

## Undifferentiated form-function

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Any biological system embody complementarity between parts and whole in organized unity. Clear separation of parts and whole and complementarity, however, are not given in advance. They are gradually generated and are self-organized due to the undifferentiated feature of form and function in material. Building blocks can lead to an organized unity only if they are manipulated by a kid who can arrange the blocks. They cannot entail such unity otherwise. This fact shows that "block" containing materialistic agent who can detect and sense its own environment can self-organize the complementarity between parts and whole.

With respect to the origin of life, we have to accept the intelligence inherited in materialistic nature in a broad sense. Although this kind of proto-intelligence is different from human intelligence by which individualized objects and/or signs can be manipulated and operated, the proto-intelligence in material has capability to detect environments and generate relations to the environments simultaneously. The proto-intelligence is not explicitly found. We have to evoke and enforce proto-intelligence in the experimental setup of the origin of life. For this purpose, I will show what is and how is proto-intelligence in various biological systems, e.g., swarm of soldier crabs, *Mictyris guinotae*, navigation of garden ant, *Lasius niger* and positional information in morphogenesis.

In a system with proto-intelligence, external perturbation always detected can positively contribute to generation of orders due to the negotiation between a system and environments, resulting from proto-intelligence. I will show proto-intelligence can be implemented by asynchronous updating and mutual anticipation in our model scheme.

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