Preface

How Life Began by William Day

Of life's untold mysteries, none seems more veiled than its origin. It is one of science's most intractable problems. We have extensive knowledge of the compositions of cells and how they operate, and we know the organisms that seem to have been the earliest form of microbial life. To show how an initial crossover from the inanimate to the animate could have occurred, however, has remained elusive.

Why has it been so difficult to solve how life began?

One reason is that biology differs from chemistry and physics in the extreme complexity of its compositions. When we look at contemporary organisms, the human body with its trillions of cells, the quintillions of atoms and molecules, we are staggered by the sheer numbers. Even the simplest of living cells consists of billions of atoms and molecules, moving and reacting in intricate precision and order.

The other reason is the exact organization of these constituents. If we dissociate a living microbe into its nucleic acids, proteins, and polysaccharides, and these in turn into their monomers and other simple compounds, nothing remains except lifeless chemicals. We can account for all the chemical components of the organism, but what made the microbe living has been lost. Life is not in the parts, it is in the exact order in which each and every part exists in the living system. And therein lies the problem. In terms of molecular composition and function, there are no simple cells, nor are there any theoretically possible.

There is a threshold of complexity that must be crossed for a living organism to exist. This challenges attempts to account for how life began because we have to assume that the many chemical interactions and transformations that resulted in a living system were probable events. This leaves a huge chasm between the realm of simple chemistry and a bridgehead to life where tens of thousands of chemical components are locked in precise order and harmony.

How then did nature bridge this chasm?

It is generally believed that the essential organic compounds pre-existed biology and assembled into a protocell that then evolved into the first organisms. Over the past fifty years considerable research has been devoted to demonstrate the abiotic synthesis of organic compounds under conditions simulating the conditions of primordial earth. Nothing, however, even approximating a functional cell has emerged from these efforts. The problem has been how the compounds could possibly have assembled into the necessary order.

Two conditions make a living cell: the chemical composition, and the exact order of the constituents. Researchers have assumed that the synthesis of starting materials came first, and that assembly followed. But they have been defeated by the inability of a cell to assemble itself.

Suppose then that synthesis and assembly were not separate steps but occurred in a same procedure simultaneously. Instead of organic constituents to initiate biology forming abiotically, they would have been synthesized in situ as the biological organization grew, the way organisms do it.

Life did not come into existence in a single bound; it evolved in stages, each stage with its own development, each development distinctly different from the one that preceded it. In life's origin, therefore, the chasm that separated the chemical condition and the biological cell was bridged in three stages: an initial synthesis, a development of a metabolic cell, and finally the formation of a genetic system.

This book explains these stages in four parts. The first part outlines the sequence in which a metabolic system for a pre-genetic cell would have evolved with a metabolic system based on coenzymes.

The second part suggests how the initiation of a biological cell would have begun, based on the theory of Günter Wächter-shäuser's surface-bonded metabolism. The third part explains how the genetic system began and evolved within the antegenesic cell - first as a parasite, then as a symbiont, and finally as an integral part of the cell.

The fourth part is titled: How Then, Where and When? It summarizes the latest findings on life's origin, and where and when it seems to have formed. And it proposes the evolutionary development that breathed life into the composition of molecules.