

Thomas Joseph King Jr. (1921–2000)

Thomas Joseph King Jr. and fellow scientist Robert Briggs pioneered a method of transplanting nuclei from blastula cells into fresh egg cells lacking nuclei. This method, dubbed nuclear transplantation, facilitated King's studies on cancer cell development. King's work was instrumental for the development of cloning of fish, insects, and mammals.

King was born on 4 June 1921 in New York City, New York. When his mother died in childbirth, an aunt raised King in Ridgefield Park, New Jersey. He studied at Fordham University in Bronx, New York, where he earned his BS in 1943. Following graduation, King served as a US Army instructor in the Army Medical Technicians School at the Lawson General Hospital in Atlanta, Georgia. While in the Army, he met registered nurse Marion Emerson, whom he married in 1946.

After receiving an honorable discharge from the Army in 1946 as a First Lieutenant, King began his graduate studies at New York University in New York City, New York. King earned his Master's degree working with a renal tumor in the frog *Rana pipiens*. During his studies, he worked as an Instructor at the Department of Physiology at Hunter College in New York City, New York, as well as a teaching fellow at NYU. He also trained in microsurgery with Robert Chambers and Milan Kopac, providing him with the techniques he would later use to develop nuclear transplantation.

Based on his training in microsurgery, Robert Briggs recruited King to work with him in Philadelphia, Pennsylvania as a Research Fellow at the Institute for Cancer Research in 1950. There the two researchers developed the method of nuclear transplantation. Briggs and King first inseminated an egg with irradiated sperm, then pricked the egg with a clean glass needle to remove the nucleus and demonstrate that the egg could not continue developing. They then infused the activated cell with a donor nucleus. In a set of experiments performed in 1952, Briggs and King demonstrated that the transferred nuclei had produced viable tadpoles. Their method became the foundation for later cloning procedures.

King earned his PhD in Zoology studying with embryologist Ross Nigrelli from New York University in 1953 for his dissertation "The Transplantability of Nuclei of Arrested Hybrid Blastulae (*R. pipiens* Male X *R. catesbeiana* Female)." His nuclear transplantation work continued through the next decade, as he began experimenting with donor nuclei from progressively later stages in development. Briggs and King attempted to discern whether differentiation caused irreversible loss of genes as cells specialize during development. Their experiments revealed that as cells specialize, their nuclei appear to lose the ability to fully direct and regulate developmental processes. However, in 1958 John Gurdon's results with the *Xenopus laevis* frog directly challenged the idea of nuclei losing the potential to regulate development. Gurdon was able to induce differentiation with the nuclear transplantation method at much later stages in development than did Briggs and King in their experiments.

King chaired the Department of Embryology at the Institute for Cancer Research in Philadelphia, Pennsylvania from 1956 until 1967. There, he researched cancer cells in frogs. At that time, many scientists assumed that cancer cells were genetically programmed to give rise only to more cancer cells. King challenged this assumption. He used nuclear transplantation to move cancer cell nuclei into enucleated eggs, and instead of producing tumor cells, the transplanted nuclei developed into abnormal embryos. King thus demonstrated the potential of the cancer cell nucleus to direct development rather than simply produce more cancer cells.

From 1967 until 1972 King worked as a biology professor at Georgetown University in Washington, D.C. Briggs and King won the Charles Leopold Mayer Prize of the Académie des Sciences in 1972

for their 1952 research on nuclear transplantation in tadpoles. They were the first two Americans in history to receive the award from the French academy. King then held several administrative positions at the National Cancer Institute in Bethesda, Maryland until 1980, when he returned to Georgetown University as Professor of Obstetrics and Gynecology and took over as Director of the Kennedy Institute of Ethics until 1983. Afterwards, King served as Special Assistant to the Director of the Lombardi Cancer Research Center at Georgetown until 1988. He retired as the center's Deputy Director Emeritus in 1990, shortly after his wife Marion died in 1989. King died of cancer on 25 October 2000, at the Johns Hopkins Hospital in Baltimore, Maryland.

Modern work in cloning would not be possible without the techniques Briggs and King developed and employed. Today's somatic cell nuclear transfer (SCNT) experiments have used techniques similar to those that Briggs and King developed. His cancer research with frogs, despite belief at the time that cancer only begets cancer, altered the perspective on cancer cell differentiation. As a direct result of his research, many scientists have developed new therapeutic treatments by controlling cancer cells through induced differentiation.

Sources

1. Briggs Robert, and King Thomas Joseph. "The transplantation of living nuclei from blastula cells into enucleated frogs' eggs." *Proceedings of the National Academy of Sciences* 38 (1952): 455-463.
2. Crowe, Nathan. "A 'Fantastical' Experiment: Motivation, Practice, and Conflict in the History of Nuclear Transplantation, 1925-1970." PhD diss., University of Minnesota, 2011.
3. Di Berardino, Marie A., and Robert G. McKinnell. "The Pathway to Animal Cloning and Beyond—Robert Briggs (1911-1983) and Thomas J. King (1921-2000)." *Journal of Experimental Zoology* 301 (2004): 275-9.
4. Gurdon, John B., Tom R. Elsdale, and Michael Fischberg. "Sexually Mature Individuals of *Xenopus-Laevis* from the Transplantation of Single Somatic Nuclei." *Nature* 182 (1958): 64-5.
5. King, Thomas Joseph, and Robert Briggs. "The Transplantability of Nuclei of Arrested Hybrid Blastulae (R-Pipiens Male X R-Catesbeiana Female)." *Journal of Experimental Zoology* 123 (1953): 61-78.
6. McKinnell, Robert G., and Marie A. Di Berardino. "Obituary: Thomas J. King Jr. (1921-2000)." *Differentiation* 67 (2001): 59-62.