

Interconnectedness OF ALL LIVING THINGS & The Role of Evolution

By Dr. S. Adhikari

What Is Life? by Paul Nurse is a masterful synthesis of biology's foundational ideas, rendered accessible through clear prose, personal narrative, and historical context. Each chapter builds upon the weaving together the cell, gene, evolution, chemistry, and information into a coherent framework for understanding life. Nurse's central thesis is that life is best understood as a dynamic, evolving system-bounded, self-regulating, and information-rich, emerging from the interplay of physical, chemical, and informational processes. This understanding is not merely academic; it is essential for addressing the existential challenges of our time.

Sir Paul Nurse is one of the most distinguished biologists of his generation, renowned for his pioneering work on the cell cycle. Nurse's Nobel Prize in Physiology or Medicine (2001), shared with Leland Hartwell and Tim Hunt, recognized his discovery of key regulators of the cell cycle work that has had profound implications for cancer research and our understanding of cellular reproduction.

Drawing inspiration from Erwin Schrödinger's classic scientific book, also titled What Is Life? Nurse both pays homage to, and expands upon Schrödinger's focus on genetic inheritance and order in living systems. However, Nurse argues that a complete answer requires a broader perspective, one that synthesizes five foundational ideas in biology: the cell, the gene, evolution by natural selection, life as chemistry, and life as information. These concepts, he proposes, are the "steps" that allow us to climb toward a clearer understanding of life's essence.

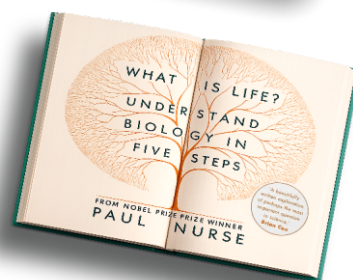
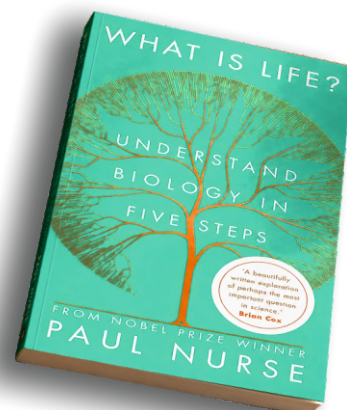
Nurse begins his exploration of life with the cell, which he dubs "biology's atom" to emphasize its foundational status. The historical narrative traces the discovery of cells, beginning with Robert Hooke's 1665 observations of cork under a microscope, followed by Anton van Leeuwenhoek's identification of single-celled "animalcules" (bacteria) in pond water and dental plaque. The development of cell theory in the 19th century by Schleiden, Schwann, and Virchow, who famously declared "Omnis cellula e cellula" ("all cells come from cells"), cemented the cell's status as biology's atom.

Nurse also explores the implications of cell division, both in development (from a single fertilized egg to a complex organism) and in disease (such as cancer, which arises from uncontrolled cell division). He highlights the importance of model organisms like yeast in uncovering the mechanisms of cell division, drawing on his own Nobel winning research.

Nurse explains the central dogma of molecular biology: DNA encodes genetic information, which is transcribed into RNA and translated into proteins. The genetic code, composed of triplets of nucleotide bases, specifies the amino acid sequences of proteins. Mutations that introduce variation, is the raw material for evolution. The interconnectedness of all life is illustrated through the metaphor of the "tree of life," with all species tracing back to common ancestors. Nurse elucidates the evolution of biochemical understanding, from early studies of enzymes to modern systems biology, which seeks to map and model the vast networks of interactions within cells.

WHAT IS LIFE ?
Understand Biology in Five Steps

By Paul Nurse
Nobel Laureate



Dr. Soumyakanti Adhikari joined the Chemistry Division at BARC in 1991 following his graduation from the BARC Training School. He quickly established himself as a specialist in radiation chemistry, focusing his research on free radical chemistry, electron processes in exotic solvents, and the synthesis of nanomaterials for bio-applications. Over a distinguished career spanning several decades, he has received numerous honors, including the IUPAC Young Chemist Prize (2001), the Asia Pacific EPR/ESR Society's Distinguished Service Award (2004), and the DAE-Science & Technology Excellence Award (2008). After serving in leadership roles within BARC's Knowledge Management Group, Dr. Adhikari currently holds the prestigious Homi Sethna Chair Fellowship in the Department of Atomic Energy.