Article #3 - Encoding Multiple Reactivity Modes within a Single Synthetic Replicator

Robertson, C. C.; Kosikova, T.; Philp, D. Encoding Multiple Reactivity Modes within a Single Synthetic Replicator. *Journal of the American Chemical Society* **2020**, *142* (25), 11139–11152. https://doi.org/10.1021/jacs.0c03527.

Figure 1

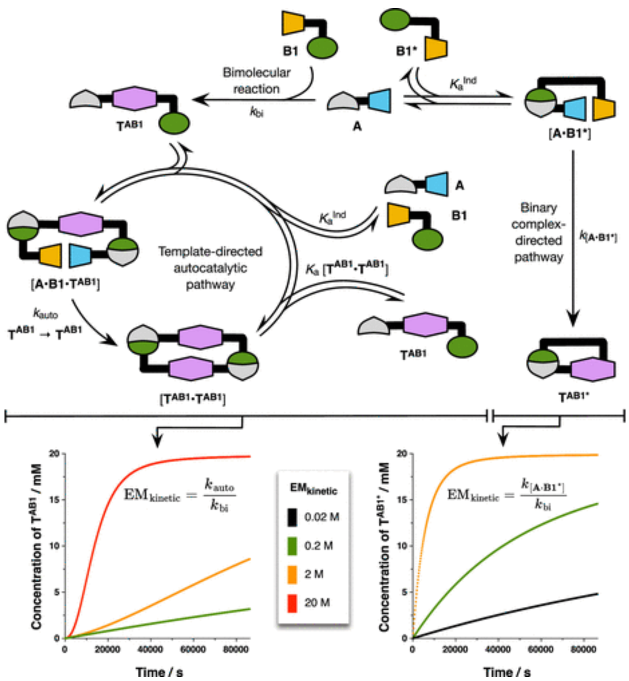

Figure 1 depicts a minimal self-replication model where components A and B1, with complementary recognition and reactive sites, react to form template TAB1, which then catalyzes its own formation via a ternary complex ([A·B1·TAB1]). Alternatively, A and B1* form a binary complex ([A·B1*]), which accelerates the reaction but leads to an inert TAB1* that cannot replicate. The system uses both template-directed and template-independent pathways, initially relying on the binary complex and later switching to the ternary complex for efficient replication. This dual-pathway model mimics early Earth replication processes and could evolve into a more complex system with new substrates.

<u>Synopsis</u>

The article "Encoding Multiple Reactivity Modes within a Single Synthetic Replicator" by Craig C. Robertson, Tamara Kosikova, and Douglas Philp, published in the Journal of the American Chemical Society, explores the design of chemical systems capable of self-replication through various pathways. This advancement is significant because it brings us closer to creating artificial systems that can replicate themselves, a fundamental characteristic of living organisms.

In this study, the researchers focused on a synthetic replicator—a molecule designed to make copies of itself. They modified one of the components of this replicator to include an additional recognition function. This modification allowed the components to assemble into a binary complex, which then facilitated the replicator's formation through a template-independent pathway. This approach achieved maximum rate acceleration at early stages of the replication process.

The key figure in this study is Figure 1, which illustrates the design of the modified replicator system. The figure shows how the additional recognition function enables the components to form a binary complex, leading to the self-replication process. This visual representation is crucial for understanding the mechanism by which the replicator operates and how the modifications enhance its reactivity modes.

This research is important because it demonstrates that a single synthetic replicator can possess multiple reactivity modes, allowing it to replicate through different pathways. Such versatility is a step toward creating artificial systems that can adapt and evolve, similar to natural biological systems. The findings could have applications in developing self-replicating materials and systems with complex behaviors.

In summary, the article presents a significant advancement in the field of synthetic chemistry by demonstrating how a single replicator can be engineered to replicate through multiple pathways. This work brings us closer to understanding and creating artificial systems with self-replicating capabilities, a fundamental characteristic of life.