

## **CASE STATEMENT**

### **ORGANIZATIONAL MISSION**

Former BYU President, Rex E. Lee's name is inseparably connected with the Cancer Research Center at BYU. President Lee, diagnosed with immunoblastic T-cell lymphoma, passed away during his tenure as university president. To remember him in a fitting and forward-thinking way, BYU students organized the "Rex Lee Run Against Cancer". Over the past 19 years, more than 27,000 students and community members have participated in this annual event. The proceeds are donated to the University's Cancer Research Center and are used to award fellowships to students conducting cancer research at BYU. While most students are hunting for a summer job, these fellowships support students as they focus entirely on cancer research during the summer months.

In 2012, BYU student Andrew Roach participated in the Rex Lee Run. Andrew is a cancer survivor of the same type of cancer that took President Lee's life. He chose to run in honor of Rex Lee and in recognition of the hope that cancer research offers to anyone affected by this disease. In Andrew's own words:

So, I was diagnosed with the same type of cancer as Rex Lee. It took his life. Fortunately for me, the technology we have today made my experience a lot easier and a lot quicker than other people I've talked to who had cancer [treatment] ten years ago, or even a few years ago. It's a very different experience. It's awesome that in six months, I can be completely treated without radiation because the chemotherapy works. I was treated quickly and efficiently because people have studied the medicine, they have studied the disease and have found different methods [for treating it]. We really want to make people aware, and so we raise money for the research. We try to reach people's hearts and say, "You know if we can do the research now, we can come up with better methods for treating cancer that aren't as painful, that are quicker, and more effective . . . because it's probably going to affect everyone sometime . . ."

There are few people in today's world that have not been affected by cancer—either personally or through a family member, neighbor, or friend who has battled or is currently battling this disease. Andrew's story speaks to the value of cancer research in all its aspects—he is now free from the same cancer that took President Lee's life.

### **CANCER RESEARCH AT BYU**

The Cancer Research Center at BYU is a stand-alone research facility focused on solving the fundamental issues underlying cancer--studying the cellular mechanisms of cancer development and how to target and block the cancer-causing mechanisms. This very basic research is essential in order for the next research phase—clinical human trials conducted at medical institutions—to follow.

Cancer Research at BYU is conducted by multiple research faculty in various departments and colleges across campus. Their research is financially aided through fellowships granted by the Cancer Research Center to student researchers. This affords student recipients an opportunity to continue cancer research under the direction of a faculty mentor, and provides faculty with resources to conduct more effective and in-depth research.

The purpose of the Cancer Research Center comes from a charge given to former BYU President, Dallin H. Oaks, by President Harold B. Lee, president of The Church of Jesus Christ of Latter-day Saints, at President Oaks' inauguration:

We would hope that you would give to the students of this institution the vision of the possibility that the Eyring Science Center could make a significant contribution to the discovery of a cure for cancer . . .

The Cancer Research Center's mission and vision statements reflect this charge.

### **Mission Statement**

To establish the BYU Cancer Research Center as a nationally-acclaimed institution for the training of graduate and undergraduate students in cancer research.

### **Vision**

The BYU Cancer Research Center will be actively engaged in conducting and publishing innovative research that will significantly contribute to a cure for cancer.

## **OBJECTIVES – BYU CANCER RESEARCH CENTER**

The objectives and goals were clearly defined at the inception of the Cancer Research Center. They carry through today, consistent with the purpose for the center:

- Identify, consolidate, and professionally cultivate an interdisciplinary faculty with significant training, skill, and experience in performing cutting-edge cancer research
- Establish a vigorous mentorship program that encourages and supports undergraduate involvement in research done in laboratories studying cancer
- Establish a stable source of funding to:
  - Support graduate and undergraduate researchers
  - Provide additional mentors (postdoctorals, experienced grad students, visiting faculty)
  - Support seminars, sabbaticals, and in-house training in cancer research
  - Provide a bridge-grant program to amplify and leverage the ability of the BYU Cancer Research Center faculty to maintain consistently high levels of external funding.

Students graduating from BYU who have been involved with the Cancer Research Center have a competitive edge when applying for graduate programs at highly ranked universities across the United States. Xiuqi Li “Jade” is a 2014 graduate of BYU who participated in the Cancer Research Fellowship Program as an undergraduate. While interviewing for graduate programs at Harvard, Duke, and Yale, Jade reported that the interviewing committees were most impressed with her cancer research fellowship opportunity. She will be attending Yale University to pursue a PhD in Biological and Biomedical Sciences.

John Prince, former BYU faculty in Chemistry and Biochemistry and one of the 2014 Cancer Research Fellows Workshop speakers, noted a similar experience. As an undergraduate at BYU, he was awarded a cancer research fellowship. Following graduation, he continued his graduate studies at the University of Texas at Austin and his post-doctoral studies at the University of Colorado, Boulder. He reports that his experience doing cancer research as an undergraduate provided him with expertise and qualified him for research opportunities in greater depth than other graduate students at his same level.

## **SPECIFIC GOAL**

In 2014, we had more qualified applicants with worthy research proposals than we were able to fund. The program is growing and we would like to grow with it by funding all applicants who qualify for the fellowship program. However, this requires adequate funding and ever-increasing resources.

We propose to establish a “Fund a Cancer Research Fellow” initiative that would increase the number of fellowships awarded annually. Specifically, for the 2014-2015 academic year, we would like to solicit donations of \$8000 from individuals who share our desire to further cancer research. This amount would fund one student researcher from April through August—BYU’s Spring/Summer Term. Each donor would be linked with a specific fellow whose research aligns with the donor’s general research interest, chosen from a list of options provided by the Cancer Research Center. Donors would be invited to participate in the opening and closing summer fellowship programs, where they would meet with their fellow and witness first-hand the impact of their donation. We anticipate this to be a rewarding opportunity for researcher and donor, alike.

## **CANCER RESEARCH FELLOWSHIP PROGRAM**

The Cancer Research Fellowship program was the vision of former director, Dr. Daniel Simmons. Since its establishment in 1998, 236 students have been afforded the opportunity to continue their cancer research full-time during the summer months under an expert cancer research faculty member. In an interview with the Church News, Dr. Simmons stated, “As these faculty members make breakthroughs in cancer research, they will also be training students who they hope will continue in their study of cancer.” (Church News, 30 May 1998)

The unique structure of the program offers the following:

- Mentored cancer research under the direction of a principal investigator in a laboratory
- A paid research opportunity that is relevant to the student’s academic interests and career pursuits
- Funding that allows students to focus solely on full-time cancer research
- Participation in weekly seminars where expert speakers share their specific research in relation to cancer research
- Potential publication of research findings
- Networking opportunities with other cancer researchers
- An opportunity to present research findings to other fellows and guests at the program’s close

Students wanting to participate in the program submit a proposal for review. The proposals must be endorsed by a faculty member. The proposals are reviewed by a faculty committee of cancer researchers according to the following criteria:

- Significance of proposed research
- Well-defined approach--research framework, design, methods, and analyses
- Feasibility of plan--likelihood of success and potential pitfalls
- Grantsmanship: instructions followed precisely
- Preparation and commitment of student
- Research potential and link to cancer research priority of faculty mentor

## GOVERNANCE– 501(c)(3)

The Cancer Research Center is jointly sponsored by the College of Physical and Mathematical Sciences and the College of Life Sciences. Merrill Christensen, PhD, from Life Sciences, is the director and Steve Castle, PhD, from Chemistry and Biochemistry is the associate director. Both directors have been involved with the center for several years and bear a vested interest. Members, all BYU faculty, are listed in the tables below, both by the department they represent and their cancer interest. While all principal investigators who have had cancer research fellows in their lab are members of the Cancer Research Center, active members tend to be those with current research fellows in their lab, making this group dynamic in nature. Financial oversight is administered by the colleges' controllers, Kurt Huntington and Russell Nielson, as well as Kim Christensen, controller of the Chemistry and Biochemistry Department.

**Table 1- BYU-CRC Membership by Department**

<b>Chemistry and Biochemistry</b>	<b>Microbiology &amp; Molecular Biology</b>	<b>Health Sciences</b>
Joshua Andersen	Bradford Berges	Ray M. Merrill
Merritt Andrus	Laura C. Bridgewater	<b>Chemical Engineering</b>
Greg Burton	Julianne Grose	William G. Pitt
Steven L. Castle	Kim L. O'Neill	Brad Bundy
Matt Peterson	Richard Robison	<b>Nutrition, Dietetics &amp;</b>
John C. Price	Scott Weber	<b>Food Science</b>
Joshua Price	<b>Physiology &amp; Developmental Biology</b>	Merrill J. Christensen
Paul Savage	Jonathan Alder	Jason Kanealey
Daniel Simmons	Jeffery Barrow	Jeffery Tessem
Richard Watt	John D. Bell	<b>Biology</b>
Barry M. Willardson	Marc D. Hansen	Stephen Piccolo
Adam Woolley	<b>Electrical Engineering</b>	<b>Statistics</b>
	Aaron Hawkins	G. Bruce Schaalje

**Table 2- BYU-CRC Membership by Interests**

<b>Drug/Diagnostic Discovery</b>	<b>Cancer Biochemistry</b>	<b>Cancer Immunology</b>
Merritt Andrus	Jonathan Alder	Joshua Andersen
Brad Bundy	Jeffery Barrow	Brad Berges
Steven L. Castle	John D. Bell	Greg Burton
Aaron Hawkins	Merrill Christensen	Richard Robison
Kim O'Neill	Marc Hansen	Scott Weber
Matt Peterson	Jason Kenealey	<b>Cancer Genetics</b>
William G. Pitt	John C. Price	Laura Bridgewater
Joshua Price	Daniel Simmons	Julianne Grose
Paul Savage	Jeffery Tessem	<b>Bioinformatics</b>
Adam Woolley	Richard Watt	Stephen Piccolo
<b>Cancer Epidemiology</b>	Barry M. Willardson	G. Bruce Schaalje
Ray M. Merrill		

## STAFF

Under the direction of Drs. Merrill Christensen and Steve Castle and coordinated through Sue Mortensen in the Chemistry Department, the Cancer Research Center is staffed by student employees. The student program director assumes responsibility for office financial records, organizing volunteers, administrative oversight for the Rex Lee Run, and the summer Cancer Research Fellowship program. This position is supported by the Rex Lee Run Project Manager, who manages the logistics and other aspects for the run. The project manager is trained to assume the job of program director, creating a seamless transfer of responsibilities, a consistent operation, and a continued relationship with sponsors of the Rex Lee Run

Additionally, the Cancer Awareness Group (CAG), a student service club on campus is the sponsor and volunteer army behind the Rex Lee Run. All proceeds from the run are donated by CAG to the Cancer Research Center.

## DEVELOPMENT AND FINANCES

Sources of funding for the Cancer Research Center include the following:

- Endowment to the College of Life Sciences (formerly the College of Biological and Agricultural Sciences)
- Endowment to the College of Physical and Mathematical Sciences
- Cancer Education Endowment
- Rex Lee Run proceeds
- Small donations made to the university through BYU-LDS Philanthropies specified for the Cancer Research Center

Endowment funds have been victim to the stock market and economic downturn during the first decade of this century. However, as the economy has improved, so has the return from these investments. The accounts have been carefully managed through the university and are showing increased earnings since 2010 (see appendix). Additionally, during those down years, the number of cancer research fellowships awarded stayed constant due to careful management of funds donated through the Rex Lee Run. Because of expert oversight and care, the endowment principals were preserved and not compromised.

Net revenue from the Rex Lee Run has generally decreased since 2008, with a recent upturn for the 2014 run (see appendix). This return from decline in both participation and sponsorship has been encouraging, and it is the goal of the Cancer Research Center to continue to sponsor the run which is approaching its 20<sup>th</sup> anniversary.

With sustainable funding for growth, the Cancer Research Center will be able to realize its vision. Our goal is to increase sustainable funding so that more students will have an opportunity to be trained and primed for careers in cancer research. We anticipate that the “*Sponsor a Cancer Research Fellow*” initiative will do just that, and become the spring board to maximize our endowment growth to our \$3,000,000 goal, and beyond. We hope to see the cancer research fellowships become year-round research opportunities, rather than being limited to spring and summer terms.

## HISTORY

In response to the charge from Harold B. Lee to BYU President, Dallin H. Oaks, the Cancer Research Center at BYU was announced in 1978. Roland K. Robins, professor of Chemistry and Biochemistry and one of the nation’s leading medicinal chemists was appointed director. The objective from the beginning of the center was basic cancer research. Dr. Robins was quoted as saying, “We will pursue an answer to the cancer problem using molecular probes and combining the resources of the

University's impressive programs in virology, thermochemical and enzyme research." Succeeding directors, all recognized experts in their field of study, include:

- John Mangum, Biochemistry: 1985-1990
- Brian Murray, Microbiology and Immunology: 1990-1997
- Daniel Simmons, Biochemistry: 1997-2014
- Merrill Christensen, Nutrition, Dietetics and Food Science: 2014 to present

Since the organization of the Cancer Research Center, there have been several breakthroughs in research that have aided or are projected to aid in a cure for cancer. Some of the breakthroughs were serendipitous and unexpected—the result of conscientious inquiry and data gathering.

- 1989 – Discovery of COX-2 enzyme, the target of aspirin-like drugs, involved in numerous human tumors
- 1992 – Discovery of an enzyme that was linked to the recurrence of breast cancer
- 1993 – Found that ribavirin, a drug used to treat hantavirus, interacts with a regulatory gene sequence of the HIV virus
- 1995 – Study of a bacterial solution in abundance on human skin demonstrated that it could be instrumental in activating the body's own immune system to combat tumor growth
- 1998 – Identification of a protein that pumps chemotherapeutic drugs out of cancerous cells
- 2003 – Successfully tested a new method of targeted drug delivery to cancerous cells using ultrasound technology
- 2006 – Developed extremely efficient method for synthesis of Leukemia drug, Cladribine
- 2010 – Discovered BMP2 protein, indicated in cell nucleus development
- 2011 – Created a nucleoside with selective toxicity against colon cancer cells
- 2014 – Discovered, *Programmed Cell Death Protein 5*, instrumental in blocking cell division in cancerous cells
- 2014 – Discovered a novel mechanism used by tumor cells to activate autophagy, a process that promotes chemo-resistance in many cancer types

The vision for the Cancer Research Center has been there from the beginning and has not been lost in changes in leadership, economic downturns, or lack of public interest or need. We all want to trust that a cure for cancer is just around the corner. The Cancer Research Center at BYU is here to support the faculty and student cancer researchers who will carry the trust and hope forward . . . that someday there will be a cure for cancer.