# James Edgar Till (1931– ) [1]

By: Bains, Ajeet Keywords: discovery of stem cells [2] regenerative medicine [3] Ernest McCulloch [4]

James Edgar Till is a biophysicist known for establishing the existence ofstem cells [5] along with Ernest McCulloch in 1963. Stem cells are undifferentiated cells that can shift, or differentiate, into specialized types of cells and serve as a repair system in the body by dividing indefinitely to replenish other cells. Till's work with stem cells [5] in bone marrow, which produces the body's blood cells, helped form the field of modern hematology, a medical discipline that focuses on diseases related to the blood. He also worked on issues in the medical field including patient inclusion in clinical trials, matters of effective and ineffective clinical communication, and limitations of public access to medical and scientific research. Till's work with stem cells [5] furthered scientists' understanding of abnormal blood cell development, which helped set the foundation for regenerative medicine [6].

Till was born in Saskatchewan, Canada, on 25 August 1931, but was raised near the Alberta side of the provincial border town of Lloydminster in Canada. As a child, Till lived on a farm and manually harvested crops, work that he performed for sixteen hours per day. Grain harvesting machines only came into common practice during his teenage years, so the farm work Till did as a child involved a lot of manual labor. After his childhood, Till frequently visited his family's farm in Lloydminster and helped with the harvest there each fall.

After graduating high school, Till pursued his higher education in physics. He attended the University of Saskatchewan in Saskatchewan, Canada, with scholarships from the Standard Oil Company and the National Research Council [7] for academic merit, and he graduated with a bachelor of science degree in 1952 and a master of science degree in 1954. Till completed his master's degree in physics under the supervision of Harold Elford Johns, a scientist who had discovered that ionizing radiation [8], which is radiation [8] that removes electrons from atoms, could be used as a cancer treatment. Till later secured a fellowship position at the National Cancer Institute [9] of Canada, or NCIC, modernly known as the Canadian Cancer Trials Group, where he explored how radiation [8] affects cells in mammals. Till's fellowship at the NCIC gave him the chance to pursue further graduate studies, later completing his doctoral studies in biophysics at Yale University [10] in New Haven, Connecticut, in 1957. During his doctorate, Till studied the effects of radiation [8] on cell division in mammals.

In 1957, Till accepted a position located in Toronto at the Ontario Cancer Institute's Physics Division, where he met McCulloch, who studied blood and blood diseases. Till and McCulloch's research partnership in the late 1950s and early 1960s led to their eventual collaboration on stem cell research. Till and McCulloch formally collaborated in 1958 when McCulloch began performing experiments that involved exposing mice bone marrow to radiation [8] to test susceptibility of tissue toradiation [8]. McCulloch's experiments needed a physicist who knew how to work with radiation [8] to operate the radiating equipment. Till and McCulloch were trying to understand why and under what circumstances radiation [8] therapy killed cancer cells.

Till and McCulloch continued their research with mice andradiation [8] in the 1960s. Scientists had previously theorized that some component in the blood could save people who had radiation [8] sickness. Scientists then realized they could save mice from death caused by radiation [8] by transplanting healthy bone marrow cells into sick mice. That served as the basis to Till and McCulloch's research. After injecting mice with bone marrow cells, Till and McCulloch noticed small lumps forming in the mice's spleens. They named those lumps, spleen colonies. Further experiments demonstrated that the colonies were clones derived from single cells, which later scientists identified as stem cells [5]. The pair published their results in the scientific journal*Nature* in 1963. Additional experiments demonstrated that the colony-forming cells were capable of self-renewal, which is the process by which stem cells [5] divide to create morestem cells [5]. At the time, the technique of bone marrow transplantation was in its early stage and scientists knew that transplantation replenished the essential cells of the blood system. Till and McCulloch's work shed light on the source of those cells by showing how a single type of cell could proliferate to repopulate bone marrow cells while also specializing into different types of mature blood cells.

In the following decades, Till shifted his focus away from stem cell research. In the 1970s, he collaborated with cancer researchers and published an article on the efficacy of different treatments for a type of throat cancer. Then, in the 1980s, he focused on patient inclusion in clinical trials. Till and colleagues revealed a direction for future research in efficiently preventing barriers to patient entry in clinical trials, which would help apply fundamental science to human disease.

During the 1990s, Till researched issues relating to doctor-patient communication. He discussed the problems facing clinical communication from doctors to patients, including how medical schools lacked effective courses to teach their students how to communicate with dying patients. Till and colleagues published that analysis in the British Medical Journal in 1991. They also questioned how researchers could address the issue of communication between doctors and patients if educational and health care systems do not incentivize health care professionals to learn and teach clinical communication skills. Till claimed that medical school was a stressful and abrasive experience that bred cynicism and callousness among future doctors rather than encouraging empathetic doctors who know how to communicate with terminally ill patients. Till ended the article by stating that

such communication education needed to be incorporated into medical education and continuing education programs promptly so that physicians are empowered to provide better medical care for their patients.

Till has achieved several awards and distinctions. He served on numerous national and international committees, including at the University of Toronto in Toronto, Ontario, and the Canadian Cancer Trials Group. In 1994, he became an officer of the Order of Canada, soon becoming a fellow of the Royal Society of Canada and the Royal Society of London. In 2005, he won the Albert Lasker Award, which recognizes contributions to medical science, for basic medical research. Till later founded the Canadian Stem Cell Foundation in Ottawa, Ontario, which researches stem cell derived therapies for clinical benefit.

During the late twentieth century, Till's list of research topics extended to include quality of life research, clinical and epidemiological studies, research ethics, decision-making behaviors of cancer patients and those at high-risk to develop cancer, and the influence of the internet as a source for information, support, and advocacy. He advocated for public open-access to medical journals to provide medical and research study results to everyone. Because of his advocacy, the California Institute of Regenerative Medicine in Oakland, California, later required that papers published with CIRM funding to be available to the public. Till also was the editor of two blogs, called *Be Openly Accessible or Be Obscure* and *Cancer Stem Cell News*.

Till's research with McCulloch provided the foundation for both modern-day stem cell research and for medical advances to treat cancer and other diseases. Those advances include therapies like bone marrow transplants, which involve the infusion of certain stem cells [5] into the body to restore immune function. Till's research also provided new opportunities in regenerative medicine [6], which is a field in which scientists use stem cells [5] to repair or replace damaged or diseased cells to produce artificial organs. As of 2020, Till holds the title of Professor Emeritus at the University of Toronto in Toronto, Canada.

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