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Evolution Depends on the Interplay between Organic and Inorganic

Interactions between organic and inorganic elements have been crucial for the evolution of life. Researchers discovered conodont fossils dating back 250-500 million years, and these fossils demonstrate initial evidence of hard teeth in the fossil record (Shubin 2009). Because of their teeth, conodonts may represent some of the first animals capable of biomineralization. Early biomineralization in animals like the conodont may have been an important factor in the Cambrian Explosion and subsequent explosion of animal diversity. Some researchers believe that a common set of biomineralization genes may have originated in one common ancestor, but the evolution of skeletal systems still arose independently across many different clades. This means that biomineralization genes could have served a pre-adaptive purpose (Murdock, 2020). Without biomineralization capabilities inherent in their genomes, carbon-based life would not have been able to use minerals for building increasingly intricate skeletal forms over time. Animal genomes then have an undeniable relationship with the inorganic environment, and the growth of this relationship has allowed for animals to prosper over time.

Animals’ relationship with the surrounding inorganic environment is also key to understanding trajectories of evolution. The mollusk, another animal with origins in the Cambrian explosion, had an aragonitic shell early in the Cambrian period but a calcitic shell a bit later in time. The shift in mineral composition likely reflects changes in ocean water chemistry during the Cambrian period, suggesting how biomineralization and hard-shell development was highly dependent on what was available in the physical environment (Li 2017). This means that even though biomineralization is a process likely controlled by a common set of genes, this process can be easily influenced by ecological factors. This relationship between carbon-based life and the inorganic environment was important during the Cambrian era and continues to be important today, as it is a relationship that has shaped the structural evolution of all animal skeletal systems. Studying organic-inorganic interactions may further illuminate how evolution shaped the past as well as how it can inform innovations in the future. It might also help us re-configure our current definitions and shed certain distinctions between life and the non-living.

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