

# The Princess Margaret

## ON THE FRONT LINES

Meet the team pushing  
the body's boundaries

## DISCOVERY AND INNOVATION

Why we lead the way

## BOOSTING THE ARSENAL

Empowering the body  
to battle cancer

# THE CANCER WARRIOR UNLEASHED

How Your Immune System  
Could Help Conquer Cancer

## MESSAGE FROM OUR LEADERS



It's one of the biggest ideas of the past decade, with the potential to revolutionize cancer therapy, and it's happening at Princess Margaret Cancer Centre. Immunotherapy is about harnessing the body's own immune system to attack and kill cancer.

This past January at the J.P. Morgan Healthcare Conference, a preeminent investors' event, immunotherapy research and treatment generated intense interest. Even more striking, academic journals agree with these healthcare executives and investment analysts.

Why the hype? Let's start with the remarkable cancer treatment that helped save former U.S. President Jimmy Carter's life. In August of 2015, he announced he had melanoma and it had spread to his liver and brain. He underwent surgery, radiation, and a new cancer treatment, immunotherapy. Fast forward to December and another announcement, there were no further signs of cancer in his body.

In March, Johns Hopkins established a cancer immunotherapy research centre with two \$50-million gifts — from former New York City Mayor Michael Bloomberg and Jones Apparel Group Founder Sidney Kimmel. An additional \$25 million came from others.

There's also Silicon Valley billionaire Sean Parker, of Napster and Facebook fame, who committed \$250 million to bring together more than 300 researchers from six key U.S. cancer centres to advance developments in cancer immunotherapy.

As one of the top 5 cancer research centres in the world, The Princess Margaret has already seen significant breakthroughs in immunotherapy. We will continue to lead the way with the generous support of our community. Help us push discoveries and new treatments forward.

**PAUL ALOFS**  
President & CEO  
The Princess Margaret  
Cancer Foundation

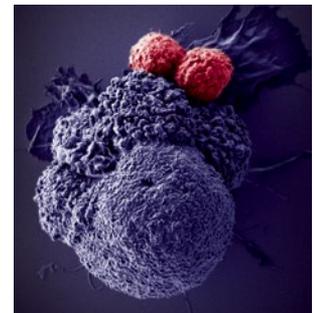
**GLENN IVES**  
Chair, Board of Directors  
The Princess Margaret  
Cancer Foundation

## The Princess Margaret

feature publication

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### ON THE COVER



An example of immunotherapy in action – two T-cells [red] attacking an oral cancer cell. Image captured by U.S. cancer researcher Dr. Rita Serda.

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“I was very, very fortunate to get on an immunotherapy drug trial program, which has brought great success and new hope to my life.”

## 4<sup>TH</sup> CANCER BATTLE, NOW WITH IMMUNOTHERAPY

In the past six years, Jeanette Edl has faced the fight of her life four times.

In May of 2010, she was diagnosed with endometrial cancer, which occurs in the lining of the uterus. “It came back on three occasions,” says Edl.

It also spread to her lungs.

Edl went through chemotherapy and radiation, as well as targeted drug therapy. Yet after all of these treatments, she found herself facing Stage 4 lung cancer last year.

That diagnosis brought her to Canada’s leading cancer centre, The Princess Margaret, where she took part in an immunotherapy clinical trial.

Edl was treated with a drug that is intended to provoke a response from her immune system to attack the cancer.

Within a few months, scans showed the tumors in Edl’s lungs had shrunk by 70%.

“I was very, very fortunate to get on an immunotherapy drug trial program, which has brought great success and new hope to my life,” says Edl. She hopes she will live to see her four grandchildren (shown in the photo above) grow up.

Edl says she and her family are simply in awe of the potential of immunotherapy.

“Immunotherapy is truly an area that could help many, many people with cancer who are fighting for their lives,” says Edl.



### MESSAGE FROM

## PHILLIP CRAWLEY

PUBLISHER AND CEO OF THE GLOBE AND MAIL

As a cancer survivor, I am deeply passionate about the cancer cause. Immunotherapy is in its very early days but the potential of harnessing the body’s own immune system to target and fight cancer holds incredible promise. This publication features stories about the science of immunotherapy, as well as the patients who are receiving treatment. Importantly, it also showcases the talented experts who are on the front lines, researching and developing treatments to advance personalized cancer medicine.

# DR. TAK MAK GOES TO THE VATICAN

Dr. Tak Mak was there. So was U.S. Vice-President Joe Biden and former CBS News Anchor Katie Couric. As was Sean Parker, the Co-Founder of Napster and the former President of Facebook.

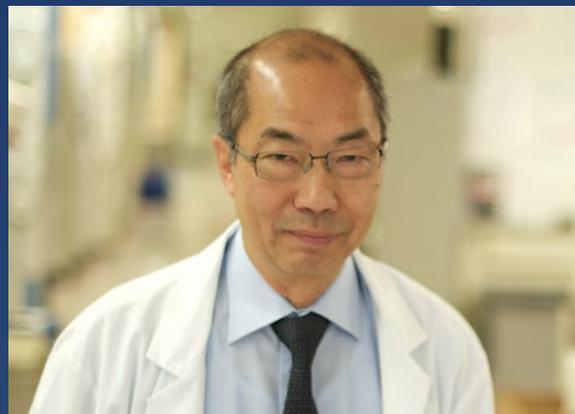
This eclectic mix of people was at the Vatican this past April to take part in an international conference on regenerative medicine.

For Dr. Mak, the invite came from Dr. Ronald DePinho, the President of MD Anderson Cancer Center in Texas, who was **“putting together a small group of people to discuss immunotherapy at the Vatican.”**

That’s how Dr. Mak ended up on the same stage as Couric, who moderated a panel discussion involving him and three other cancer immunotherapy experts.

While Dr. Mak was initially surprised by the invitation, he wasn’t surprised that immunotherapy was something of interest to the Vatican and such a wide range of individuals.

**“Immunotherapy could become a pillar in cancer therapy,”** Dr. Mak says, underscoring its growing importance in the field of cancer treatment.



**DR. TAK MAK, SENIOR SCIENTIST**

Dr. Tak Mak is one of The Princess Margaret’s most renowned scientists and one of the most cited medical researchers in the world.

Dr. Mak joined the Ontario Cancer Institute, now part of Princess Margaret Cancer Centre, as a post-doctoral fellow in the ‘70s. He was mentored by Dr. James Till and Dr. Ernest McCulloch – the celebrated Canadian scientists who proved the existence of stem cells.

Dr. Mak’s cloning of the T-cell receptor more than three decades ago helped advance the field of immunology and had major implications for the still-emerging world of immunotherapy.

Today, Dr. Mak serves as the **Director of The Campbell Family Institute for Breast Cancer Research at The Princess Margaret.** Some of his recent work has involved unique research on a so-called sharpshooter drug that slows down the growth of a number of types of cancer.



# REAL CURES COME FROM DISCOVERY RESEARCH

## INNOVATION AT THE PRINCESS MARGARET

The history of immunotherapy stretches back decades, involving many researchers around the world who have helped sort out the complex pieces of the immune system puzzle.

Understanding the T-cell has been a key part of that puzzle. The T-cell can attack and destroy cells infected with viruses. Most importantly for immunotherapy, it can also take on cancer cells.

The Princess Margaret's Dr. Tak Mak helped advance our understanding of the T-cell with a significant discovery. It was in his lab that the human T-cell receptor was first cloned in the 1980s.

Dr. Pamela Ohashi, co-director of The Princess Margaret's Tumor Immunotherapy Program (TIP) and a member of the Immunology Department at the University of Toronto, was working with Dr. Mak when that discovery was made. It provided the foundation for future understanding about the immune system and how it could be used to fight cancer.

Half a world away, the breakthrough inspired Dr. Naoto Hirano. "I was in Japan, I was very excited,"

he says. "I thought that Tak Mak was a genius."

Dr. Hirano never dreamed they would meet.

Three decades later, they are colleagues at Princess Margaret Cancer Centre.

The understanding of the T-cell has steadily increased over time. And Dr. Ohashi's own career was heavily influenced by these advances.

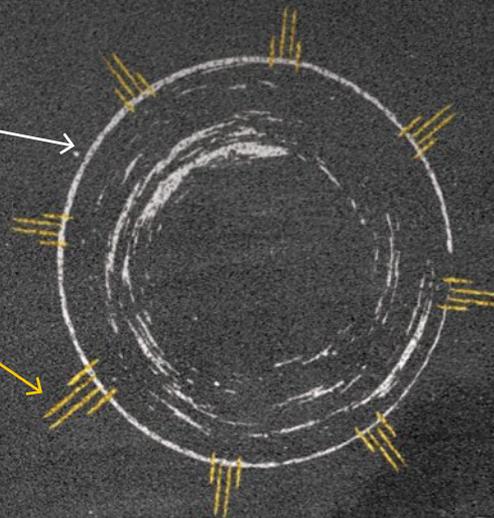
Today, she works with Dr. Linh Nguyen and Dr. Marcus Butler on adoptive T-cell therapy at The Princess Margaret. **MORE ON PAGE 13.**

In 2005, Dr. Ohashi, Dr. Nguyen and their colleague Patty Yen travelled to the U.S. to learn about adoptive T-cell therapy. This was the origin of immunotherapy at The Princess Margaret.

Many important discoveries have been made by members of the research team at Princess Margaret Cancer Centre that are providing key insights for translating and developing novel clinical trials. Today, the immunotherapy program at The Princess Margaret is growing and more than 1,300 patients have been treated through clinical trials in the past two years alone.

**T-CELL OR T-LYMPHOCYTE**  
An important type of white blood cell that can kill cancer cells

**T-CELL RECEPTOR**  
A molecule found on the surface of T-cells, responsible for guiding the immune response to targets such as viruses or cancer cells



Dr. Tak Mak is seen at a July 3, 1984, press conference about the cloning of the T-cell receptor. Image courtesy of University Health Network Archives. The image has been modified.

# THE CANCER WARRIOR: THE IMMUNE SYSTEM

Think of your immune system as the hero in an action-packed blockbuster. It exists to protect your body from harmful invaders.

It is made up of two lines of defence: the innate and the adaptive immune systems.

The innate and the adaptive immune systems work together to protect us from germs and cancer. The innate immune system is fast acting and kick-starts the adaptive immune response; however, the innate immune system does not provide long-lasting protection. The second line of defence, the adaptive immune system, provides lifelong immunity; it “remembers” germs or cancers so that it can protect your body against similar attacks in the future.

If the immune system is the cancer warrior, then T-cells are the key weapons in its arsenal. They attack and destroy cells that are infected. Each bears its own unique crest called the T-cell receptor that has the ability to recognize different parts of an enemy.

## **INNATE IMMUNE SYSTEM**

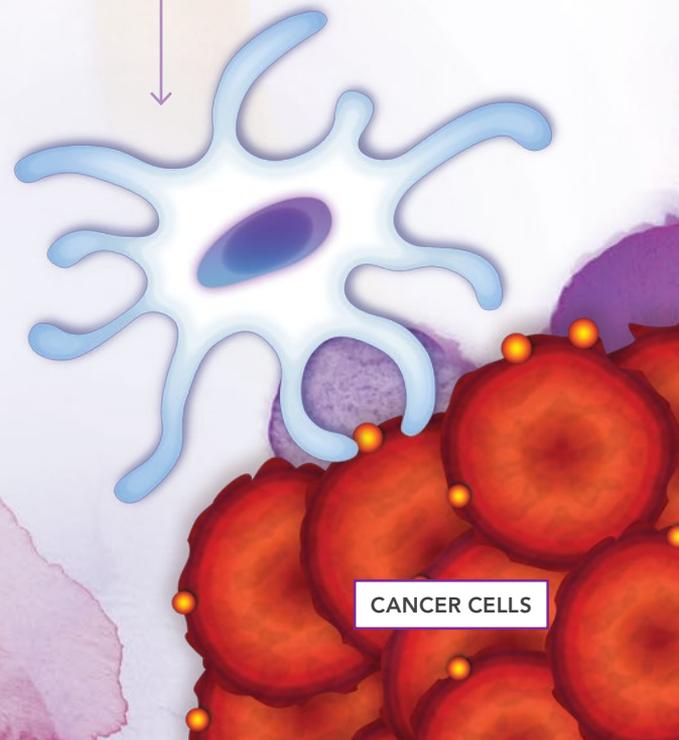
A group of cells that are rapidly alerted after an infection to start the immune response.

## **ADAPTIVE IMMUNE SYSTEM**

A group of highly specialized cells, including T-cells, which can eliminate or prevent a viral or bacterial infection, or fight against cancer cells.

### **DENDRITIC CELL**

A specialized cell that initiates an immune response and directs the immune response against a certain kind of virus or cancer. It picks up and processes pathogens or tumor cells, so that T-cells can become activated to kill these targets.



**CANCER CELLS**



T-CELL

T-CELL RECEPTOR

**1 ALERTING T-CELLS TO A THREAT**

In order for T-cells to be activated, the dendritic cell recognizes and processes an enemy in a format that the T-cell can recognize through its T-cell receptor.

# HOW THE WARRIOR DEFENDS THE BODY

**2 T-CELLS MULTIPLY AND ATTACK**

Once activated, T-cells multiply in order to attack and destroy the threat. Once the infected cells are terminated, the germs die along with them. T-cells can work in a similar way to kill cancer cells.

**3 END OF THE T-CELL RESPONSE**

Once the threat to the body is gone some of those T-cells convert to "memory T-cells" and stay in the body. That way, the next time the body encounters another threat, these memory T-cells are ready to rapidly destroy it. This is how some vaccinations work.

# DEVELOPING TOMORROW'S TREATMENTS TODAY

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has a **world leading**  
clinical trials program,  
with over **20%** of  
patients enrolled,  
versus **4%** in the U.S.\*



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Research With  
Patient Impact**

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Princess Margaret  
Cancer Centre  **UHN**

**ONE OF THE TOP 5  
CANCER RESEARCH  
CENTRES IN THE WORLD**

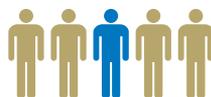
# PRINCESS MARGARET CANCER CENTRE

ONE OF THE TOP 5 CANCER RESEARCH CENTRES IN THE WORLD

## RESEARCH PERFORMANCE



Ranks 4th for percentage of papers published in high-impact oncology journals, and 4th for percentage of highly cited papers



1 in 5 patients participating in a clinical trial



Canada's largest and one of the world's top-rated clinical trial programs

388,588 ft<sup>2</sup>  
Research Space

10 floors at Princess Margaret Cancer Research Tower and 3 floors at Princess Margaret Cancer Centre are dedicated to research. This is larger than five soccer fields combined.



## SCALE



The world's largest single-site radiation medicine program



18,033  
new patients a year



International partnerships with centres in Kenya, Ethiopia, Ghana, Jordan, India, Spain, Qatar

Over **1,200** people employed in our research enterprise, including

**64** Scientists

**315** Clinical Researchers

**450** Trainees

## BREADTH



**200+**  
Cancers Treated

200+ types of cancer treated including many of Canada's most complex and rare cases



Canada's largest surgical oncology team and one of the largest in the world



Canada's first centre to use genetic "fingerprints" to precisely diagnose patient cancers

## A WORLD LEADER



Stem Cells in Cancer



Immunotherapy



Tumor Biology and Imaging



Cancer Genomics, Epigenetics and Bioinformatics



Bio Discovery and Drug Development

## TRACK RECORD

### WORLD FIRSTS

- Stem cells
- Cloning T-cell receptor
- Colon cancer stem cells
- Lung cancer gene signature
- Blood stem cell
- Root cause of myeloma relapse
- A new view of how blood is made



### SCIENTIFIC SUPER STAR

**Dr. Tak Mak**  
Brilliant researcher, cloned the T-cell receptor and developed first-in-class cancer drug, cited over 75,000 times



### IMAGE-GUIDED THERAPEUTICS ROCK STAR

**Dr. David Jaffray**  
World leader in image-guided radiation with 5 patents issued, has won most major prizes in medical physics, founding Director of Techna Institute



### GLOBAL ONCOLOGY LEADER

**Dr. Mary Gospodarowicz**  
Medical Director of The Princess Margaret, Globally recognized radiation oncologist, researcher and mentor, 1<sup>st</sup> Canadian and 1<sup>st</sup> female President of Union for International Cancer Control



# A DRUG THAT SHOWS YOUR BODY HOW TO BEAT CANCER

For Jason Smith it all started back in 2010 with a funny-looking mole. “For years I ignored it. I went to the doctor one day and he said let’s take a look at this.”

Following a biopsy, Jason received a call from his doctor. “He told me I had melanoma. I thought skin cancer was no big deal.” In the end, it turned out to be Stage 2 melanoma. He embarked on his first immunotherapy trial, which had mixed results.

## A RUNNER’S NIGHTMARE

A few years later, there was a setback. The cancer had spread to Jason’s right lung.

His first reaction was: “Why my lung? As a runner you develop a fairly close connection to your heart and lungs and I felt vulnerable.”

There was a flurry of appointments at the Princess Margaret Cancer Centre and then Jason had surgery to remove part of his lung. “It all happened very quickly, everyone was amazing.”

The recovery from lung surgery was tough. Jason could barely walk to the end of his driveway. He was given breathing exercises and he was also told to go for daily walks. “I would walk to the neighbour’s driveway and the next day I would go two driveways down. Every day I started getting stronger.”

“I was thinking what an absolute miracle it is that we’ve got this treatment that seems to be working and allowing me to get on with my life.”

## THE ODDS ARE CHANGING

In 2016, Jason embarked on his second immunotherapy clinical trial. He now has two small tumors in his left lung and is being treated with a different immunotherapy drug. “Both tumors have shrunk as of the last CT scan and that’s amazing.” One of his tumors is 50% smaller, the other has shrunk by 30%.

“This drug is showing my body how to beat the cancer,” he says.

“I go to work every day, I play with my kids every night, and I’m still running.”

This past April, Jason ran the Boston Marathon while he was in the middle of treatment. “It was a fairly emotional experience for me. I was thinking what an absolute miracle it is that we’ve got this treatment that seems to be working and allowing me to get on with my life.”

**WATCH** Jason’s story in his own words: [www.thepmcf.ca/JasonStory](http://www.thepmcf.ca/JasonStory)

# IMMUNO

## AT THE PRINCESS MARGARET

### REVOLUTIONIZING CANCER THERAPY

Immunotherapy is rapidly gaining recognition for its potential to change the way we treat cancer and to join chemotherapy, radiation and surgery as a fourth pillar of cancer treatment.

Within the international scientific community, it has been long understood that the immune system has the ability to conquer cancer.

We're now at a point where this knowledge has started to become translated into treatment possibilities for cancer patients.

We have already seen numerous success stories of cancers fought and lives extended through immunotherapy.

### IMMUNOTHERAPY STRATEGIES

Three types of treatments being studied, developed and tested at Princess Margaret Cancer Centre:

#### BOOSTING THE ARSENAL

In **adoptive T-cell therapy**, samples of T-cells are taken out of a patient. A lab process is used to boost the number and effectiveness of these cells, so they can be put back into the patient to attack a tumor.

**MORE ON PAGE 13**

#### T-CELLS ON ALERT

The goal of **cancer vaccines** is to alert T-cells to the presence of cancer and to initiate a strong T-cell response against the tumor.

**MORE ON PAGE 14**

#### UNLEASHING THE IMMUNE SYSTEM

The immune system has ways of controlling its response to threats to the body. Most of the time, it holds back its response at various checkpoints. In **immune checkpoint blockade**, drugs are used to get the immune system to release the brakes and allow an immune response. **MORE ON PAGE 13**

#### ABOUT CLINICAL TRIALS:

The immunotherapy treatments being studied and administered at The Princess Margaret are available to specific patients with cancers for which these treatments are applicable. Many ongoing clinical trials are occurring at the Cancer Centre. Patients interested in participating in such trials should consult their oncologist to determine if this is a suitable course of action for them.

# THERAPY

## BOOSTING THE ARSENAL

### ADOPTIVE T-CELL THERAPY

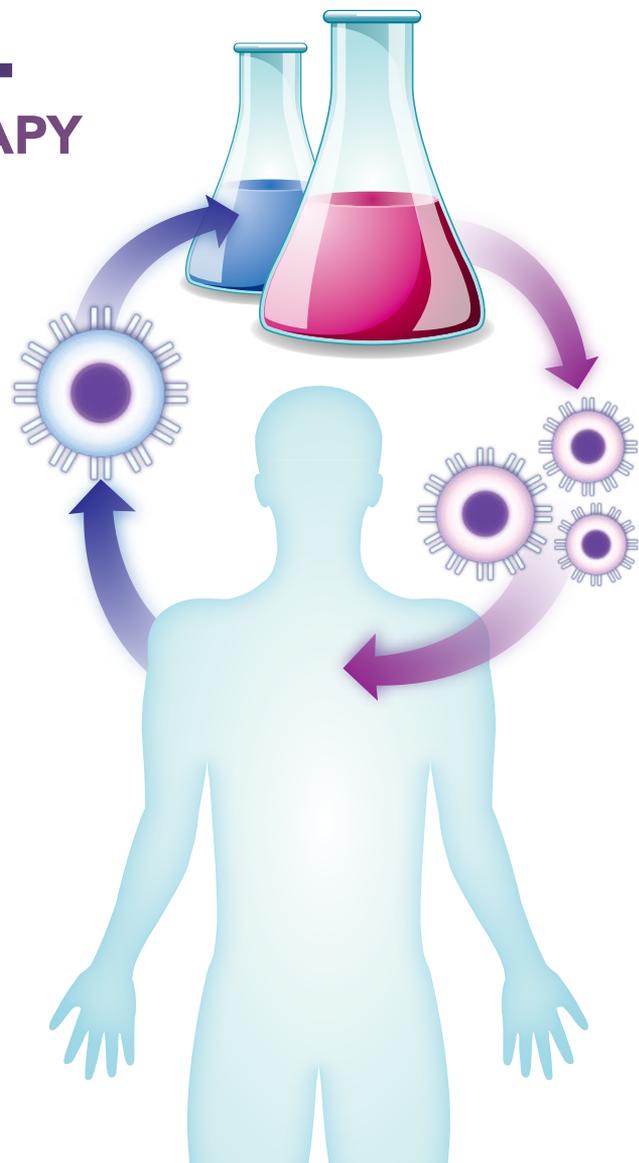
When the immune system unleashes a response against a threat, it sends the T-cell to do its bidding. The T-cells are a key part of the immune system's arsenal, able to attack and kill cancer cells.

In fact, there are T-cells found in tumors that can kill cancer cells. The problem is that there are often not enough of them inside a tumor to get the job done.

That's where adoptive T-cell therapy comes in – it's a method of boosting the number of T-cells inside a patient. "We're trying to engineer an immune response by taking cells from a patient and modifying them in such a way, so that they can fight the cancer more effectively," says Dr. Marcus Butler of Princess Margaret Cancer Centre.

In this type of immunotherapy, T-cell samples are taken from a patient's tumor and laboratory methods are used to boost their overall numbers and their tumor-fighting abilities. They are then put back into the patient.

This type of immunotherapy has shown good results in patients treated at major cancer centres around the world. The complex technology needed to produce T-cells for clinical use can only be found in comprehensive cancer centres like The Princess Margaret.



# T-CELLS ON ALERT

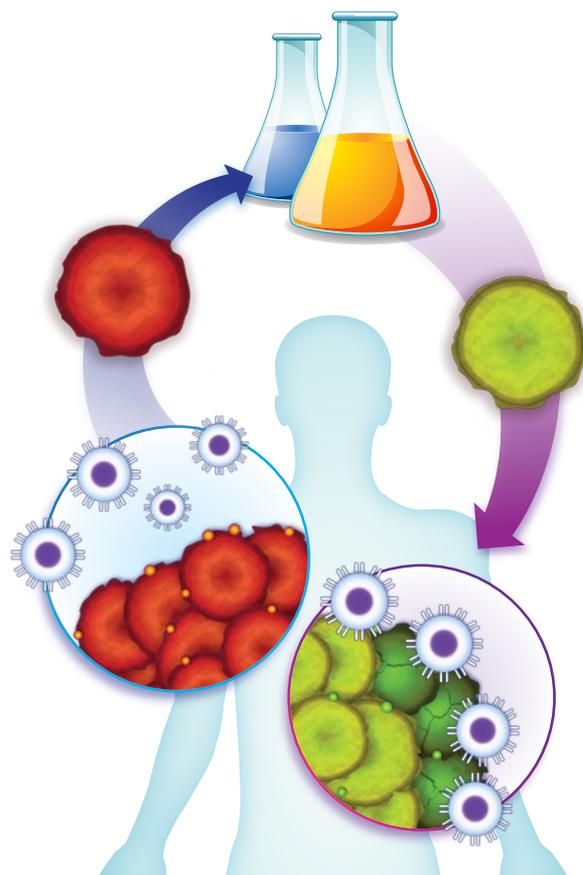
## CANCER VACCINES

The goal of cancer vaccines is to get T-cells to recognize the presence of cancer and fight back.

Dr. Christopher Paige leads a laboratory where cancer cells are genetically modified to make them more visible to the immune system. The modified cancer cells are returned to the body where they activate immune system T-cells, which spread throughout the body killing both the modified cancer cells and any other residual cancer cells that are present.

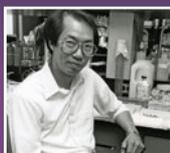
This is considered to be a therapeutic vaccine as it is designed to be used after a cancer has appeared. This is a different concept from vaccines that prevent something from occurring in the first place, such as the vaccine against the virus (HPV) that causes cervical cancer.

Other cancer research seeks to stimulate the immune system by using a type of immune cell that helps spur T-cells into action – the dendritic cell. Dendritic cells can be loaded with cancer-specific substances that are recognized by the immune system, triggering an anti-cancer immune response.



Background imagery courtesy of Thermo Fisher Scientific. The original picture was captured by Dr. Rita Serda

# IMMUNOTHERAPY: A RICH HISTORY



**1984**

Dr. Tak Mak clones the T-cell receptor.



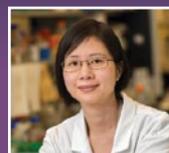
**1994**

Dr. Tak Mak demonstrates that CTLA4 (protein receptor) is a key regulatory checkpoint in the immune system.



**2002**

Dr. Pamela Ohashi (above) and Dr. Linh Nguyen demonstrate that tumor-specific T-cells exist and are capable of mounting a response against tumors.



**2005**

Dr. Pamela Ohashi, Dr. Linh Nguyen (above) and Patty Yen travel to Dr. Steven Rosenberg's lab in the U.S. to learn techniques to grow tumor-specific T-cells.



**2008**

Dr. Pamela Ohashi, Dr. Brad Nelson, Dr. Réjean Lapointe and Dr. Jonathan Bramson found the Canadian Cancer Immunotherapy Consortium.

# UNLEASHING THE IMMUNE SYSTEM

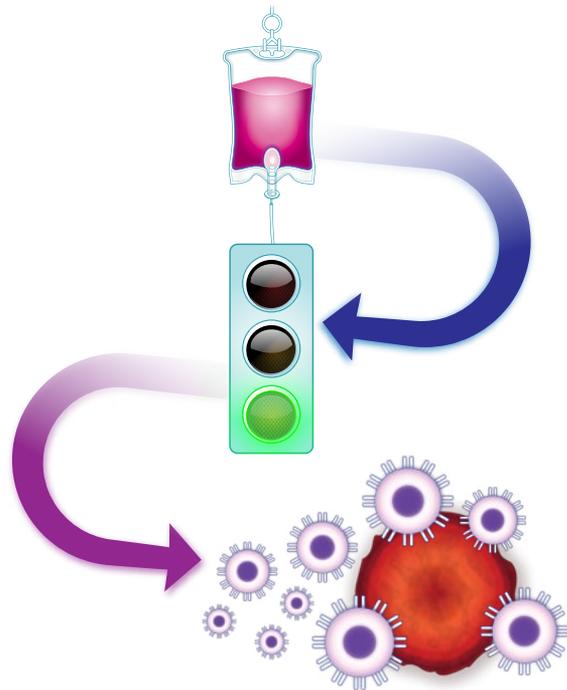
## IMMUNE CHECKPOINT BLOCKADE

The immune system has to be able to take on invaders without damaging normal tissue. To do that, it must turn off or limit its attack at key points – scientists call these immune checkpoints.

A type of immunotherapy called immune checkpoint blockade uses drugs to get the immune system to ignore the stop signals at these checkpoints. Conceptually, we think about this as releasing the brakes on the immune system.

Immune checkpoint blockade has shown impressive results when tested against certain cancers.

Currently, there are many studies taking place at The Princess Margaret that are focused on improving our understanding of immune checkpoint blockades for multiple types of cancer.



# OF DISCOVERY AND INNOVATION



**2009**

Immune Therapy Program is launched at Princess Margaret Cancer Centre.



**2011**

Rising stars Drs. Marcus Butler and Naoto Hirano are recruited from the U.S. for the immunotherapy program.



**2013**

First adoptive T-cell therapy clinical trial opens in Canada at The Princess Margaret.



**2015**

Clinical leadership is expanded with Dr. Lillian Siu joining the immunotherapy program.



**2016**

Over 180 active immunotherapy clinical trials are underway at The Princess Margaret, including Canada's first gene-engineered T-cell trial.

# BE EPIC

#TheRideTO

# RIDE

TO SUPPORT  
INNOVATIVE  
PROGRAMS LIKE  
IMMUNOTHERAPY



**ENBRIDGE**  
**RIDE TO**  
**CONQUER**  
**CANCER**  
benefiting  
PRINCESS MARGARET CANCER CENTRE

REGISTER FOR OUR 10<sup>TH</sup>  
ANNIVERSARY RIDE  
[conquercancer.ca](http://conquercancer.ca)



# IMMUNOTHERAPY OFFERS HOPE

“Within three months, the three tumors had been reduced by 50 percent.”

Tish Vigna knew something was very wrong. While out on a run with her dog, she had chest pains. She struggled to get home. When she did, she called an ambulance.

In hospital, staff checked to see if a heart attack was to blame. Instead, they found a mass on Vigna's left lung. Within days, Vigna, a non-smoker, learned she had Stage 3 lung cancer.

“It was surreal,” says Vigna, recalling the diagnosis she received at Princess Margaret Cancer Centre in March 2013.

## NEW OPTIONS FOR PATIENTS

Vigna underwent six weeks of chemotherapy and radiation and after that, surgery – yet her cancer endured.

More chemotherapy and radiation followed. A follow-up appointment in January found the cancer had spread to her right lung, in three locations.

Surgery wasn't an option. But her doctor hoped to get Vigna into an international immunotherapy clinical trial. She ended up being among a handful

of Princess Margaret patients who were admitted.

Vigna was then put on a drug designed to stimulate an immune response.

## ‘HOPE FOR EVERYBODY’

“Within three months, the three tumors had been reduced by 50% in size,” says Vigna. And those tumors haven't grown any bigger in the 2½ years that have passed since then.

For Vigna, immunotherapy treatments will continue for the foreseeable future. That's okay with her. She and her family are simply grateful she could participate in the trial.

Her experience so far with immunotherapy has left her optimistic about what the future of cancer treatment holds for patients like her. “We are going somewhere in science ... and there's hope for everybody out there,” she says.

She's also optimistic about her own future. “I am extremely confident about what the future holds for myself and others!” Vigna says.



# THE PRINCESS MARGARET LEADS THE WAY

## TUMOR IMMUNOTHERAPY PROGRAM (TIP)

Princess Margaret Cancer Centre is home to Canada’s first and most comprehensive immunotherapy program. Our cutting-edge research expertise spans basic immunology discoveries to clinical trials. We focus on improving our knowledge of the immune system to better detect, diagnose and target cancers.

“There’s a lot of expertise that needs to come together to really move us forward in this field. The special thing about Princess Margaret Cancer Centre is that we have an excellent team of experts who are really in this to be game-changers,” says Dr. Pamela Ohashi.

“This is the perfect place to do things that are considered impossible. We have the brainpower, we have the resources, we have the patients and we have support from the Foundation.”  
– Dr. Lillian Siu

## KEY FEATURES OF TIP

**NEXT GENERATION OF IMMUNE THERAPIES:**  
We’re conducting studies to understand how a T-cell response can be regulated and augmented to improve its ability to kill cancer cells.

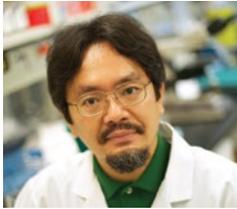
**NEW CLINICAL TRIALS OF COMBINATION THERAPIES:**  
We’re combining different therapeutic strategies to improve the immune response and provoke a stronger attack on a patient’s cancer.

**TCR GENE TRANSFER TRIAL:**  
We have opened the first clinical trial in Canada that uses genetically engineered T-cells to kill off cancer cells when given to patients.

**TIP DATABASE:**  
We’re developing a comprehensive database of clinical data from patients who have undergone immunotherapy that will inform future treatments.

# ON THE FRONT LINES OF IMMUNOTHERAPY

## OUR CANCER EXPERTS WORK TOGETHER TO TAKE IDEAS FROM THE LAB TO THE CLINIC



**DR. NAOTO HIRANO**  
ASSOCIATE DIRECTOR, RESEARCH,  
TUMOR IMMUNOTHERAPY PROGRAM

For Dr. Naoto Hirano, the true value of research occurs when it can be translated into making a difference in patients' lives. To him, that is the beauty of Princess Margaret Cancer Centre. He and his team aim to turn discoveries into practical solutions for patients and make adoptive T-cell therapy available for every cancer patient who could benefit. His research aims to invent new and personalized anti-tumor immunotherapeutic models that can cure cancer. Dr. Hirano attended medical and graduate school at the University of Tokyo. He was an Assistant Professor at the Dana-Farber Cancer Institute, Harvard Medical School, before joining The Princess Margaret five years ago.



**DR. TRACY MCGAHA**  
SENIOR SCIENTIST

Dr. Tracy McGaha likes a challenge. What motivates him is the opportunity to help people through his research. Years ago, he lost his father to prostate cancer. While his father battled cancer, Dr. McGaha realized just how much was left to discover about cancer's ability to co-opt immune processes to protect itself. This is now his area of study. He studies how the body protects itself from immune attack and how immune protective mechanisms affect attempts to fight tumors.



**DR. DAVID BROOKS**  
SENIOR SCIENTIST

Dr. David Brooks got his start studying immune responses to persistent viruses – an interest that came from seeing his parents' work with AIDS patients. Through his understanding of the immune system's response to chronic infections, the transition to cancer research was natural. It became clear to him that many suppressive strategies of chronic viruses are also present in cancer. He leads a team at The Princess Margaret that seeks to manipulate the immune system to take on cancer.



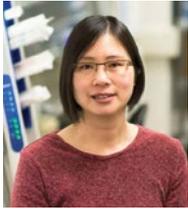
**DR. DEREK CLOUTHIER**  
HEAD, IMMUNE  
PROFILING TEAM

Dr. Derek Clouthier is one of the newest members of the Tumor Immunotherapy Program. He came to The Princess Margaret late last year, after finishing his PhD in immunology. He is a Scientific Associate and the Program Manager of the Terry Fox Research Institute-sponsored immunoTherapy NeTwork (iTNT). Some of his work with TIP involves working with clinical trials and managing the workflow, distribution, and analysis of patient samples.



**LEE-ANNE STAYNER**  
CLINICAL  
RESEARCH NURSE  
CO-ORDINATOR

Lee-Anne Stayner is on the front lines of immunotherapy clinical trials at The Princess Margaret. Through her interaction with patients, she is dedicated to providing the highest level of care. Stayner sees the difference clinical trials can make in the quality of life for patients. As a Nurse Co-ordinator, Stayner is a liaison between patients and scientists. She is involved in the delivery and assessment of patient care to facilitate clinical trials.



**DR. LINH NGUYEN**  
HEAD, CELL  
PRODUCTION TEAM

Dr. Linh Nguyen has been part of The Princess Margaret's immunotherapy efforts since they started a decade ago. The field has changed rapidly and Dr. Nguyen says a number of breakthroughs have helped it take flight. She's excited to see a growing number of approved immunotherapies that can be used to treat patients – and how they may be combined in future.

Dr. Nguyen went to graduate school at the University of Toronto, before pursuing post-doctorate studies at Harvard Medical School. She came back to Toronto to join The Princess Margaret.

Today, Dr. Nguyen leads the Tumor Immunotherapy Program's Cell Production Team. Much of her current work involves adoptive T-cell therapy.



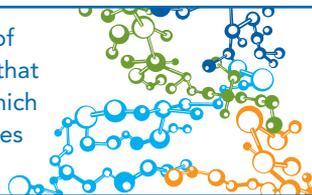
**DR. DANIEL DE CARVALHO**  
SCIENTIST

Since he was young, Dr. Daniel De Carvalho always had a keen interest in science. That continued into his university years in Brazil and has carried into his work in cancer research at The Princess Margaret.

Today, Dr. De Carvalho does research on cancer treatments involving epigenetics and immunotherapy. He is currently working on treatments that make cancer cells appear as virus-infected cells, so the immune system can take action. A clinical trial is taking place right now at The Princess Margaret which combines that approach with immunotherapy drugs, to boost the immune system to attack cancer.

Dr. De Carvalho is also interested in researching blood-based methods of cancer detection, in hopes of finding the disease earlier.

Epigenetics is the study of changes in gene activity that can be passed on, but which also occur without changes in the DNA sequence.



**DR. CHRISTOPHER PAIGE**  
SENIOR SCIENTIST

Throughout his 42-year career, Dr. Christopher Paige has seen the field of cancer immunotherapy rise and fall, but he believes it's finally having its moment. Studies of experimental models have given scientists a better understanding of the immune system and the therapies that can be derived from it. His hope is for immunotherapy to become a standard form of cancer treatment.

In his lab, Dr. Paige and his collaborators have learned how to use viruses to alter cancer cells to make them more visible to the immune system. They are using these methods to develop cancer vaccines. These vaccines have reached the clinical trial stage. Dr. Paige says it has taken more than a decade of work to get to this point.



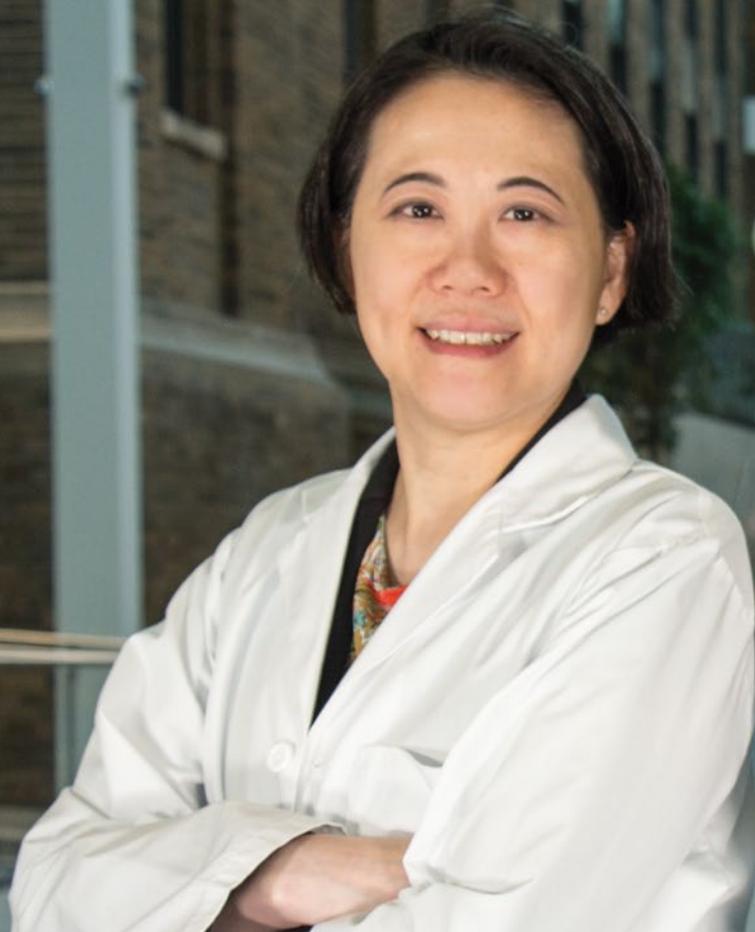
**DR. MARCUS BUTLER**  
CLINICAL HEAD, IMMUNE  
PROFILING TEAM

Dr. Marcus Butler is motivated to help patients, and in his own words, cautiously optimistic about immunotherapy. For Dr. Butler, the challenge he currently faces is determining how immunotherapy can be tailored to treat each type of cancer effectively. He's excited about the possibilities of his work in adoptive T-cell therapy.

In his lab, Dr. Butler and his team work to engineer an immune response by taking cells from a patient's own immune system and modifying them to fight cancer more effectively. Essentially, they supercharge the immune system.

Dr. Butler was drawn to The Princess Margaret for its international reputation and commitment to immunotherapy as a powerful tool to treat cancer. He was recruited from the Dana-Farber Cancer Institute.

The collaborative culture at the Cancer Centre inspires Dr. Butler to push forward with innovative research. "This is the kind of environment that anyone would want to be in to help move the field forward."



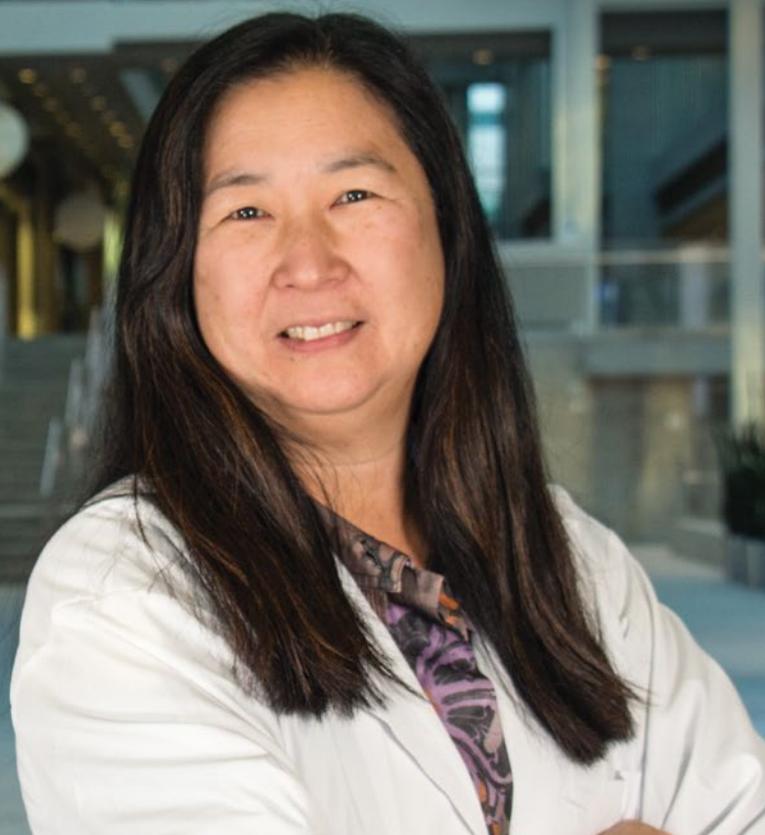
## **DR. LILLIAN SIU**

### **CO-DIRECTOR, TUMOR IMMUNOTHERAPY PROGRAM**

Dr. Lillian Siu is always prepared to take on a challenge. A medical oncologist for the past 20 years, she is determined to advance treatment to provide patients with the best possible care.

For Dr. Siu, that comes in the form of personalized cancer medicine. This uses molecular profiling and genomics to target cancer cells specific to each patient. Immunotherapy is no different. Dr. Siu is focused on identifying patient-specific markers to determine whose immune system will respond to a particular drug.

Dr. Siu is involved in three major programs focusing on drug development, cancer genomics and tumor immunotherapy. As both a scientist and clinician, Dr. Siu is actively involved in immunotherapy clinical trials and leads genomics initiatives and immunotherapy trials at Princess Margaret Cancer Centre.



## **DR. PAMELA OHASHI**

### **CO-DIRECTOR, TUMOR IMMUNOTHERAPY PROGRAM**

Dr. Pamela Ohashi is driven by the desire to cure cancer. Her positive outlook and dedication to innovation pushes her research forward. As a graduate student, Dr. Ohashi worked with Dr. Tak Mak when he cloned the T-cell receptor in 1984. Being part of that key discovery allowed Dr. Ohashi to continue to build her career doing research in this new, exciting field.

Dr. Ohashi's research focuses on understanding ways to regulate and improve the immune response to cancer. New strategies and mechanisms are being uncovered that will help control immune responses and may be applied to enhance the immune attack on cancer. In addition, her team has developed techniques to grow tumor-infiltrating T-cells. This is important in two ways: it gives us insights into what is going on inside a tumor and importantly can also be used as a therapy to treat patients.

Dr. Ohashi knows teamwork is key to finding a cure. Together, she and her colleagues at The Princess Margaret are implementing new clinical trials and building a team of experts with a goal to provide personalized cancer medicine.

**LEARN MORE: [www.pm-TumorImmunotherapyProgram.ca](http://www.pm-TumorImmunotherapyProgram.ca)**



# The Princess Margaret

feature publication

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## CLINICAL TRIALS AT PRINCESS MARGARET CANCER CENTRE

### WHO CAN JOIN A CLINICAL TRIAL?

To participate in a clinical trial, the patient must have a referral from their doctor. Each clinical trial has eligibility guidelines based on the questions the research is trying to answer.

#### COMMON CRITERIA:

- Having a certain type or stage of cancer
- Having received a certain kind of therapy in the past
- Having adequate organ functions such as kidney, liver and bone marrow functions

These criteria ensure that people in the trial are as alike as possible. This way doctors can be sure that the results are due to the treatment being studied and not other factors.

#### SAFETY:

Some people have health problems other than cancer that could be made worse by the treatments in a study. Patients interested in joining a trial will receive medical tests to be sure they are not put at increased risk.

#### ACCURATE AND MEANINGFUL STUDY RESULTS:

Patients may not be able to join some clinical trials if they have already had another kind of cancer treatment. Otherwise, doctors could not be sure whether their results were due to the treatment being studied or the earlier treatment.

The Tumor Immunotherapy Program has a number of studies that are currently recruiting patients. For information about how to be referred to one of these studies, please contact the team at TIP@uhn.ca.

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# 5 FACTS ABOUT IMMUNOTHERAPY

1. It harnesses the power of the immune system to fight cancer
2. It can specifically target cancer tissues
3. It can have fewer side effects
4. It's poised to become the 4th pillar of cancer treatment
5. The Princess Margaret has Canada's most comprehensive immunotherapy program

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