# Kevin C Kain, MD, FRCPC

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## Academic and Professional History

Dr. Kain was not always interested in a career in tropical medicine. After completing his undergraduate medical degree at the University of Western Ontario, Dr. Kain was set to enter a residency program in orthopedic surgery. However, at the last minute he opted out and started doing emergency medicine in underserviced areas in northern Ontario. Dr. Kain then spent three years traveling the world. He was exposed to diseases that had never been taught in medical school, and found himself intrigued and eager to make a contribution to different parts of the world.

Dr. Kain came back to Canada and began a residency program at the University of British Columbia. He studied for two years in internal medicine, one year in infectious diseases, and two years in medical microbiology research. Prior to residency, Dr. Kain had never done any formal research but he quickly embraced it and made it a part of his career. Upon finishing his residency, Dr. Kain came to Toronto to work in tropical medicine for six months and then completed post-doctoral research on malaria vaccine development at the Walter Reed Army Institute of Research in Washington, DC.

Currently, Dr. Kain is director of the McLaughlin-Rotman Centre for Global Health, director of the Center for Travel and Tropical Medicine at the Toronto General Hospital, and director of the Parasitology Lab at Mount Sinai Hospital (Toronto Medical Labs). Dr. Kain is also a professor in the Faculty of Medicine at the University of Toronto and holds the Canada Research Chair in Molecular Parasitology.

## Personal History

*Birthplace*: Hamilton, Ontario.

*Family*: Dr. Kain is married to his wonderful wife Cathy and they have identical twins, Dylan and Taylor, aged 15.

*Pets*: Dr. Kain has always loved animals. Growing up he had interesting pets, such as raccoons, squirrels, lizards, and snakes. He currently owns a golden retriever puppy.

*Hobbies*: During his free time, Dr. Kain enjoys running, cycling, skiing, wind surfing, rock climbing, and mountaineering. He has climbed several mountains during his travels, including some in Peru and western Tibet. He has also taken his mountain bike through northern Pakistan, over the Himalayas and into China. His two kids are actively involved in rock climbing, and they often take family trips together to climb. Their next trip will be to Africa where they plan on climbing Mount Kenya and Mount Kilimanjaro.

## Research

Dr. Kain's research begins by identifying clinical problems associated with different populations. While some researchers use the term 'from bench to bedside', Dr. Kain prefers to complete the circle – starting with clinical observations at the bedside or fieldside, moving to the bench to understand it, and then taking this new knowledge back to the bedside in the form of a new diagnostic or therapeutic. He begins by identifying a clinical problem, dissecting it at the molecular level, and then attempting to do something practical about it.

Dr. Kain has faced a number of hurdles studying tropical medicine in Toronto, one of them being funding. Funding is always a challenge since the diseases that Dr. Kain researches (eg. malaria, tuberculosis, AIDS) are considered less important in Ontario than in other parts of the world. However, he stresses the importance of his research in today's age of globalization. Toronto is such a multicultural and connected city

that most diseases eventually find their way here. It is, in essence, a microcosm of the world. SARS is a perfect example of how fast diseases can spread, and how important it is to be prepared. However, since SARS, global health research has been more widely accepted and funded in Toronto. Five to ten years ago, Global Health was not "hip", but it is becoming exceedingly obvious how relevant and important it is.

Dr. Kain is also very passionate about treating diseases that affect the young. While substantial funding is currently directed toward research aimed at prolonging lives by relatively insignificant amounts, more money should be invested in helping those whose lives have been dramatically shortened. It is very difficult to go to third world countries and see five year-old children dying of malaria, measles, etc. – children who have not been afforded any opportunity to make their mark on the world.

The outcome of most infectious diseases depends on the pathogen and the response of the host. While traditionally emphasis has been placed on attacking the pathogen (with antibiotics or antimicrobials), Dr. Kain is approaching the problem from a different angle. He believes that for some serious infectious agents the most efficient avenue might be to modify the host response. Although antibiotics offer some protection, they are fairly inefficient. It takes a company roughly $800 million to develop an antibiotic, about five to ten years for the pathogen to develop resistance to the antibiotic, and for several serious infectious diseases such as cerebral malaria and meningoccemia there is no increase in survival. It is simply not a sustainable approach to infectious diseases. Dr. Kain believes that a more sustainable solution can be found by studying and exploiting the human evolutionary responses to infections.

The extremely effective mechanisms of the human immune system are the result of co-evolution with many different pathogens. Thus, evolution may prove to be one of the best teachers regarding the types of responses that allow us to survive infections and, alternatively, those that fail. The key is to determine what responses are successful and then harness them, exploit them, and possibly enhance them. Dr. Kain also believes that a major focus should be on the innate immune system. Many people are able to survive a second attack by the same pathogen; but it is often the first attack that kills. Dr. Kain is trying to apply this insight to malaria. Surprisingly, most people actually survive malaria. However, some people are unable to clear the parasite effectively, resulting in an inflammatory cytokine response, which in turn increases the number of pathogen receptors in the brain, eventually leading to cerebral malaria and death. Dr. Kain is trying to address this problem by first understanding the molecular pathways responsible for these problems, identifying compounds that act on these pathways, and then examining in clinical trials how drugs might modulate a susceptible person's response to malaria, increasing their innate clearance of the parasite and decreasing the inflammatory response associated with infection. He was able to do this by finding an FDA-approved drug already on the market for an unrelated purpose. He is a strong believer that finding new indications for old drugs can be a cost effective way of developing treatments, especially for diseases of the developing world since development costs of new drugs are often prohibitively high for resource-poor countries.

Another research project in which Dr. Kain is involved examines malarial infection during pregnancy. For centuries it has been known that women during their first pregnancy are especially susceptible to malaria, but the underlying processes are poorly understood. Pregnancy is probably the only time when the human body grows an entirely new organ – the placenta. In response to the placenta, the parasites coat themselves with a new set of proteins, which are foreign to the body. The body therefore defaults to its innate immune response, which is normally effective in containing an infection. But in the case of pregnancy there is a defective innate response and the antigens cannot be recognized. If they survive and have subsequent pregnancies, women are eventually able to cope with malaria. Dr. Kain is therefore studying the molecular mechanisms behind this difference, trying to figure out how to change the body's immune response to better handle the infection and decrease pregnancy-associated malaria, which currently results in hundreds of thousands of deaths each year.

### Questions

What advice would you give a medical student who is interested in research?

Research is incredibly rewarding. You need to look inside your own heart and see what excites you. There will always be obstacles in research. Passion can go a long way to overcoming barriers and frustrations that unfortunately are a fundamental part of life. Today, students do not have enough exposure to research. They would benefit from a mentorship program with physician-researchers to increase their exposure to research in an informal but engaging and thought-provoking way.

As a student, it is important to not close your doors to ideas and career paths. The same skill set as a clinician is quite applicable to becoming a successful researcher. Too often we seem to be taking very intelligent students and we try to turn them into computers, regurgitating facts on command. These same students have significant unrealized intellectual potential to think, create, discover, ie. to become great medical researchers.

In research, as physicians, we use our instincts and bring our clinical perspective to bear. We can distill out certain parts of problems to answer the clinically relevant questions. We need to create an environment where research becomes part of how physicians routinely think and approach problems and patients. There can be a beautiful match of patient care and research; they complement each other. Research keeps you engaged, intellectually challenged, and stimulated. Patients keep you focused on the important questions. There are countless truths to be discovered and answers to medical mysteries to be found; we just need to keep encouraging medical students and trainees to keep asking questions and seeking answers.

### What was the best advice you received from a mentor?

I believe that the research physicians at the Walter Reed Army Institute of Research were excellent role models. They were honest, straightforward, and ethical. There were no politics; they worked well as a team. They had a "can do attitude", focusing on how to make things happen rather than why things might not work. It is much better to be success-driven or outcome-driven rather than be paralyzed thinking of all the reasons why something might not work.

Too often when students look toward a career, they think, "Would other people think this is a cool job?" To find a good mentor or role model, find someone that does things for the right reasons – someone you admire, someone you would like your children to emulate. Most importantly ask, "Would I be excited and fulfilled by this choice?"

### What career would you have chosen if not medicine or research?

I probably would have been a photojournalist, traveling around the world, capturing images, emotions, and places. I am also interested in learning more about commercialization. For example, I would like to know much more about how best to bring affordable and appropriate medical technology to the developing world.

### What is your favourite book?

Currently I am reading A Short History of Progress by Ronald Wright and The Kite Runner by Khaled Hosseini. One of my favorite books I recently read was A Fine Balance by Rohinton Mistry.

### What is your favourite quote?

"Fill the unforgiving minute with sixty seconds worth of distance run." – Rudyard Kipling

"Nothing in the world can take the place of persistence. Talent will not; nothing is more common than unsuccessful men with talent. Genius will not; unrewarded genius is almost a proverb. Education alone will not; the world is full of educated derelicts." – John Calvin Coolidge