[FEATURED]

Robust information transmission of cellular signaling pathways
- Autonomous cellular compensation ensures signal transmission-

2 Aug 2013

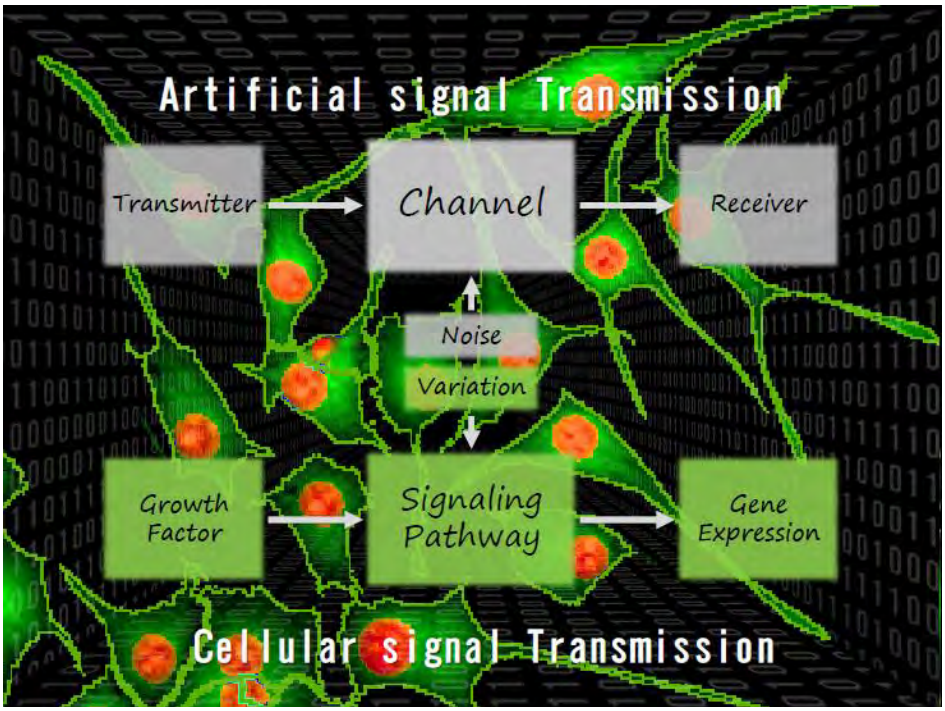
Robust transmission of information despite the presence of variation is a fundamental problem in cellular functions. However, the capability and characteristics of information transmission in signaling pathways remain poorly understood.

Professor Shinya Kuroda and his research group have shown that information transmission from growth factors to c-FOS and EGR1 in the ERK signaling network is robust despite pharmacological perturbations.

Professor Kuroda's group applied Shannon's information theory to the analysis of cellular information transmission along signaling pathways at the cell population level. The group calculated the mutual information transmitted through signaling pathways for growth factor-mediated gene expression. Growth factors appeared to carry information sufficient for making a binary decision. Information transmission was generally more robust than average signal intensity despite pharmacological perturbations, and compensation of information transmission occurred. Information transmission to the biological output of neurite extension appeared robust. The researchers propose that cells may use information entropy as information so that messages can be robustly transmitted despite variation in molecular activity among individual cells.

The robustness and compensation mechanism of information transmission in cellular signaling will allow effective design of medication patterns, and the design of artificial communication systems which may be more flexible than current communication systems.

The paper was published in the online version of Science on Aug 2, 2013. This is a major advance in understanding information transmission mechanism in cellular signal transduction and the robustness of information transmission is arised from the compensation of other unperturbed pathway.



*Related Figure: The research group analyzed the communication capacity of cellular signaling pathways (lower half of image) by applying Shannon's information theory, which is often used for the analysis of artificial communication channels. They found that signaling pathways were robust and cells demonstrated autonomous compensation for pharmacological perturbation, ensuring information transmission along signaling pathways.

[Journal Information]

Shinsuke Uda, Takeshi H Saito, Takamasa Kudo, Toshiya Kokaji, Takaho Tsuchiya, Hiroyuki Kubota, Yasunori Komori, Yu-ichi Ozaki, and Shinya Kuroda, "Robustness and compensation of information transmission of signaling pathways," Science Online Edition: 2013, Aug 2 (Japan time), doi:[10.1126/science.1234511].

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Prof. Kuroda leads the CREST project titled as "Temporal coding of cellular dynamical system" (Project duration: 1 Oct, 2012 - 31 Mar 2018).