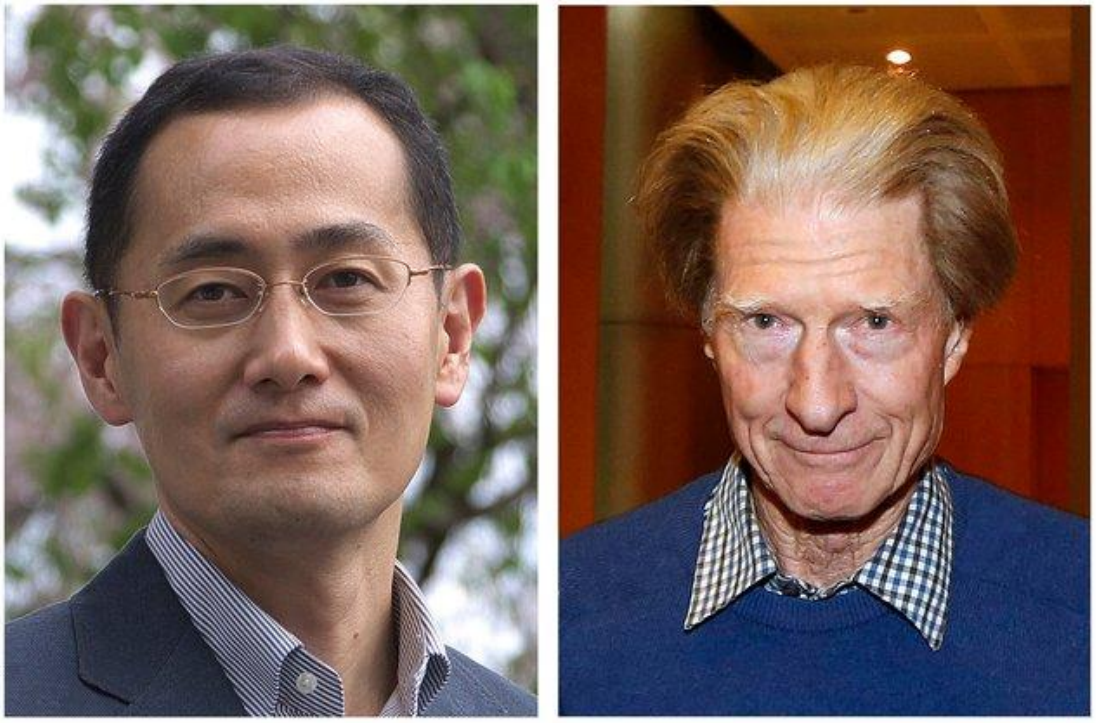
Cloning and Stem Cell Discoveries Earn Nobel in Medicine

By NICHOLAS WADE October 8, 2012



Shinya Yamanaka, left, in April 2009, and John B. Gurdon.

A pair of landmark discoveries made 40 years apart have earned the 2012 Nobel Prize in Physiology or Medicine for John B. Gurdon of the University of Cambridge in England and Shinya Yamanaka of Kyoto University in Japan. The prize was announced in Stockholm on Monday.

The discoveries concern the manipulation of living cells, and lie at the heart of the techniques for cloning animals and generating stem cells, the primitive cells from which the mature tissues of the body develop. Dr. Gurdon was the first to clone an animal, a frog, and Dr. Yamanaka discovered the proteins with which an adult cell can be converted to an egg-like state.

Both techniques reach to the beginnings of life, and have generated objections from people who fear, on ethical or religious grounds, that scientists are pressing too far into nature's mysteries and the ability to create life artificially.

Biologists have pushed ahead nonetheless, believing that manipulations like these may lead to regenerative medicine, the hope of repairing or replacing stricken organs with the body's own cells.

Dr. Gurdon's discovery came in 1962, when he produced living tadpoles from the adult cells of a frog. His work was at first greeted with skepticism, because it contradicted the textbook dogma that adult cells are irrevocably assigned to their specific functions and cannot assume new ones.

Dr. Gurdon's technique was to extract the cell nucleus, containing the frog's chromosomes, from a mature intestinal cell and inject the nucleus into a frog egg whose own nucleus had been removed. The egg was evidently able to reprogram the introduced nucleus and direct its genes to switch from the duties of an intestinal cell to those appropriate to a developing egg.

But how did the egg cell body accomplish this reprogramming feat? The answer had to wait another 44 years while molecular biologists gained a more intimate understanding of genes and the agents that control them.

Working with mice, Dr. Yamanaka discovered in 2006 that the reprogramming is accomplished by just four specific gene control agents in the egg. The agents, known to biologists as transcription factors, are proteins made by master genes to regulate other genes. By injecting the four agents into an adult cell, Dr. Yamanaka showed that he could walk the cell back into its primitive, or stem cell, form.

Stem cells generated by this method, known as induced pluripotent cells, or iPS cells, could then mature into any type of adult cell in the body, a finding with obvious potential for medical benefits.