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An artificial cell based on gene expression in vesicle

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A new experimental approach is presented to build an artificial cell using the translation machinery of a cell-free expression system as the hardware and a DNA synthetic program as the software. Cytoplasmic extracts, encapsulated in phospholipid vesicles, are used to assemble custom-made genetic circuits to develop the functions of a minimal cell. The objective is to understand how a DNA algorithm can be designed to build an operating system that has some of the properties of life. We show how a long-lived bioreactor is built to carry out in vitro transcription and translation in cell-sized vesicles. To develop the synthetic membrane into an active interface, a few amphipathic peptides and an insertion mechanism of integral membrane proteins have been tested. With vesicles composed of different phospholipids, the fusion protein alpha-hemolysin-eGFP can be expressed to reveal patterns on the membrane. Finally, specific degradation mechanisms are introduced to create a sink for the synthesized messengers and proteins. Perspectives and limitations of this approach will be discussed.