lost and things fall apart, never to reunite, is an inescapable fact, a law, of nature. Life, with its complex order, does not violate the thermodynamic law of inexorable tendency toward disorder. Life always requires its specific source of high-quality energy. Sunlight moves through life, empowering cyclic work, in much the same way that chemical energy channels through a Belousov-Zhabotinsky reaction. But because cells grow and reproduce to form more cells like them, once life evolved the life chemistry never ceased. Cyclic life, if provided a continuous source of energy and nutrients, will indefinitely make more of itself. Chemical systems lack selves: they cannot make more *selves.* Life is a series of selves—organisms or cells. These must expend energy to continue to exist, but they do so in unseverable connection to past life. Life has been, since inception and with no discontinuity, chemically connected to its past.

Morowitz points out that the cumulative metabolic chart of living organisms, worked out by hundreds of scientists, mainly since the beginning of this century, is one of the greatest and most underappreciated intellectual achievements of humankind. Several Nobel Prizes have been awarded for deciphering significant fragments of metabolism, the intertwined chemical reactions of cells. Only Morowitz, as far as I know, tries to organize the massive details of metabolic information into a single coherent whole, a lens to peer into life's ancient history.

Because life is intrinsically a memory-storing system, some scenarios advanced to explain its origin seem unlikely to me. Crystals, glasses, coacervates, clay, and iron pyrite (fool's gold) have all been claimed to be keys to the earliest prelife chemical systems. Advocates tout rock crevices or clay particles as the sites of the origin of life. Cavities filled with fluid exist in the membrane-bounded cells of nearly all living beings. Similar cavities, chemical bags called *liposomes,* also arise naturally. Such liposomes, membrane vesicles, appear spontaneously in so-called origin-of-life experiments. These sorts of droplets appear to me to be far more likely to represent life's original natural architecture than iron pyrite, clay, or glass. A principle of life's continuity, of life's memory, can be invoked here. I think the proverbial primordial soup of free-floating DNA or RNA never existed, because nucleic acids (DNA, RNA) are far more easily destroyed than they are spontaneously formed. Membranous structures are the sine qua non of life. Today the membrane-bounded entities with identity and integrity are cells. Life arose in its cellular wholeness. The cells of today are, as Morowitz says, "virtual fossils."