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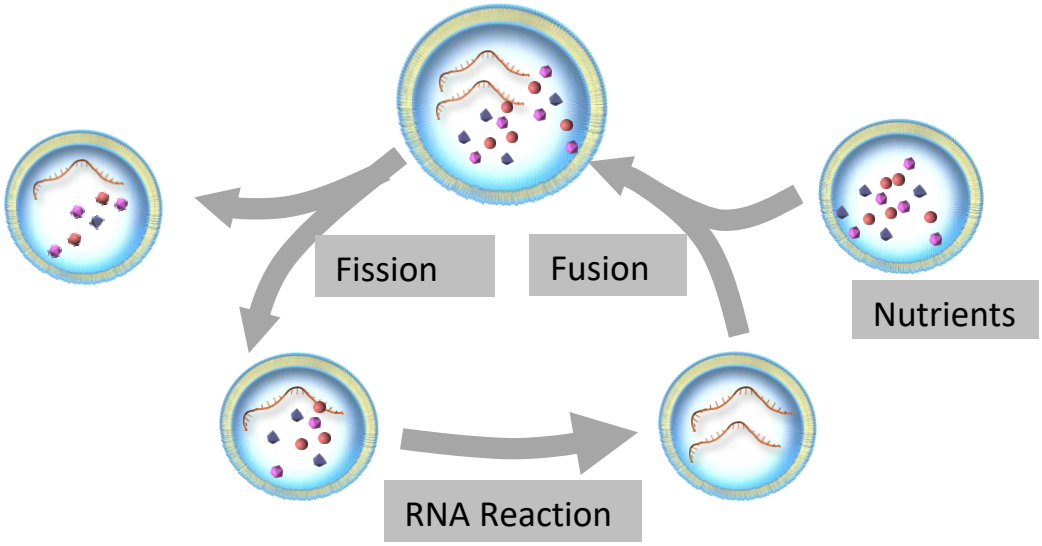
Sustainable proliferation of liposomes compatible with inner RNA replication

G. Tsuji[1], S. Fujii[2], T. Sunami[3], and T. Yomo[4*]
[1]Graduate School of Frontier Biosciences, Osaka Univ.; [2]Kanagawa Academy of Science and Technology; [3]Institute for Academic initiatives, Osaka Univ.; [4]Institute of Biology and Information Science, East China Normal Univ.;
* e-mail of Correspondence Author, yomo@sei.ecnu.edu.cn

Introduction: Many types of biochemical reactions such as gene replication and protein synthesis have been reconstructed in liposomes. However, the encapsulated reactions were temporary because the nutrients in the liposomes were easily exhausted. We aimed to develop a system in which the nutrients were supplied through liposome fusion and fission. The lipsome fusion is beneficial because it can supply not only the nutrients for inner reactions but also the lipid membrane, enabling the growth of liposomes as shown in the figure below.



Results: First, we prepared two liposome populations; one containing template RNA and the other containing all other molecules required for RNA replication, including RNA replicase (nutrients). The two populations were mixed and centrifuged to increase the membrane contact between the two kinds of liposomes. By freeze-thawing, we facilitated the fusion and fission of the liposomes by destabilizing the membrane contact. Although approximately half of the liposomes were destructed, fusion and fission were observed in the other half. Based on the fact that the size distribution of liposomes did not show significant change between before and after the freeze-thawing, liposome fission was induced probably by the excess membrane surface area. In the survived liposomes, RNA replication reaction was carried out, indicating that the nutrients were supplied to the liposome containing RNA. The resultant liposome population was diluted by 50% and mixed with the liposomes containg the nutrients for the next cycle of the fusion, fission, and RNA replication. We repeated 10 times of this cycle in order to confirm the sustainablity of this system. After 5 cycles, the ratio of the liposomes containing RNA reached a steady value of 60%, indicating the sustainability of the proliferation compatible with RNA replication.

Reference: Tsuji G., Fujii S., Sunami T. and Yomo T. (2016) *Proceeding of National Academy of Science USA* 113(3) 590-595