

ATTRIBUTING FUNCTION TO MOLECULES: WHAT'S ALLOWED AND WHAT'S USEFUL? L. J. Mix,
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The critical transitions in the origin-of-life occur at the intersection of chemistry and function, where we can speak of molecules encoding life-specific information, maintaining local disequilibrium, or displaying adaptive significance. All three cases require us to use the language of forms, to invoke some entity whose interesting characteristics reside in a pattern of molecules, rather than the molecules themselves. Indeed, the ability of organisms to perpetuate themselves through a complete change of constituent atoms is one of their most interesting features. Their ability to create near copies of themselves – often by dividing their material and pairing each half with new atoms – is another. I present three cases where a misapplication of form in biology has prevented progress. Each tells us something important about the role concepts play in modeling the origin of life. Restriction enzymes required us to recognize an evolutionary conflict between host genomes and opportunistic polynucleotides existing within or alongside them. Identification of “writer” and “reader” are intrinsic in concepts of information. Similarly, the endosymbiotic theory required us to redefine ideas about biological individuals. Only by thinking in terms of “inside” and “outside” could we differentiate cells, organelles, and vacuoles. Fungi challenge our current understanding of boundaries as we find more examples of hyphae with multiple nuclei from different lineages. The boundary between replicator and environment may be different for different processes of adaptation. The first functional biopolymers will be those we associate with an informational, bounded, or replicating entity. The non-material categories we choose will critically determine when such entities come into being. We must attend to the roles these categories play in biological hypotheses, regardless of philosophical debates about their natural, essential, or subsistent character.