Real science taught in a real lab!

Pathways to Stem Cell Science

605 E. Huntington Drive, Suite 103, Monrovia, CA 91016
Email: drvictoriafox@live.com  │  Tel: (310) 483 3651  │  www.stemcellpath.com
Last updated: January 1st 2018
“Education is the most powerful weapon we can use to change the world” – Nelson Mandela
CONTENTS

4 The Problem
5 What is Pathways to Stem Cell Science?
6 What We Do
7 Our Mission
8 Our Goals

9. Why Focus on Stem Cells?
10. Milestones
11. Our Unique Approach
12. Why Real World Training?
13. Why our Work is Important
21. Our Vision
22. Current Courses
23. EiHS CIRM SPARK
24. EiHS Journal
25. Custom Courses
26. Course Development Methods
27. Program Benefits
28. Our Impact
29. Success Stories
30. Testimonials
31. What our students say
32. Leadership
33. Our Dedicated Staff
34. Facilities
35. News and Media
36. Partners and Affiliates
37. Acknowledgements

Learn more about our organization at stemcellpath.com
The Problem

Bioscience is a scientific field that focuses on the study of living organisms. We have identified three critical components that are lacking in traditional PreK-12 and college bioscience education programs: 1. Education equality; 2 Career education and guidance; 3. Real-world, work-based learning.

These components are essential for aspiring scientists from all socioeconomic backgrounds to pursue bioscience education and develop prosperous bioscience careers. Their absence has a variety of knock-on effects from deflating students interest in and aptitude for science in the early years to hindering graduation and employment success at college and beyond. These issues disproportionately affect students from low-income, underserved and underrepresented communities, who do not receive equal access to quality science education and career guidance, leading to an unbalanced bioscience workforce.

To address these problems, we have founded a novel, real-world bioscience training institute called Pathways to Stem Cell Science. Our non-profit organization provides work-based education and career knowledge to students of all ethnic and socioeconomic backgrounds. We also help students who are underserved and underrepresented to pursue bioscience careers and leverage STEM education as a vehicle for mobility into the middle classes.
Pathways to Stem Cell Science is a unique laboratory-based non-profit training institute in Los Angeles California. It was founded in January 2016 by former University of Southern California (USC) professor, Dr. Victoria Fox to address the unmet need for K-12 and college students to gain real-world bioscience exposure. We offer education and training in contemporary bioscience skills to aspiring scientists through innovative hands-on courses that use human stem cells as a learning tool. We also support public education and outreach and provide career guidance to students who are interested in forging bioscience careers. Located in a biotech incubator, we are one of the only industry-based educational programs for PreK-12 and college students in the world.

At Pathways to Stem Cell Science we believe bioscience is an applied subject which should be taught in a professional laboratory under the guidance of experienced scientists. This kind of real-world training has profound benefits for the social, academic and technical development of students, fostering confidence and improved problem-solving abilities, while addressing the industries need for a skilled laboratory workforce. Real-world, work-based training and career guidance also provide critical insights into the bioscience jobs market - helping students to narrow down their career interests, make better choices about their schooling and move through the education system into paid work as quickly and debt free as possible.

Originally developed nine years ago at the USC Stem Cell Core Facility, our innovative hands-on courses enable participating students to learn broadly applicable bioscience skills while training for the future science of stem cell biology and regenerative medicine. Our core curriculum is adapted from professional industry-level training programs that have been tested during accredited degree programs at six universities and one community college. Course participants enjoy the rare opportunity to learn in a professional bioscience laboratory with state-of-the-art equipment alongside experienced scientists who are also exceptional teachers. Through small classes taught by multiple course instructors, we provide the same quality personalized education as work-based training programs such as laboratory internships.

One of our main priorities is to increase diversity in the sciences and improve the lives of underserved and underrepresented students by supporting their pursuit of well-paid bioscience careers. Approximately 1/3 of our students come from socioeconomic groups that are disadvantaged and underrepresented in science and medicine. We take a unique approach to educating these students by combining them in desegregated classes with elite students from privileged backgrounds who provide accomplished yet relatable role models.
What We Do

**Bioscience Skills & Training**
We provide real-world training and education in core skills and techniques required by all professional bioscience industries.

**Career Development**
We help students to focus their career interests, make better choices about their education and prepare for their future careers.

**Real-World Skills & Exposure**
We provide real-world exposure to professional scientists, research laboratories, state-of-the-art equipment and real-life bioscience techniques.

**Diversity & Inclusivity**
We offer educational opportunities for students of all social, ethnic, religious and socioeconomic backgrounds.

**Resources & Information**
We provide resources, information and public outreach relating to stem cell science, regenerative medicine and bioscience careers.

**Stem Cell Biology**
We prepare students with specialized skills for the rapidly growing, cutting edge fields of stem cell biology and regenerative medicine.

**Innovative Education**
We provide unique training and education through innovative lab-based courses involving human stem cells.

**Biotech Industry**
Located in a biotech incubator we are one of the only industry based programs for K-12 and college students in the world.

**Support Disadvantaged Youth**
We inspire, support and enable underserved students to pursue professional bioscience training and employment.

**Personal & Professional Development**
Our programs promote the development of important social and professional skills.
Our Mission

To inspire future scientists and prepare students for higher education and employment through real-world training in bioscience skills - taught using stem cells and regenerative medicine as an engaging learning platform.
Our Goals

HANDS-ON TRAINING
Equip students for higher education and employment through hands-on training in bioscience skills that are not taught to the standard needed for a practicing bioscientist during school or college.

REAL-WORLD SCIENCE
Expose K-12 and college students to real-world bioscience, professional scientists, STEM careers and state-of-the-art lab facilities.

CAREER DEVELOPMENT
Enable K-12 and college students to learn about bioscience professions, hone their career interests and develop successful bioscience careers.

BIOTECH EXPOSURE
Expose K-12 and college students to the biotech industry and broaden their understanding of private sector bioscience professions.

PUBLIC EDUCATION AND OUTREACH
Improve the public’s understanding of stem cell biology, regenerative medicine, bioscience, careers and real-world science.

STEM CELL BIOLOGY AND REGENERATIVE MEDICINE
Prepare K-12 and college students for the rapidly expanding cutting-edge fields of stem cell biology and regenerative medicine.

DIVERSITY AND EQUALITY
Increase diversity in science and improve the lives of underserved students by supporting their pursuit of a bioscience education and career.
Why Focus on Stem Cells?

- Fascinating and inspirational
- Intersect with almost every field of medicine and bioscience
- Becoming widely used in bioscience research and medical therapy
- Stem cell knowledge and practical experience will be essential for future scientists and medical practitioners
- Provide an excellent tool for teaching many aspects of human bioscience, physiology and medicine owing to their ability to make any cell in the human body
- Cultured and analyzed using core techniques required by all practicing bioscientists - provide an excellent tool for teaching essential and broadly applicable bioscience/lab skills

For these reasons stem cells provide the perfect tool and model system for teaching conventional and specialized bioscience work-skills

We work exclusively with adult, pluripotent and cancer stem cells which do not pose ethical concerns for any religious or political groups
Dr. Fox launches the first stem cell training program for professional scientists and students attending the CIRM Bridges Program.

2009

Professional training program is expanded to include a 3-day stem cell techniques workshop.

2010

The Early Investigator high school (EiHS) stem cell research program begins development – CIRM Bridges training expanded to 7 colleges.

2011

EiHS Stem Cell research program launches with its flagship 8-week research internship program.

2012

College programs expanded to include accredited courses for USC graduate students.

2013

EiHS launches a second course for high school students – the 10-day Regenerative Medicine and Disease Modeling Program.

2014

Planning begins for a new non-profit training institute – Pathways to Stem Cell Science – to expand stem cell education to K-12 and college students.

2015

Pathways to Stem Cell Science is formally launched – February 2016.

2016

Pathways to Stem Cell Science launches a third EiHS program – the 5-day Stem Cell Academy and begins development of after school and K-6 programs.

2017

Pathways to Stem Cell Science launches a third EiHS program – the 5-day Stem Cell Academy and begins development of after school and K-6 programs.

Milestones
Our Unique Approach

At Pathways to Stem Cell Science we provide comprehensive training in the four core skills needed for a modern bioscience career.

### Knowledge
Our courses cover real-world science knowledge in addition to traditional “textbook” theory through lecture-discussions and interactive science forums.

### Technical Skills
Our courses teach broadly applicable lab skills and specialized bioscience techniques that plug directly into professional bioscience laboratories.

### Real-World Skills
Our courses teach important real-world skills such as troubleshooting, team-work, organization, problem solving, communication and independence.

### Career Knowledge
Our courses provide knowledge and guidance relating to bioscience occupations and alert students to the skills, expertise and training needed to pursue a professional bioscience career.

Why Our Courses are Different

- **Real-World**
  Our courses are held in a real-world bioscience environment and teach real-world science skills as they are practiced by trained bioscientists.

- **Relevant**
  Our courses teach essential 21st century skills required by all bioscientists using industry standard protocols, modern equipment and state-of-the-art facilities.

- **Professional**
  Our courses promote the development of professional work skills and social competencies to prepare students for advanced education and employment.

- **Personalized**
  Our courses are student-centered and provide the same personalized mentorship-style training that makes one-on-one internships so beneficial.
Real-world training describes learning activities that take place in real-world environments such as a workplace or professional setting (i.e., conference or professional training course). Real-world training involves learning activities that prepare students with work-based skills and experience for future employment. This type of learning offers tremendous benefits for improving student behavior, motivation, academic achievement, graduation rates, and career preparedness. It is particularly critical for young students in high school and college to make appropriate career choices and forge successful careers. Students who take part in real-world learning report the skills and confidence they gain lead to new opportunities for promotion and career progression. Employers favor individuals with real-world experience in addition to a college education because they adapt to the workplace more quickly and are better equipped to work productively with minimal training and oversight.
Why our Work is Important

Global Expansion of the STEM/Bioscience Economy

Students today need to prepare for an economy that increasingly demands workers with Science, Technology, Engineering and Math (STEM) skills. According to the US Department of Commerce, bioscience occupations have grown at more than twice the rate of non-STEM occupations during the last 15 years and are expected to continue growing at a higher rate through to 2025 (Figure 1: STEM Economy Growth Statistics). Within the biosciences industry, occupations such as biomedical science and biomedical engineering are predicted to undergo among the highest increases in growth throughout the entire STEM sector – up to 62% by the year 20201. That National Science Board has reported that even non-STEM occupations are increasingly requiring workers with STEM skills in at least one field2. To meet the increasing demand for a trained STEM/bioscience workforce and remain competitive in the global biosciences industry, we must ensure that K-12 and college students develop relevant 21st century work skills in addition to receiving a contemporary science education. At Pathways to Stem Cell Science we are working to achieve this goal by providing relevant, real-world, practical training in essential STEM and bioscience skills to students of all ages.

Rising Poverty and Income Inequality

Over the last 30 years, wage and income inequality in the United States has increased substantially to the same high levels that prevailed prior to 1929 – before that start of the Great Depression3. In 2016, an estimated 40.6 million people or 12.6% of the US population were believed to live in poverty, earning only $25,000 per year for a family of four – significantly less than the current median US family household income of $75,0624. The number of individuals living in extreme poverty also increased in 2016 to 45.6% – up from 39.5% in 19964. Most low-wage workers earn less than $10 per hour, receive no health insurance, sick days or pension plans from their employers; meaning they cannot get sick and have no hope of retiring. Even the middle class, defined as adults who make up to $126,00 for a household of three, constitute a smaller percentage of American society today (50%) than they did in the 1970’s (61%), and are struggling to make a living wage or afford their own home. If we are to combat poverty and income inequality and boost our economy it is essential that our young people are equipped through education and training to enter higher paying jobs. At Pathways to Stem Cell Science we are working to achieve this goal by inspiring and preparing K-12 and college students from all socioeconomic backgrounds to pursue STEM-based occupations, which not only pay higher average salaries than non-STEM based occupations but also have lower rates of unemployment (Figure 2: STEM Occupation Employment Statistics).
Postsecondary education, which provides training in advanced and often specialized skills, has become essential for accessing the global, knowledge-based economy and earning a living wage (Figure 3: Employment Education Requirement Statistics). This is particularly true for STEM/bioscience occupations which, due to the complex nature of science, demand extensive training and a minimum of an undergraduate degree.

To prepare for future employment, students must complete the daunting task of identifying college programs that provide the requisite skills and training for their chosen career. This in turn requires students to 1) decide on a career path that matches their interests and aptitudes and 2) identify the skills they will need to learn in order to enter their chosen profession. Since young students in high school and college have very little understanding of careers or workplace skills, they cannot make these decisions without guidance from a trained occupational counselor and real-world exposure to their chosen profession. However, a large proportion of the nation’s students are being failed at every level of college and career preparedness from accessing a college counselor, to obtaining career guidance to achieving the basic core skills needed to attend college (Figure 5: College and Employment Readiness Statistics). In addition, there are currently few opportunities for young students to gain worthwhile exposure to STEM/bioscience professions, aside from volunteer positions which vary in quality depending on the assigned mentor’s interest in mentoring young students; these types of volunteer positions can even place students in danger if they are left unsupervised in hazardous laboratory environments (Figure 8: Extracurricular STEM Program Statistics). Consequently, many students enter college unprepared both academically and from a career readiness standpoint. This leads to a variety of knock on effects including but not limited to poor educational choices, late graduation, increased student debt and delays moving into paid employment (Figure 4: Student Loan Debt Statistics and Figure 5: College and Employment Readiness Statistics).

At Pathways to Stem Cell Science, we are working to combat these issues by exposing students’ real-world STEM/bioscience environments through safe and effective programs and by providing STEM career guidance to help students to make better choices about their education and future careers.

The “STEM Skills” Gap: Deficiencies in STEM Education and Training

Despite the wide availability of bioscience jobs, many students still face difficulties transitioning into a professional bioscience career. This situation occurs in part because schools and colleges are failing to prepare students with relevant skills for the 21st century STEM workforce, creating a “skills gap” that hinders their ability to qualify for jobs. Deficiencies in STEM education and training have been reported at all levels of the US education system. One study by the National Research Council concluded that
K-12 science is often “marginalized” by emphasizing core subjects such as Math and English, “especially in the early grades”. They also found that, “instruction in schools focuses narrowly on received knowledge and simplistic notions of scientific practice”. By focusing disproportionately on core subjects and “traditional textbook theory” schools fail to present science in a relevant and engaging way or provide opportunities for hands-on learning. K-12 students also lack exposure to real science as it is practiced in the real-world. Real-world science and hands-on STEM experiences are essential not only for equipping students with the skills and competencies employers demand but also for inspiring them to pursue science as a career. Without exposure to engaging real-world science young students can’t understand the value of science or perceive themselves working in a STEM profession. Neglect for contemporary science training is not limited to K-12 schools. To cut costs, many colleges also emphasize lecture-based teaching over the
real-world skills needed for a modern bioscience career. A key example we have observed first hand is undergraduate lab classes which are often neglected and designed to reinforce classroom theory, rather than preparing students with actual skills for practicing science in the real-world. To address this issue student’s look to post-graduate programs as a way of gaining additional skills. For many students’ grad school is the default move they make after undergraduate college because they can’t find a job or aren’t sure what to do with their lives due to lack of career guidance. Students who enter grad school without knowing much about the jobs a graduate degree could lead to, risk spending time and money pursuing an advanced education that does not prepare them for their eventual career – particularly since the quality and relevance of graduate programs varies greatly. At Pathways to Stem Cell Science we are working to address the skills gap by providing exposure and training to relevant real-world bioscience skills needed for the modern bioscience workplace. We also encourage students to learn about bioscience occupations, seek professional career guidance and plan their futures carefully before attending college programs.

Education Inequality

The deficiencies in STEM education, college counseling and career preparedness discussed here, disproportionately affect underserved students from low income and minority backgrounds (Figure 6: Inequality in STEM Education and College Counseling). As a result, underserved students are less likely to be inspired, prepared or able to pursue a college education or STEM Career. In the modern skilled-based economy the prospects for low-income students to work their way out of poverty without a college degree are extremely bleak. At Pathways to Stem Cell Science we are working to address this issue by providing underserved students with the motivation, advanced real-world training, confidence and career guidance to pursue a college degree and professional science career. We support the cost of educating socioeconomically disadvantaged students by fundraising for grants, corporate sponsorships and philanthropic donations.

Inequality in STEM Education and College Counseling

<table>
<thead>
<tr>
<th>% of schools offering access to science and math courses according to race</th>
<th>High black/Latino enrollment</th>
<th>Low black/Latino enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calculus</td>
<td>33%</td>
<td>56%</td>
</tr>
<tr>
<td>Physics</td>
<td>48%</td>
<td>67%</td>
</tr>
<tr>
<td>Chemistry</td>
<td>65%</td>
<td>78%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>% of schools that provide supplies and equipment for hands-on science classes</th>
<th>High poverty (&gt;75%)</th>
<th>Low poverty (&lt;25%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4th grade</td>
<td>43%</td>
<td>61%</td>
</tr>
<tr>
<td>8th grade</td>
<td>52%</td>
<td>74%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>% of 8th grade teachers that have all or most of the resources needed to teach math and science</th>
<th>High poverty (&gt;75%)</th>
<th>Low poverty (&lt;25%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math</td>
<td>62%</td>
<td>79%</td>
</tr>
<tr>
<td>Science</td>
<td>49%</td>
<td>75%</td>
</tr>
</tbody>
</table>

High-schools with the highest population of low-income students offer, on average, half as many AP courses in science and math as do schools with wealthier students. Only 1 in 10 people from low-income families earn a bachelor’s degree by age 25 compared to 5 in 10 people from high-income families. High schools serving predominately low-income and minority students have counselor to student ratios twice the national average – 1,000 students versus 470 students per counselor. Low-income students are less likely to take a core curriculum, and less likely to meet readiness benchmarks on college entrance exams. Low-income and minority students are more than twice as likely as wealthy students to attend a school with inexperienced or unqualified teachers. The number of low income students enrolling in college has declined 10 percentage points since 2008. Low-income students are twice as likely to drop out of college than students from high income families.

Student-Centered, Active Learning and Hands-On STEM Approaches

**Benefits**

- Communication
- Critical thinking
- Problem solving
- Knowledge retention
- Creativity
- Improved focus
- Positive attitudes
- Real-world skills
- Collaboration
- Better engagement
- Social development
- Improved behaviour

**Methods and Approaches**

The following methods have been found to be important for implementing a successful student-centered active learning approach in science education:

- Lecture-discussions
- Collaborative learning groups
- Inquiry-based learning
- Outside speakers
- Reflection and review sessions
- Troubleshooting
- Problem solving
- Small groups
- Hands-on activities
- Formative assessment
- Practice opportunities
- Real-world context
- Multimedia presentations
- Question and answer sessions

*We employ all of these methods in our courses at Pathways to Stem Cell Science*

**The Importance of Active-STEM Learning**

An enormous body of research collected globally over the past 45 years has demonstrated that student-centered, active learning provides a superior approach to keeping students engaged, helping them master difficult subjects and preparing them with relevant 21st century skills (Figure 7: Student-Centered, Active Learning and Hands-on STEM Approaches). Active learning is defined as an educational process which requires students to reflect upon ideas, assess their own skills and understanding, gather information and apply their knowledge to solve problems – all while performing a physical or mental activity. Active learning is considered to be student-centered when the content, activities, materials and pace of learning are centered around the student as opposed to the teacher. In this paradigm the teacher acts as a guide, providing students with the skills and opportunities to learn independently and from one another. When properly implemented, student-centered, active learning can lead to many benefits including but not limited to, increased motivation, greater retention of knowledge and more positive attitudes towards the subjects.
being taught. Despite the obvious benefits to this approach, teacher-centered, lecture-based teaching remains the mainstay of many classrooms, both in college and K-12 schools. Even organizations that implement active learning opportunities, do not always dedicate the necessary care and focus required for maximum benefit. This leads to misinformed students who are unaware of their lack of skills, and wrongly believe they are ready for 21st century STEM careers. At Pathways to Stem Cell Science we are working to address this issue by providing student-centered, active-learning opportunities through real-world work-based educational programs which teach authentic skills needed to succeed in STEM education and employment.

The Critical Importance of Extracurricular STEM

Even the most well-funded, well-planned school science programs cannot provide every learning opportunity needed to deliver a comprehensive 21st century science education. Research has shown that extracurricular afterschool STEM programs also needed to create positive attitudes towards science and prepare students for STEM education and careers. It is a widely held consensus by experts around the world that extracurricular afterschool programs do more than just complement school based learning – they provide critical and indispensables skills and education that cannot be provided in a school setting (Figure 8: Extracurricular STEM Program Statistics). Extracurricular afterschool STEM programs are needed to bridge gaps in skills and knowledge; place science within a relevant real-world context; inspire students to pursue STEM courses and careers and enable students to gain the confidence and social skills to succeed. Students who engage in extracurricular afterschool STEM programs perform better academically, socially and professionally. For this reason, education researcher’s and STEM advocacy groups recommend all K-12 and college students engage in regular extracurricular STEM programs

Extracurricular STEM Program Statistics

Education research has shown that extracurricular STEM programs:

- Promote social development
- Improve academic achievement
- Improved science and math literacy/proficiency
- Improve behaviour
- Bridge skills and knowledge gaps
- Create positive attitudes towards STEM learning
- Engage students in STEM learning
- Motivate/inspire students to pursue STEM subjects/careers
- Provide a safe place to learn STEM without fear/stress of academic failure
- Facilitate multidisciplinary learning
- Provide critical training in 21st century knowledge and skills
- Place science in an authentic, real-world context
- Bolster teacher morale by improving behavior and academic achievement
- Improve college graduation rates and STEM retention
- Improve career preparedness and professional development

Following participation in extracurricular STEM programs:

- 78% of students reporting being more interested in STEM
- 80% of students report having more knowledge of STEM careers
- 70% of students report positive gains in 21st century skills
- 90% of teachers report students are more proficient in science and math

* 21st century skills include: perseverance, critical thinking, problem solving, independence, confidence and social skills

after school and/or in the summer. At Pathways to Stem Cell Science we are supporting this recommendation by providing the ultimate afterschool STEM experience for students of all ages, learning abilities and socioeconomic means, taught according to guidelines set by extracurricular experts such as the Afterschool Alliance.

The Importance of and Need for Real-World, Work-Based STEM Learning Opportunities

The term work-based learning refers to all and any learning that is situated in the workplace or designed to prepare students for work-place activities. Examples of work-based learning include (laboratory) workplace internships, professional training programs, classroom career visits and work-skills courses; at Pathways to Stem Cell Science we use all of these approaches to introduce students to work-place skills. Workplace learning is particularly critical for young students to make appropriate career choices and forge successful professional careers (Figure 9: Work-Based Learning Statistics). The benefits of work-based learning, which include improved school/college attendance, academic achievement and graduation rates, have been shown to also continue into employment. Students who take part in workplace learning report the skills and confidence they gain open new opportunities for promotion and career progression. These programs also provide tremendous and widely recognized benefits for employers by creating work-ready staff. Even students themselves understand of the importance of workplace exposure and have communicated a clear desire for increased participation in work-based learning activities. Despite the benefits of a work-based learning approach, the vast majority of students to not gain adequate exposure to work-based education, particularly in STEM subjects which can involve complex and potentially dangerous work environments. At Pathways to Stem Cell Science we are working to fill this need by providing one of the only known opportunities for young students in grades 8-12 and college to learn real bioscience techniques and work practices in a professional biotech work place, as they are carried out by professional scientists.

Work-Based Learning Statistics

Work-based learning programs have been shown to:
- Increase school attendance and reduce drop out rates
- Improve college attendance and graduation rates
- Improve academic achievement
- Improve career awareness, exploration and preparedness
- Provide opportunities for career progression
- Improve job prospects for graduating students
- Improve future chances for promotion
- Improve motivation for career development
- Provide positive benefits for employers

10%-20% average increase in college attendance by students who take part in work-based learning

67% of college students report workplace internships would have improved their employment-readiness

20% of high school students report gaining access to work-based learning (i.e. job shadowing or volunteering)

82% of high school students report wanting work-based learning and that it would benefit them

fields are more creative and innovative when they include people from different backgrounds with distinct experiences and ways of thinking. Science workforce diversity refers to the cultivation and full inclusion of scientific talent from across the social spectrum. Diversity leads to better problem-solving, expands the talent pool and is important for long-term economic growth (Figure 10: STEM Diversity Statistics). Currently, there are significant imbalances in racial, cultural and gender representation across all scientific fields. At Pathways to Stem Cell Science we are working to address this issue by educating students of all genders from a diverse range of social, ethnic and racial backgrounds and by providing supportive role models for women and minority students who are interested in entering a science or medical careers.

References

7. National Science Board
OUR VISION

For bringing real-world stem cell science to students of all ages
## CURRENT COLLEGE COURSES

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>Duration</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional Cell Culture Workshop</td>
<td>Provides training in essential cell culture techniques required for working in a professional bioscience laboratory</td>
<td>3-days</td>
<td>Introductory</td>
</tr>
<tr>
<td>Pluripotent Stem Cell Workshop</td>
<td>Teaches essential methods for culturing, cryopreserving and analyzing human pluripotent stem cells</td>
<td>3-days</td>
<td>Advanced</td>
</tr>
<tr>
<td>CIRM Bridges Stem Cell Techniques Course</td>
<td>Comprehensive training in methods for deriving, culturing, cryopreserving and analyzing human pluripotent stem cells</td>
<td>5-days</td>
<td>Advanced</td>
</tr>
</tbody>
</table>

## CURRENT HIGH SCHOOL COURSES

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>Duration</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stem Cell Field Trip</td>
<td>Features college-level lecture discussions, hands-on classes with cancer stem cells and a career development seminar</td>
<td>1-day</td>
<td>Introductory</td>
</tr>
<tr>
<td>After School Program</td>
<td>Introductory hands-on course focusing on stem cell engineering and RNAi mediated gene knock-down techniques</td>
<td>5-nights</td>
<td>Introductory</td>
</tr>
<tr>
<td>EiHS Stem Cell Academy Program</td>
<td>Provides training and education in the basic biology of three human stem cell systems: cancer, adult and pluripotent</td>
<td>5-days</td>
<td>Introductory</td>
</tr>
<tr>
<td>EiHS Regenerative Medicine and Disease Modeling Program</td>
<td>Teaches students how to create human induced pluripotent stem cells and beating heart cells for research and therapy</td>
<td>10-days</td>
<td>Intermediate</td>
</tr>
<tr>
<td>EiHS Research Internship Program</td>
<td>PhD style training program featuring independent research, educational science forums and a research poster presentation</td>
<td>8-weeks</td>
<td>Advanced</td>
</tr>
</tbody>
</table>
EiHS CIRM SPARK Program

The EiHS CIRM Summer Program to Accelerate Regenerative Medicine Knowledge (SPARK) is a hands-on research internship program run collaboratively by Pathways to Stem Cell Science and the California Institute of Technology (Caltech). Funded by a grant from the California Institute for Regenerative Medicine (CIRM), EiHS CIRM SPARK enables six students to participate in stem cell research at Caltech funded by a full tuition scholarship.

EiHS CIRM SPARK is part of a larger CIRM initiative to provide advanced science education to low income students who lack the means to participate in summer research programs. Participating students follow a similar curriculum to the EiHS Research Internship Program, completing introductory techniques training, hands-on research, educational forums and career development seminars.
EiHS Journal is a scientific publication written by high school students for high school students. It covers a range of popular topics in science and stem cell research and features articles written by participants of the EiHS Program. Students from any EiHS course can submit an article to the EiHS Journal. The publication is disseminated freely to support public outreach and education.
Custom Courses

Pathways to Stem Cell Science offers a custom course design service for educators to enhance their curriculum with advanced bioscience and laboratory-based training. We create tailored courses for students of all ages from kindergarten to university post graduates. Our courses involve engaging classes taught using a range of innovative methods including hands-on labs, lecture-discussions and independent research assignments. We have expertise in a wide range of topics from basic cell biology to stem cell science to professional laboratory management.
1. Identify a Skills Gap

Our course development process begins with identifying skills, techniques, and real-world applications that are not taught to the standard needed to be a practicing bioscientist, in either school or college. We focus on core skills and specialized procedures required for emerging bioscience fields.

Example Techniques
- Cell culture
- IPSC derivation
- Microscopy
- PCR
- Flow Cytometry
- Cloning

2. Protocol Development

Because novice scientists find it difficult to understand and perform professional bioscience techniques, we translate them into easy-to-follow protocols designed specifically for young trainees. These protocols are developed by optimizing a technique until it is streamlined and less complicated to perform, yet still produces the same industry-level result. We standardize finicky steps and test different ways of performing techniques to find the most efficient approach. Unlike university or school protocols, our protocols impart real scientific procedures that can be implemented in a real-world bioscience laboratory. The resulting techniques and protocols form the basis for our laboratory training manuals and also our own standard operating procedures.

3. Curriculum Development

The final step of our course development process involves creating a course curriculum to teach our optimized techniques within the context of an engaging topic relating to stem cell science and regenerative medicine. Our curriculum is composed of three main components: Hands-on lab classes, lecture-discussions, and real-world enrichment activities.

- **Hands-On Lab Classes**
  - Hands-on lab classes typically comprise more than 70% of our course curriculum. They feature a range of activities including:
    - Optimized real-world bioscience techniques
    - Specialized stem cell techniques
    - Lab safety education
    - Lab management
    - Equipment training
    - Reagent purchase, preparation and storage
    - Troubleshooting problems

- **Lecture-Discussions**
  - Lecture-discussions are held prior to each laboratory class to provide a theoretical overview of the protocols and techniques. They connect textbook science to real-world application and typically include the following information:
    - Real-world knowledge
    - Basic bioscience theory
    - Technical details (i.e., how techniques are performed, including a breakdown of the individual steps, the science behind how they work, why they are important, and what goes wrong when they are not performed correctly)
    - Purchasing options for laboratory reagents
    - Approaches to amending and improving technical procedures
    - Troubleshooting problems
    - Real-world application and implementation of lab techniques
    - Biosafety and regulation
    - Purpose and importance of lab techniques

- **Real-World Enrichment**
  - To promote the development of professional work-based skills, our curriculum is enriched with the following types of real-world activities:
    - Teamwork, cooperation
    - Communication and networking
    - Professional lab facilities and equipment
    - Guest lectures from academic, medical, and industry scientists
    - Individual time management
    - Independent research skills
    - Career development seminars
Program Benefits

Pathways to Stem Cell Science is a non-profit training institute offering unique hands-on courses with educational benefits that are not provided by conventional schools and colleges.

HIGHLY SOUGHT AFTER SKILLS
Our Programs teach highly-sought after skills required by all bioscience industries.

FEMALE ROLE MODELS
Our instructors include women with children, providing valuable female role models for young women looking to balance a science career and family.

STEM CELL EXPERIENCE
Our students enjoy the rare opportunity to isolate, culture and differentiate human stem cells: less than 1% of K-12 and college students gain this unique experience.

INNOVATIVE CURRICULUM
Tried and tested at six universities including USC, our real-world curriculum is adapted from industry training programs, developed by university professors who are also stem cell experts.

REAL WORLD LABORATORIES
Our courses are taught with state-of-the-art equipment in professional R&D laboratories in academic, industry and medical facilities.

COURSE VARIETY
We offer a variety of courses to suit different interests, aptitudes and career goals - held throughout the year.

EXPERT INSTRUCTORS
Our courses are taught by professional scientists who are also exceptional teachers.

CAREER GUIDANCE
Our students receive career guidance from professional scientists who understand the bioscience jobs market and what it takes to forge a successful science career.

ADVANCED TEACHING METHODS
We use a variety of advanced teaching methods including college-level lecture-discussions, research-style seminars and hands-on lab classes.

SIMPLE ADMISSION
Eligible students are admitted on a rolling basis, first come first served. Unlike college-based programs we do not charge application, housing or health fees or require an extended (year-long) time commitment.

INDIVIDUAL MENTORSHIP
Our students receive personalized training and mentorship in small classes with an average student to teacher ratio of 5:1.

CONTINUING SUPPORT
We provide continuing support through letters of recommendation, career counseling and alumni resources.
OUR IMPACT

Teaching

9 YEARS EXPERIENCE
74 COURSES RUN
610 COLLEGE STUDENTS
134 K-12 STUDENTS
100% STUDENT SATISFACTION

Student Demographics*

41% OF OUR STUDENTS COME FROM MINORITY GROUPS
41% OF OUR STUDENTS RECEIVE A TUITION SCHOLARSHIP
64% OF OUR STUDENTS ARE FEMALE
100% OF K-12 STUDENTS GO ON TO ATTEND COLLEGE
WE ACCEPT STUDENTS FROM ALL SOCIOECONOMIC BACKGROUNDS

Course Evaluation

Application Process
Course Instructors
Teaching Quality
Facilities and Equipment
Lab Skills Training
Recommend to Others

What our students say

Transformative experience that changed my life and helped me gain confidence
The Early Investigator High School (EiHS) Program truly launched my research career
This program gave me an edge over people I am competing against in college
Tremendously helpful for preparing me to work in a research lab - I've used all the techniques I learned with Dr. Fox

* Data represents students tracked from 2008 - 2017 and includes alumni from USC and Pathways to Stem Cell Science.
* Data reflects high school students only.
Success Stories

Annelise Colvin
Annelise Colvin is a graduate of the 2013 EiHS Research Internship Program, which she attended through a full tuition scholarship funded by Jeffrey and Johanna Gunter. When Annelise joined the EiHS program she was planning to apply to medical school, but found a passion for research studying juvenile diabetes in the laboratory of CHLA scientist Dr. Senta Georgia. As a result, Annelise is now planning to pursue an MD PhD after completing her undergraduate degree in human developmental and regenerative biology at Harvard University. Annelise credits her success and future career choices to her experiences in the EiHS program.

Lifeline Education Charter School
Lifeline Education Charter School (Lifeline) provides educational services for socioeconomically disadvantaged students living in the underserved communities of Compton and South Central Los Angeles. We first began working with Lifeline in 2012, and have since educated more than 25 of their students in the EiHS program. Our partnership has made a tremendous impact on the school, improving student moral and college attendance rates. With our help, Lifeline students have progressed from attending only local community colleges to entering the college of their dreams, including ivy league institutions like UC Berkley. Lifeline students who attend the EiHS Program are also more likely to pursue postsecondary STEM education and employment.

Adriana Millan
Adriana Millan is a graduate of the 2016 EiHS CIRM SPARK Program – a CIRM funded EiHS Research Internship Program operated collaboratively by the California Institute of Technology and Pathways to Stem Cell Science. The unique opportunity to participate in hands-on stem cell research changed Adriana’s life for the better, by providing her with the confidence and experience to apply to a four-year college. Adriana now attends UC Berkley, where she is majoring in Biology. Adriana’s entire family also moved with her to Berkley to support her dream of attaining a college education and a better life.
JEANNE M. HUYBRECHTS, Ed.D.  
Former Head of Harvard-Westlake School

'Young people learn science best by doing science……our students have participated in EiHS research, and for every one of them it was a transformative experience, one that shaped their perception of the nature of scientific inquiry and strengthened their desire to become scientists……Our young people can do so much when encouraged and nurtured in programs like EiHS.'

ALAN ABRAHAMSON  
Award Winning Sports Journalist and Parent of two EiHS Research Internship Fellows

"Our son’s experience at EiHS was transformative. He not only learned valuable laboratory research skills—he gained a true appreciation for the importance of collaboration in research and its enormous potential to save lives, and he is now inspired to do more."

Marialuisa Flores  
2014 EiHS Research Internship Fellow

'The EiHS program was an once-in-a-lifetime opportunity which changed my life for the better.……It was experience that I will never forget. It gave me a view on a lot of things that I never even knew existed. I give a special thanks to Dr. Victoria Fox, the EiHS director, and my personal mentor who has given me the opportunity to be a part of this unforgettable experience.'

OBED NARTEY  
Principal, Lifeline Education Charter School in Compton

"My students have definitely been inspired by the EiHS Stem Cell Research Program……The staff at EiHS have been caring and understanding towards our students. Dr. Fox has done an excellent job in helping our students to understand that anything is achievable if they work hard and gain a good education."

Jeffrey Gunter MD.  
Director and Founding Donor of the EiHS Program

"EiHS is transforming the inner city youth through its two-week program. The eight-week Research Internship Program not only creates future scientists, but also motivates those students in their application to the finest universities in the country. In the premier state for Stem Cell research, EiHS is now the authority and premier brand in stem cell education. For our family: philanthropy well spent."
What Our Students Say

Dear Dr. Fox,

Thank you for taking the time to write my recommendation letter for college applications. Your support and time means a lot to me. Have a great holiday season!

Sincerely,
Scott Nussbaun
Leadership

**Dr. Victoria Fox**
Dr. Victoria Fox is the president and executive director of Pathways to Stem Cell Science and CEO of the stem cell consultation company PluriCORE. Formerly Dr. Fox was an assistant professor of research at USC.

**Dr. Jeffrey Gunter**
Dr. Jeffrey Gunter is a board certified dermatologist, businessman and philanthropist. He is also the co-founder of the EiHS program.

**Dr. Martin Pera**
Dr. Martin Pera is a professor at the Jackson Laboratories in Maine. Formerly he was the Director of the Monash Institute of Medical Research, Chair of Stem Cell Sciences at The University of Melbourne and Program Leader of Stem Cells Australia. He was also the Founding Director of the Eli and Edythe Broad Center for Regenerative Medicine and Stem Cell Research at USC.

**Dr. Thomas Zwaka**
Dr. Thomas Zwaka is a Professor of Cell, Developmental and Regenerative Biology at Mount Sinai Medical Centers in New York and Interim director of the Black Family Stem Cell Institute

**Mr. Mark Cervi**
Mr. Mark Cervi is a CPA and a senior director at the restructuring, financial and corporate advisory firm Zolfo Cooper. Mr. Cervi also serves as treasurer of the board.

**Mr. Joseph Bobek III**
Mr. Joseph Bobek III is a partner, general counsel and secretary of Landmark Dividend LLC. Mr. Bobek also serves as secretary to the Board of Pathways to Stem Cell Science.

**Dr. Pamela Eversole-Cire**
Dr. Pamela Eversole-Cire is a visiting professor at Caltech and director of the Biotechnology program at Pasadena City College.

Pathways to Stem Cell Science board of directors have expertise in scientific research, medicine, education, law, business, finance and philanthropy.
Our Dedicated Staff

Dr. Victoria Fox
President and Executive Director

Dr. Victoria Fox is the founder, president and executive director of Pathways to Stem Cell Science. She is a faculty course instructor with Cal State Channel Islands and CEO of the stem cell consultation company PluriCORE LLC. Formally an assistant professor of research and Stem Cell Core Director at the University of Southern California, Dr. Fox has significant experience providing hands-on training with human stem cells to students of all levels from Pre-K to tenured professors. Dr. Fox has trained upwards of 1000 individuals at USC and Pathways to Stem Cell Science. She oversees all aspects of the institute from day-to-day operations and fundraising to curriculum development and teaching.

George Tseng
Instructional Laboratory Specialist

Mr. George Tseng is an instructional laboratory specialist with Pathways to Stem Cell Science. Formally Mr. Tseng was a research associate at City of Hope’s Department of Cancer Biology studying the effects of androgens in the pathogenesis of prostrate cancer. Mr. Tseng is a graduate of the highly regarded biotechnology program at Pasadena City College where he also participated in the prestigious CIRM Bridges to Stem Cell Research Program. His research at USC focused on developing industrial methods for deriving and characterizing induced pluripotent stem cells.
Facilities

Pathways to Stem Cell Science is headquartered at LabLaunch Monrovia – a biotechnology incubator and entrepreneurial think tank where elite scientific innovators translate their cutting-edge ideas into real-world applications.

Lab Launch Monrovia houses a diverse array of companies ranging in focus from drug development to stem cell therapeutics. It is uniquely situated in one of LA's only biotech clusters, adjacent to City of Hope's Beckman Institute Laboratories and established companies such as ChromoLogic LLC and LabCorps. We are also located within driving distance to our partner laboratories at USC, CHLA, HMRI, Caltech, UCLA and City of Hope, where students are placed during research internships.


As tenants of Lab Launch Monrovia we also benefit from many shared resources including conferencing facilities, analytical equipment and an exceptional scientific community. Pathways to Stem Cell Science is to our knowledge the only extracurricular STEM institute to be headquartered in an entrepreneurial industry setting.
Biological Industries USA to Support Training Programs for Young Scientists through Partnership with Non-Profit Institute Pathways to Stem Cell Science

By Lia Kent, Biological Industries – 5/12/17
“Being able to contribute to a scientific project that can play an important role in someone’s life is an amazing opportunity, and I would not trade it for the world.”

USC Offers a Summer of Stem Cells for Local High School Students

By Cristy Lytal, USC News – 8/14/14
“Being able to contribute to a scientific project that can play an important role in someone’s life is an amazing opportunity, and I would not trade it for the world.”

Summer School Students Help Scientists Advance Stem Cell Research at USC

By Stephanie O’Neill, KPCC/Southern California Public Radio - 8/9/12
“This is one of the great spots for looking into regenerative medicine and stem cells in general… I couldn’t have asked for anything more to do with my summer.”

Summer Camp Allows Young Scholars to Participate in Stem Cell Research

By Businesses.com.au - 7/18/14
“Known as the Early Investigator High School Program (EiHS), students work with leading faculty members to conduct cutting edge studies.”

Acknowledgements

Pathways to Stem Cell Science
Victoria Fox (PhD)
George Tseng
Kathy Rich (PhD)

Board of Directors
Jeffrey Gunter (MD)
Mark Cervi (CPA)
Joseph Bobek III
Pamela Eversole-Cire (PhD)
Thomas Zwaka (MD, PhD)
Martin Pera (PhD)

California Institute for Technology
Shirley Pease
Henry Lester (PhD)
Debra Navarette
Gayleen Ursula

Biological Industries
Dan Haus (PhD)
Lia Kent (PhD)

USC Stem Cell Core Facility
Jing Du
Susan Zhu
Gohar Saribekyan
Jack Saribekyan
Kanomi Sasaki Capela
Sunny Bhalla
Paul Shirakowa
Sarah Webster
Laura Marie-Nucho
“Science is an imaginative adventure of the mind seeking truth in a world of mystery.”
– Sir Cyril Herman Hinshelwood