

Chemical Approach Towards a Protocell Model

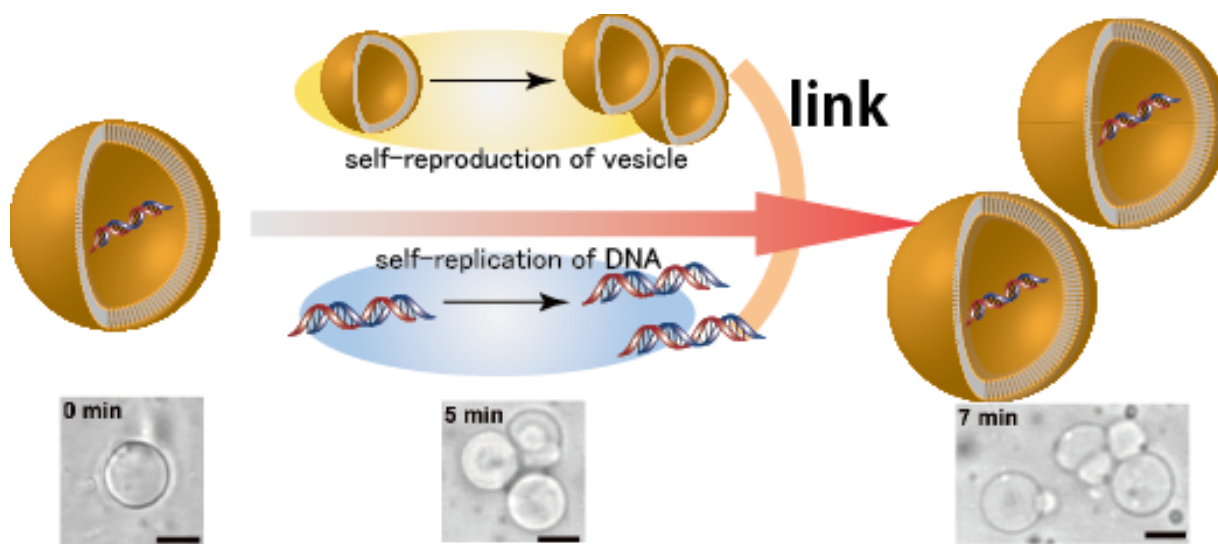
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We have been interested in the construction of a vesicle-based Protocell Model. We already reported a self-reproducing giant vesicle (GV) system in which GVs grew and divided to daughter GVs with almost the same size if a membrane precursor was added to a dispersion of GVs containing a catalyst [1]. We showed that robust self-reproduction of GVs continued over several generations, as revealed by observation through optical microscopy and population analysis on the basis of flow cytometric measurements [2]. As a model of a GV-based protocell, it is necessary to replicate RNA/DNA in GV to deliver the information to the descendant. Hence we performed a polymerase chain reaction (PCR) using a template DNA of 1229 base-pairs (bp) and confirmed replication of the template DNA [3]. The key point here has been how to couple self-replication of DNA in GV and self-reproduction of GV. We recently found that the GVs made of phospholipid (POPC, PCPG) and a cationic membrane molecule (V) grew and divided immediately after a membrane precursor was added to the PCR-subjected GVs (serial divisions within 15 min) [4]. This means that the amplification of DNA and self-reproduction of GV are linked through the chemical consequence. The appearance of self-reproducing GVs in which DNA is amplified is a milestone toward the creation of the advanced protocell model that gives a hint about the origin of life.



References

- [1] K. Takakura, T. Toyota, T. Sugawara, *J. Am. Chem. Soc.*, **125**, 8134, (2003), K. Takakura, T. Sugawara, *Langmuir*, **20**, 3832 (2004) [2] T. Toyota, et al., *Langmuir* **24**, 3037-3044 (2008), K. Kurihara, et al., *Soft Matter*, **6**, 1888 (2010) [3] K. Shohda, et al., *Soft Matter*, **7**, 3750 (2011) [4] K. Kurihara, et al., submitted for publication.