James Alexander Thomson (1958-) [1]

By: Wu, Ke Keywords: Biography [2] Stem cells [3]

James Alexander Thomson [4], affectionately known as Jamie Thomson [4], is an American developmental biologist whose pioneering work in isolating and culturing non-human primate [5] and human embryonic stem cells [6] has made him one of the most prominent scientists in stem cell research. While growing up in Oak Park, Illinois, Thomson?s rocket-scientist uncle inspired him to pursue science as a career. Born on 20 December 1958, Thomson [4] entered the nearby University of Illinois [7] Urbana-Champaign nineteen years later as a National Merit Scholar majoring in biophysics. He became fascinated with development via the encouragement and influence of Fred Meins, one of his undergraduate professors. After graduating as a Phi Beta Kappa scholar, Thomson [4] took his interest in biology to the University of Pennsylvania [8] where he earned two doctorate degrees: one in veterinary medicine, completed in 1985, and the other in molecular biology, completed in 1988. It was during his graduate years that Thomson [4] began working with embryonic stem cells [6].

During his graduate studies, Thomson [4] first worked with mouse [9] embryonic stem cells [6] and eventually moved to experimenting with monkey embryos. His doctoral research focused on genetic imprinting in early mammalian development, was conducted at the Wistar Institute in Philadelphia under the supervision of David Solter [10]. After completing his graduate studies, Thomson [4] joined the Oregon Regional Primate Center as a postdoctoral research fellow for two years. In 1991, he moved to the Wisconsin Regional Primate Center (WRPC) at the University of Wisconsin-Madison . As a resident in veterinary pathology he soon became what was called an Assistant Scientist. It was in these first few years at the WRPC that Thomson [4] worked with rhesus monkeys , leading to the publication of the first paper on deriving primate [5] embryonic stem cells [6]. The paper, ?Isolation of a Primate Embryonic Stem Cell Line,? appeared in the August 1995 issue of the *Proceedings of the National Academy of Sciences [11] of the United States of America*. That same year Thomson [4] became Chief Pathologist at the WRPC.

Studying mice and monkeys allowed Thomson [4] to gain an understanding of mammalian embryo development, but his chief curiosity was human embryo development. Before Thomson [4] and his team isolated primate [5] embryonic stem cells [6], the possibility of isolating human embryonic stem cells [6] seemed far off. Thomson?s 1995 breakthrough, however, placed human embryonic stem cells [6] at the new frontier. Before pursuing that frontier, Thomson [4] consulted two University of Wisconsin-Madison bioethicists, Norman Fost, a physician, and R. Alta Charo, a law professor. Ultimately, Thomson [4] decided that the leftover embryos from *in vitro [12]* fertilization?doomed to eventual destruction?should not go to waste when they could provide immeasurable research value. Thus he began his groundbreaking research in human embryonic stem cells [6] using these discarded embryos, donated under informed consent [13]. This research led to the publication of ?Embryonic Stem Cell Lines Derived from Human Blastocysts? in the November 1998 issue of *Science*.

This paper was the first paper to describe the derivation and cultivation of human embryonic stem cells

[6]. A few days after Thomson?s publication, another team of scientists led by John D. Gearhart at Johns Hopkins University [14] also published a paper, ?Derivation of Pluripotent Stem Cells from Cultured Human Primordial Germ Cells? in the November 1998 issue of the *Proceedings of the National Academy of Sciences [11] of the United States of America*, detailing the derivation and cultivation of human embryonic stem cells [6]. However, unlike Thomson [4], Gearhart derived the embryonic stem cells [6] from primordial germ cells [15], the precursors of fully differentiated germ cells [15]. It is worth noting that both teams of scientists received funding from Geron Corporation [16], a biotech firm headquartered in Menlo Park, California. Thomson [4] had already moved to an off-campus lab a few years earlier in a non-profit facility associated with the University of Wisconsin?s alumni association. Not wanting to deal with federal restrictions imposed by the Dickey-Wicker Amendment [17] or jeopardize the university?s government funding, he thought it would be best to separate his potentially controversial work from the government. The limited private funds meant that Thomson [4] had to perform most of the lab work himself, getting up early every morning to head to the lab. The isolated cells needed to be carefully monitored during the division and multiplication process. It was imperative that the cells not undergo morphological changes in order to characterize them as embryonic stem cells [6].

By isolating pluripotent stem cells [18], which have the ability to differentiate into any of the 200+ cell types in the body, Thomson [4] paved the way for increased research into human cellular development, drug research, and transplantation medicine. In the year following Thomson?s publication, he became Assistant Professor in the Department of Anatomy at the University of Wisconsin Medical School as well as Scientific Director of the WiCell Research Institute in Madison, Wisconsin. For his research in embryonic stem cells [6], Thomson [4] was a featured scientist in Time magazine?s ?America?s Best in Science and Medicine? in 2001. Though national policies did not support stem cell research, Thomson [4] continued to serve as an advocate for increased research in the field. Thomson [4] not only testified before the U.S. Senate on the value of such research, but was also the lead plaintiff in *Thomson [4] v. Thompson* in 2001, where he sought support from the National Institute of Health to further stem cell research.

In 2007 James Thomson [19], with first author Junying Yu [20], published yet another pioneer paper in *Science*: ?Induced Pluripotent Stem Cell Lines Derived from Human Somatic Cells.? The cells used in experimentation were adult skin cells, induced to become pluripotent stem cells [18] after the addition of four genes [21] to the cells. Independent of Thomson [4], Shinya Yamanaka [22] discovered these four genes [21] as well in his lab at Kyoto University [23]. For Thomson [4], the discovery of induced pluripotent stem (iPS) cells in humans [24] suggests that researchers can shift away from the controversial field of using embryos in research, yet still have access to research involving pluripotent stem cells [18]. In fact, he believes that iPS cells provide a whole realm of possibilities due to the relative ease of creating and cultivating iPS cells compared to pluripotent stem cells [18] derived from embryos, which may be difficult to obtain. 2007 was also the year that Thomson [4] became an adjunct professor at the University of California, Santa Barbara (UCSB). This professorship has not only allowed Thomson [4] to collaborate in an interdisciplinary research initiative, but has also provided access to marine organisms, which are important to his interest in the evolution [25] of pluripotency [26]. In addition to being the John D. MacArthur Professor at the University of Wisconsin School of Medicine and Public Health and a UCSB adjunct professor, in 2008 Thomson [4] became the Director of Regenerative Biology at the Morgridge Institute of Research.

Aside from his professorships and involvement in research, Thomson [4] also founded a

biotechnology firm in 2004: Cellular Dynamics International. He received venture capital from the Wisconsin-based Tactics II Ventures, to start this firm with the intention of applying his research in pluripotent stem cells [18] to the medical field. This company has been using pluripotent stem cells [18] in drug screening and development as well as personalized medical applications via such developments as a bank for individual stem cell lines.

Thomson [4] has received numerous honors for his contribution to the field of stem cell research. Among those honors, he was featured in *Science*?s ?1999 Scientific Breakthrough of the Year,? won the 1999 Gold Plate Award from the American Academy of Achievement, and received the 2002 Lois Pope Annual LIFE International Research Award . The Christopher Columbus Foundation awarded him the Frank Annunzio Award (Science/Technology) in 2003. Additionally, he received the 2005 Distinguished Service Award for Enhancing Education through Biological Research from The National Association of Biology Teachers, as well as the Nathan R. Brewer Scientific Achievement Award from the American Association for Laboratory Animal Science a year later. Most recently, after he publicized research on induced pluripotent stem cells [27], Thomson [4] was honored with the 2008 Massry Prize, which recognizes outstanding contributions to the biomedical sciences and the advancement of health. In 2008, he was also named one of Time magazine?s 2008 most influential people, recognizing his importance in the field of science.

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