UVIC KNOWLEDGE
Research and discovery at the University of Victoria
VOL 15 NO 9 NOVEMBER 2015

MOBILIZING A CELLULAR ARMY

Nelson. UVIC PHOTO SERVICES

Research that uses our own immune systems to battle cancer is heading for clinical trials

By Patty Pitts

Sitting on Brad Nelson's desk in his BC Cancer Agency office are two large photos of magnified cancerous tumour tissue. In one, multiple brown spots match the cancerous blue ones. In the other, the blue spots overwhelmingly dominate.

"The brown spots are T cells," says Nelson, who is a faculty member in the University of Victoria's Department of Biochemistry and Microbiology. "They're attacking the blue cancer cells. The patient with the higher number of T cells has a much better chance of survival."

Increasing the survival of women with ovarian and cervical cancer through the targeted use of their own T cells is the goal of a groundbreaking clinical trial Nelson and his research team are about to start.

T cells, a type of white blood cell, seek and destroy infected or cancerous cells in the body. Harnessing and expanding their power to fight cancer is the goal of immunotherapy, which is "the hottest area of oncology," according to Nelson.

His study involves harvesting T cells from women for whom chemotherapy has failed. While the women undergo second-round chemo, their T cells will be combined with growth factors in a special clean room to be constructed at the BC Cancer Agency's Deeley Research Centre in Victoria where Nelson serves as director and distinguished scientist. When chemo stops working altogether, patients will be given an infusion of their own cancer-fighting T cells, along with drugs that help boost their activity

The trial—a first for Canada—is the result of a decade of research on Vancouver Island with help from collaborators in Toronto, Denmark and the US. Expanding 10 T cells to 10 billion "is easier than growing dandelions on a front lawn," says Nelson. "We can create an IV bag of tumour-reactive T cells in a couple of months."

The difficulty has been identifying the tumour-reactive T cells and understanding how best to boost their activity. Recent breakthroughs at the BC Cancer Agency and elsewhere paved the way for this clinical trial.

Ten women each with ovarian or cervical cancer will be infused at Vancouver's transplant unit with T cells produced in Victoria. "Ultimately this will be an out-patient procedure but for this initial trial, we want our participants under 24-hour surveillance," says Nelson.

Pending approval from Health Canada, Nelson plans to open the trial in early 2017. "Building and staffing a clean room is a multi-million dollar endeavour," says Nelson, praising the commitment of the BC Cancer Foundation and the BC Cancer Agency. The clean room is possible through a $2 million donation from the Robert L. Conconi Foundation.

Nelson regularly lectures to UVic biochemistry and microbiology students and has UVic students on his team. The work of master's student Nicole Little will help determine the best time to harvest the T cells from patients.

As a PhD student, Nelson was headed for post-doctoral studies in embryology. Then his mother-in-law was diagnosed with ovarian cancer and later succumbed to the disease. He switched specialties, undertaking postdoctoral studies in immunotherapy research.

"Ten years ago immunotherapy was considered a fringe treatment. But in the last three to four years, it's really started to work," says Nelson. "T cells are like your own personal cruise missile system."

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The BC Cancer Agency and UVic enjoy a close research partnership. UVic PhD, master's, co-op and undergraduate honours students continually participate in agency research projects. And many of the lab studies leading to Nelson's upcoming clinical trial were conducted at UVic's research facilities.

Ten researchers will be involved in Nelson's clinical trial and he anticipates more will be hired as the project moves forward. The team will do everything from tumour retrieval to extensive documentation of all aspects of the trial.

Nelson anticipates the clinical trial will take two years to conduct and his team will be able to gauge the impact very quickly.

The first significant cancer treatment breakthrough involving T cells was 10 years ago with melanoma. Its success led researchers to begin applying the process to other cancers including breast, lung and colon. Genetic engineering of T cells, the introduction of genes to help cells better recognize cancer tumours, is now being used to treat leukemia, with up to 90 per cent of patients experiencing complete remission— "a home run" in Nelson's opinion.

Immunotherapy encompasses a "suite of treatments" that includes vaccines, immune modulation (boosting a patient's immune system with antibodies and other drugs) and T cell therapy. For some cancers, these treatments are beginning to replace chemotherapy, a major shift in oncology.