

# Transport network in living systems by current-reinforcement rule

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**A kind of huge amoeboid organism named *Physarum plasmodium* constructs an intricate network of veins for circulating nutrients and signals over the entire body. The network shape (topology of connectivity, and sequence of branching in vein network, for instance) is drastically re-organized within hours in response to external conditions. The past studies showed that the network shape was optimized to maximize possibility of survival, in some senses. So we may extract an algorithm for optimal design of functional network from the primitive organism. The key thing is adaptive dynamics of current-reinforcement rule: each vein of network becomes thicker when current is large enough through the vein itself, while it becomes thinner and dies out otherwise. We propose the equations of motion for this simple rule, and functions and formation of transport network is analyzed. We will show that the rule is applicable to the other bio-systems: (1) social dynamics of public transportation, (2) formation of network structure in sponge bone (bone remodeling in other words). A tractable perspective to think similarly of a variety of bio-network is given from the viewpoint of current-reinforcement rule.**

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