Lap-Chee Tsui (1950–)

Lap-Chee Tsui is a geneticist who discovered the gene thought to be partly responsible for cystic fibrosis (CF), and his research team sequenced human chromosome 7. As the location of the gene associated with cystic fibrosis is now known, it is possible for doctors and specialists to identify in human fetuses the mutation to the gene that partly causes the disease. Tsui's research also outlined the mechanisms for the development of cystic fibrosis, which were previously unknown.

Tsui was born on 21 December, 1950 to Hui-Ching Hsue and Jing-Lue Tsui in Shanghai, China. Tsui grew up near Hong Kong. After high school he received a Yale-in-China scholarship and attended Chinese University of Hong Kong in 1968. He received his BS in biology in 1972. Tsui continued to study biology there, earning his MS in biology in 1974. After marrying Lan Fong Ng and having two sons, the couple moved to the US in 1974 so that Tsui could begin his doctoral studies at the University of Pittsburgh in Philadelphia, Pennsylvania.

After Tsui received his PhD in biology in 1979 studying with Roger Hendrix, he became a postdoctoral researcher at the Oak Ridge National Laboratory in Oak Ridge, Tennessee. He then studied genetics as a postdoctoral fellow in the genetics department at the Hospital for Sick Children in Toronto, Canada. There he began researching cystic fibrosis. Tsui published his first paper on cystic fibrosis in 1985, although he and his research team did not discover the gene associated with cystic fibrosis until 1989.

Using various genetic techniques, including various linkage analyses, Tsui and his colleagues were able to pinpoint a specific mutation that accounted for as much as seventy percent of all cystic fibrosis cases. In his 1989 paper, "Identification of the Cystic Fibrosis Gene: Genetic Analysis," Tsui and his fellow researchers explained that the majority of CF cases are attributable to a 3-base pair deletion from a certain gene, which helps produce the Cystic Fibrosis Transmembrane Conductance Regulator (CFTR) protein. The discovery was confirmed by comparing DNA segments from cystic fibrosis patients with those from healthy patients; healthy patients had the relevant base pairs, and cystic fibrosis patients did not.

In order to pinpoint the exact location of the CFTR gene, Tsui conducted further experiments using bacterial transfection to change bacterial gene expression by inserting the region of DNA that they suspected to contain the gene into bacterial cells. If the bacteria began expressing the CTFR gene, it indicated that the gene was present in the chromosome segment. Other studies utilized chromosome walking, a technique in which specific segments of the area of DNA suspected to carry the mutation are cloned in overlapping segments. A series of these experiments enabled Tsui and his team to narrow down the possible locations for the CFTR gene in the human genome. Using these techniques, they isolated the gene on chromosome 7.

Tsui continued his investigation of the CFTR gene and discovered how the deleted amino acid affected the functioning of the epithelial cells in which the gene is expressed. He observed that the CFTR protein normally regulates the passage of chloride ions through a channel in the cell wall, which in turn regulates the water content of fluids that cells secrete. Tsui noted that a mutated CFTR protein cannot perform these functions properly, so that individuals produce abnormally sticky mucus and sweat with high salt content, two classic symptoms of cystic fibrosis. The affected cells are found on the skin, in the nasal cavity, and in the lungs. Tsui concluded that symptoms that characterize cystic fibrosis trace to the malfunctioning CFTR gene.

In 2002, Tsui returned to Hong Kong where he became the Vice Chancellor of the University of Hong Kong. He has published hundreds of peer-reviewed papers, and he has received many honors

and awards for his work from the UK, the US, and Canada.

Tsui's work helped develop methods for determining whether or not parents are carriers of the mutated cystic fibrosis gene, and if a developing fetus has the disease or not. Tsui's discovery of the CFTR gene initiated the development of prenatal testing strategies for cystic fibrosis using chorionic villus sampling (CVS) and amniocentesis. Genetic carrier testing is now used as well, allowing people to find out if they carry the mutated gene, and potentially informing their decisions about childbirth and pregnancy.

Sources

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