO₂ emissions and environmental contamination, we are going to have to rethink how we make and use things. The idea of closing the recycle loop is simple enough. Rather than dispose of products at end of life, products are re-purposed, re-processed, or re-manufactured into new products. This project focuses not just on reductions of what goes to landfills, but on a systematic approach to product design to ensure that the landfills are not needed in the first place.



Graduate Studies Program



Class of 2010



2009 Team Projects

At the end of each summer program, students identify the next action required to address the challenges defined during the team projects. In 2009 this resulted in the formation of several companies that continue to thrive today including:

Civiguard Technologies

Civiguard Technologies is developing mobile phone applications and portable medical technologies to assist civilians and officials alike in crisis, disaster and pandemic situations. The CiviCast application allows any civilian with a smart phone to receive integrated, reliable information from local authorities to find safety, aid and resources. CiviCommand integrates data from qualified professionals into a central touch-screen interface at incident command to evolve a comprehensive picture of the ground situation in times of crisis.





Acasa

According to the UN, over one and a half billion people worldwide reside in substandard housing. Imagine if we could alleviate today's global housing crisis using new, automated construction technologies.

Advances in rapid 3D additive manufacturing technologies permit the construction of customizable, affordable housing for the developing world. This low-cost, environmentally sustainable solution has the potential to create a transformative new paradigm for improving housing construction using local resources.



Gettaround

Gettaround is the first person-to-person car sharing community. Car owners rent out their cars to trusted friends, co-workers, and neighbors.







2010 Scholarship Program

Scholarships are critical to the success of Singularity University. The following students applied for and received prestigious Fellowships from our corporate, individual and anonymous donors. Please consider sponsoring an amazing student in 2011!



Alison Lewis USA Autodesk Scholar In Residence



Derek Jacobi Canada Autodesk scholar In Residence



Rosa H.M. Chan China Google Fellow



Mercy Njima Kenya Google Fellow



Fabio Teixeira Brazil FIAP Fellow



Hind Ahmed Sudan Klee Irwin Fellow



Nolene Naidu South Africa Klee Irwin Fellow



Gary Gautier Spain Bernat Fellow



David Dalrymple USA Kurzweil Fellow



Yara Shaban Jordan Michael Plouf Fellow



Dmitriy Tseliakhovich Belarus Heinlein Fellow



Jason Dunn USA Heinlein Fellow



Raycho Raychev Bulgaria Heinlein Fellow



Tony Young Lyu South Korea Heinlein Fellow



Justin Pahara Canada Baillie Gifford Fellow



Kidist Zeleke Ethiopia Anonymous DONOR



Emem Andrew Nigeria Anonymous DONOR



Francesco Galietti Italy Pierangelo Girardello Fellow

50% of our students in 2010 received a partial or full scholarship



China

srael Jordan

Romania

South

NETHERLANDS

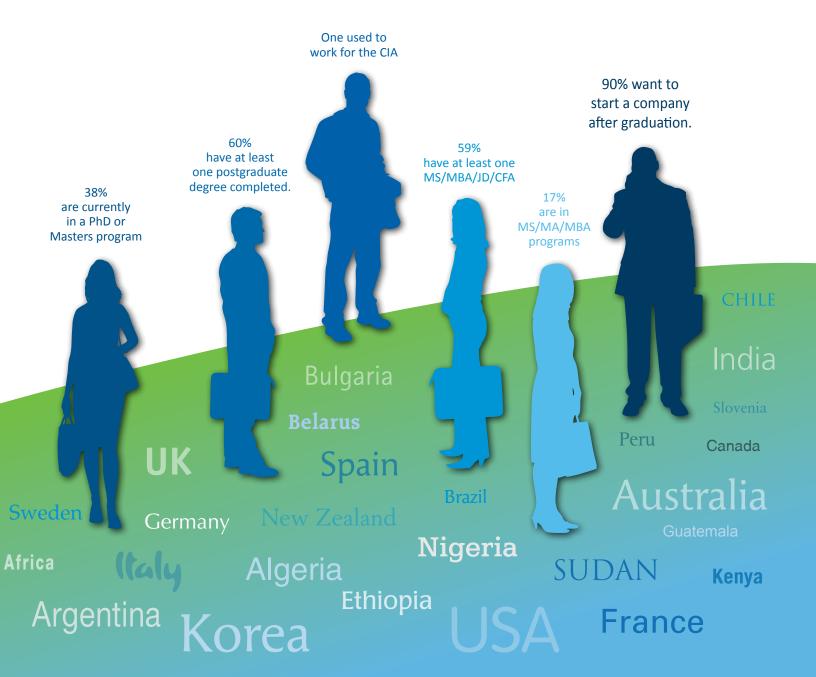
witzerland



The average age of students is 31. Youngest student is a 19 year old PhD student at MIT and the oldest is 51.

73% are from outside the USA

35 Countries represented





Program Fee & Admissions

Program fee:

The enrollment fee for the 10-week program is USD\$25,000. This includes housing, food, and tuition. A limited number of partial and full scholarships may be available.

Application Process and Admission Deadlines:

Please fill out the admissions application on the Singularity University website. | www.Singularityu.org |. Qualified individuals will be asked to submit additional information, including official transcripts, and will be scheduled for an in-person or phone interview via Skype. Students are also encouraged to submit a short (five minutes) video of themselves expressing why they should be considered for admission to the program.

The 2011 Graduate Studies Program will be in session for a 10-week period from approximately the middle of June through the end of August. The admissions schedule for 2011 is as follows:

Application Deadline*	Section	Notification of Acceptance	% of 2011 Class Accepted
November 1, 2010	Round 1	December 1, 2010	10%
December 1, 2010	Round 2	January 15, 2011	30%
January 15, 2011	Round 3 (Recommended deadline for international applicants)	February 15, 2011	50%
February 15, 2011	Round 4	March 15, 2011	70%
March 15, 2011	Round 5	April 15, 2011	100%

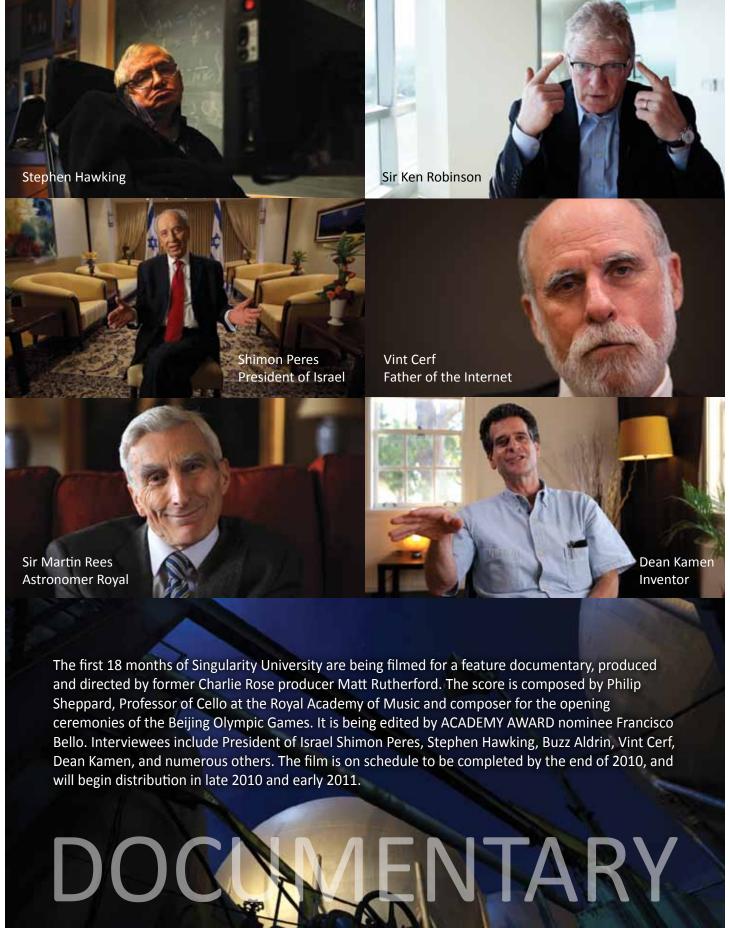
^{*}You are encouraged to apply early. This will enable us to accept you early or, if you are missing something from your application, to notify you with time to correct the error.

Location & Campus

Singularity University's Campus is located at NASA Ames Research Park at Moffett Field in Mountain View, California - right in the heart of Silicon Valley.







With the support of a broad range of leaders in academia, business and government, Singularity University is stimulating groundbreaking, disruptive thinking and solutions aimed at solving some of the planet's most pressing challenges.



Singularity University runs two important programs:

Our Graduate Studies Program brings together a diverse group—the most accomplished experts in academics, business, and government together with the brightest students from around the globe—for an intense ten-week summer program. The program immerses students in an unparalleled learning environment to focus solving the planet's most pressing challenges and how technology may solve them.

Our Exponential Technology Executive Programs are a series of intense condensed programs (4-days & 7-days) designed to educate, inform, and prepare C-Level executives (CEOs, CTOs, entrepreneurs, venture capitalists, and government leaders) to recognize the opportunities and disruptive influences of exponentially growing technologies and understand how these fields affect their futures, their companies, and their industries over the next 3 to 10 years.









Special Thanks to our sponsors and supporters:

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