Nobel prize in Medicine 2012

Prof. K. Ramesh Rao

HOD & Professor, Department of Pathology, Chettinad Hospital and Research Institute, Chennai - 603103

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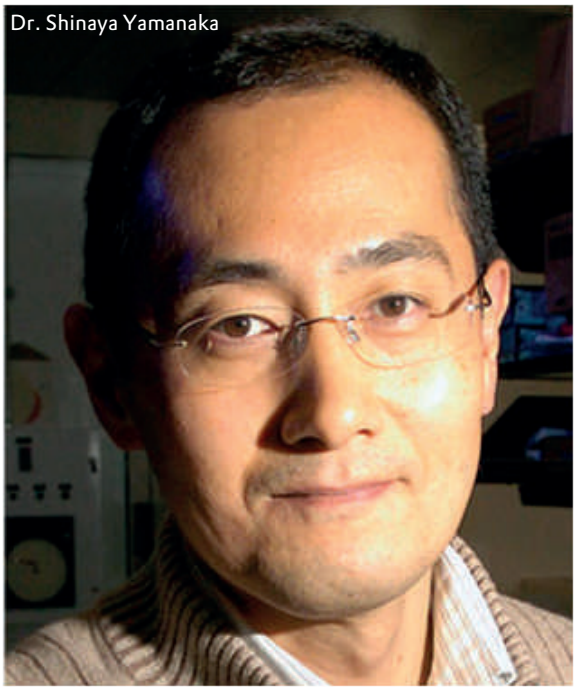
An average human body is made up of about 50 trillion cells. All of them are derived from the multiplication and progressive differentiation of a single fertilized ovum. The ovum and its immediate descendants (up to the stage of 8 cell embryo) are pluripotent, capable of differentiating into every cell in the body. Their descendants, however, mature and differentiate into more and more specialized cells performing unique but limited functions that help in the survival of the organism. This progressive specialisation is acquired at a price; the loss of ability to differentiate into other cells; actually, a programmed loss for common good. This loss is particularly noticeable in highly specialized cells like cardiac myocyte and neurons, which cannot even multiply. This loss seriously hinders the repair in these tissues. At first, this limitation was believed to be an irrevocable, unidirectional event following the arrow of time. But it was soon realized that these specialized cells have the same genetic constitution as the pluripotent cells; but some of the genes that confer pluripotentiality have been selectively silenced. Is it possible to make them sing again?

Two scientists, John B. Gurdon and Shinya Yamanaka, investigating the same question half a century apart in their separate ways, proved that it is possible to reprogram mature cells to become pluripotent. The Nobel Committee has honoured their groundbreaking discovery by awarding 2012 Nobel Prize for Physiology and Medicine to these two remarkable scientists.

Prof. John. B. Gurdon

Sir John B. Gurdon was born in 1933 in Dippenhall, UK. Having received his Doctorate from the University of Oxford in 1960,he did postdoctoral fellowship at California Institute of Technology. In 1962, in a series of seminal experiments, he replaced the nucleus of frog's egg cell with the nucleus from the mature specialized cell from the intestine of a tadpole. He managed to obtain cloned tadpole and in a later experiment, frog (Gurdon, JB - 1962. The developmental capacity of nuclei taken from intestinal epithelium cells of feeding tadpoles. Journal of Embryology and Experimental Morphology 10:622- 640).Though his work was initially received with skepticism, it was soon confirmed by other researchers. His work laid the foundation for cloning of mammals. Dr. Gurdon joined Cambridge University, UK, in 1972 and has served as Professor of Cell Biology and Master of Magdalene College. Gurdon is currently at the Gurdon Institute in Cambridge.



Dr. Shinaya Yamanaka

Prof. Gurdon's solution though elegant, required removal of the nucleus. The question that came up was "Is it possible to reprogram an intact cell?"In 2006, Dr. Shinya Yamanaka and his team answered this question first by isolating the genes that conferred pluripotency to pluripotential stem cell. In the next step, they introduced these genes in various combinations into mature cells in order to find the combination that worked. Finally they zeroed in on a group of four genes that reprogrammed mature fibroblast into a pluripotential stem cell (Takahashi, K, Yamanaka, S. (2006). Induction of pluripotent stem cells from mouse embryonic and adult fibroblast cultures by defined factors. Cell 126:663-676).

Shinya Yamanaka was born in Osaka, Japan in 1962 (The year Dr. Gurdon did his work). He obtained his MD in 1987 at Kobe University and trained as an orthopaedic surgeon before switching to basic research. Yamanaka received his PhD at Osaka University in 1993, after which he worked at the Gladstone Institute in San Francisco and Nara Institute of Science and Technology in Japan. Yamanaka is currently Professor at Kyoto University and also affiliated with the Gladstone Institute.

Sources

The Scientific American, 8, October, 2012
The Guardian, 8, October, 2012.