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OBITUARY

Sir Robert Geoffrey Edwards

(1925-2013)

The World Scientific Community suffered a huge setback on April 10, 2013 when the pioneer of reproductive medicine and *in-vitro* fertilisation (IVF) Sir Robert Geoffrey Edwards, FRS, a Nobel Prize-winning scientist died at the age of 87 after a long lung illness.

Robert G. Edwards was born on 27th September, 1925 at Batley in England. After finishing his schooling in Manchester, he served in the British Army and then completed his undergraduate studies in biology at Bangor University. Edwards then moved to the University of Edinburgh and studied at the Institute of Animal Genetics and Embryology and earned his doctorate degree in Genetics in 1955. In 1963, he joined the University of Cambridge as Ford Foundation Research Fellow and became a Reader in Physiology in 1969. He, in collaboration with Patrick Steptoe, a gynaecologic surgeon from Oldham General Hospital, developed human culture media to allow the fertilisation and recover ovocytes from patients with tubal infertility with the help of laparoscopy, ultimately led to the birth of Louise Brown, the world's first "test tube baby" at 11.47 PM on 25th July, 1978. During the entire development of the creation of this medical history, their attempts met significant hostility and opposition, including a refusal of the Medical Research Council to fund their research and a number of lawsuits.

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In-vitro fertilisation (IVF), a process by which an egg is fertilised by sperm outside the body (*in-vitro,* in laboratory condition), has offered a new way to help infertile couples who formerly had no possibility of having a baby. IVF involves monitoring the woman's ovulatory process to remove ova/eggs from the woman's ovaries and then letting sperm for fertilisation to take place in a fluid medium in a laboratory. The fertilised egg (Zygote) is subsequently transferred to the patient's uterus with the aim of establishing the successful pregnancy. It may be used to overcome female infertility due to problems of fallopian tube, making the fertilisation *in-vivo* (in natural condition) difficult. It may also assist in male infertility, if the sperm quality is defective, and in that case intracytoplasmic sperm injection (ICSI) may be used, where a sperm cell is injected directly into the egg cell. When the sperm count is very low and also has difficulty/no power to penetrate the egg, only then ICSI is utilised and also found to increase the success rates of IVF.

For the development of this path breaking treatment in the history of medical science that has revolutionized the cure of human infertility, Professor Edwards was awarded Nobel Prize in Physiology or Medicine in 2010. In addition to the Nobel Prize, he had several honours and awards to his credit too. To name a few are Fellow of the Royal Society (elected in 1984), Doctor Honoris Causa, University of Valencia (Spain), Albert Lasker Clinical Medical Research Award by the Lasker Foundation for the development of IVF technique (2001), an Honorary Doctorate, University of Huddersfield (2007), Knighthood (2011), etc.

Prof. Edwards is survived by his wife Ruth Fowler Edwards, 5 daughters and 12 grandchildren. The death of this British Physiologist, known as the father of IVF for pioneering the development of test tube babies, whose work was motivated by his belief that "the most important thing in life is having a child" has created a huge gap in the scientific community and could be termed as an unbearable loss to the entire scientific fraternity. Hopefully, the many students he mentored may carry forward his scientific legacy.

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Professor Francois Jacob

(1920-2013)

The World Scientific Community lost a scientist par excellence when Prof. Francois Jacob, a French biologist/geneticist who propounded the Operon concept with Jacques Monod that explains the regulation of gene in *Escherichia coli* (*E. coli*, a bacterium), passed away on 19th April, 2013. This Nobel Laureate was 92.

Jacob was born on 17th June, 1920 at Nancy in France. After his schooling at Lycee Carnot, he entered medical school, received his M.D. degree in 1947 from the Faculty of Medicine, University of Paris. Meanwhile, he joined the medical company of the French 2nd Armoured division in 1940 where he injured in a German air attack in 1944. He was awarded France's World War II highest decoration for valor, the Cross of Liberation as well as Legion d'honneur and Croix de Guerre for his wartime service. He had to choose research rather than medical profession (the shrapnel that pierced his side during the invasion killed his dream of becoming a surgeon) as his career because he couldn't stand for long periods to perform operations owing to his injuries during wartime. After earlier rejections, Jacob joined the prestigious Pasteur Institute as research assistant under the supervision of Andre Lwoff in 1950 in Paris and obtained his doctorate in Science in 1954. Jacob Monod, a disciple of Andre Lwoff, was also carrying out research there at the same institute. In 1960, he became the head of the department of cellular genetics at the institute and from 1965 he served as professor of cellular genetics at the College de France. Jacob worked on phage (virus) in Lwoff's lab and Monod worked downstairs on bacteria. They began to collaborate after realizing that they were actually studying the same thing i.e. repression, uncovering the switch that turns beta galactosidase synthesis off and on, led to the award of Nobel Prize in Medicine or Physiology in 1965 with Andre Lwoff. He was also conferred on Gran Prix Charles-Leopold Mayer by the

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Academie des Sciences in 1962, Lewis Thomas Prize for Writing about Science and also Academie francaise Seat 38 in 1996. He has also authored books. To name a few are The Possible and The Actual (1982); The Statute Within: An Autobiography (1988); The Logic of Life (1993); Of Files, Mice and Men (1998).

DNA of any organism doesn’t tell about the specificity of function developed in each and every cell of our body, which requires regulation. Jacob and Monod showed where and how the regulation occurred i.e. how a gene’s activity can be turned on and off (gene regulation) through Operon model, which is regarded as the secret of life’s complexity and adaptability. Operon is a unit of gene expression and regulation, which includes Regulator gene (self regulated), Promotor gene (the site where RNA polymerase is attached), Operator gene (the gene which initiates the transcription for mRNA) and different Structural genes which determine the RNA sequence for the structure of a particular protein. In true sense, the Operator, Promotor and the Structural genes together constitute the Operon. The bacterium *E. coli*, which prefers glucose as food source, is able to adapt to changes in the available food in its environment. When it is put in a culture in which the only source of energy is lactose rather than glucose, the cells will start consuming it and to do that, it needs three specific enzymes. When lactose is abundant, a lactose molecule attaches to a protein that is repressing the three enzymes’ gene. The genes are then activated, which allows the cell to consume lactose and survive. The entire complex is called the *lac* operon. Jacob and Monod’s unravelling of the *lac* operon not only introduced the concept of regulatory sites on DNA, but also the concept of mRNA, an intermediary molecule between DNA and protein.

He was married to Lysiane Bloch with whom he had four children and after her death he remarried in 1999 to Genevieve Barrier. His passing away has created a void in the scientific community in general and amongst geneticists in particular who will remain indebted to his path breaking discovery concerning regulatory activities in bacteria that fetched him a Nobel Prize in 1965 in Physiology or Medicine.

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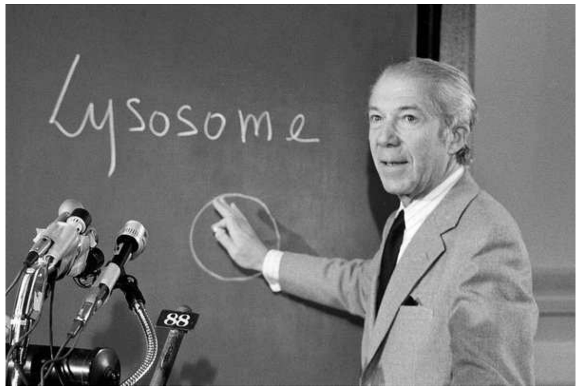
Christian de Duve



(1917-2013)

Prof. Christian Renè, viscount de Duve, an eminent Belgian Nobel Prize-winning cytologist and biochemist who pioneered the modern cell biology and cell fractionation techniques, died on May 4, 2013 at the age of 95 after battling with cancer, arrhythmia and a number of health problems. He, however, chose to end his life through euthanasia.

C. de Duve was born on 2nd October 1917 at Thames Ditton in Surrey, Great Britain. His parents fled to England during the First World War and after the end of the war, they returned to Belgium in 1920. He earned his medical degree from the Catholic University of Leuven in 1941 and a doctorate degree in chemistry in 1945 on insulin. He served as a medic in the Belgian Army during Second World War. But, he managed to escape and made his way back to Belgium when German forces captured his unit in France. He studied under Hugo Theorell at the medical Nobel institute in Stockholm and Carl Cori and Gerty Cori at Washington University in St. Louis, all are Nobel Laureates. This meritorious son of Belgian refugees specialized in subcellular biochemistry and cell biology, discovered lysosomes, peroxisomes and cell orgenelles, joined the Catholic University of Leuven in 1947 to teach physiological chemistry and became a Professor in 1951. He joined Rockefeller University in New York City in 1962 as a faculty and divided his time between New York and Leuven. Later on, he became Emeritus Professor at the University of Leuven in 1985 and at the Rockefeller University in 1988. He founded the International Institute of Cellular and molecular pathology in Brussels in 1974 and retired as President of the pathology institute in 1991. He wrote several books too, the important of them are- “A Guided Tour of the Living Cell (1984)”; “Blueprint for a Cell”; Vital Dust; Genetics of Original Sin: The Impact of Natural Selection on the Future of Humanity (1991)”.

Dr. de Duve shared the 1974 Nobel Prize in Physiology or Medicine with Dr. Albert Claude and Dr. George E. Palade for describing the structure and function of organelles (lysosomes and perixosomes) in biological cells. de Duve discovered lysosome (suicidal bag of the cell), which is a tiny sack filled with enzymes that functions like a garbage disposal and destroy bacteria or parts of cell that are old or worn out. His work led to the consensus that the

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endosymbiotic theory is correct, which proposes that mitochondria and chloroplasts and perhaps other organelles of the eukaryotic cells originated as prokaryotic endosymbionts, which came to live inside eukaryotic cells. He, later on, proposed that peroxisomes may have been the first endosymbionts, which allowed cells to withstand the growing amounts of free molecular oxygen in the Earth's atmosphere. Since peroxisomes have no DNA of their own, this proposal has much less evidence than the similar claims for mitochondria and chloroplasts. Claude (discovered mitochondria, the energy currency of the cell) first used centrifugal techniques to glance inside cells and Palade (discovered ribosomes, the protein factories within cells) pioneered using the electron microscope to better understand cell structures. de Duve, also received the Francqui Prize for Biological and medical Sciences in 1961, carried out research on insulin, a harmone involved in the regulation of blood sugar. Working with liver cells, he used Claude's recently developed centrifugal techniques to separate cell parts that in the real sense called for using a pestle to break open cells before placing them in the centrifuge. His discoveries about the internal workings of cells shed light on genetic disorders like Tay-Sachs disease and more than two dozen other genetic diseases in which a shortage of lysosomal enzymes causes waste to accumulate in cells and eventually destroy them. In Tay-Sachs disease, a build-up of fatty substances in the brain and other tissues leads to blindness, paralysis, mental retardation and death.

This Nobel laureate, who said that "we are sick because our cells are sick" and whose discoveries ultimately helped give birth to the science of modern cell biology, is survived by two sons, Thierry and Alain; two daughters, Anne and Francois; two brothers, Pierre and Daniel; seven grandchildrens and two great-grandsons.

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