Information processing in the TNF-stimulated NF-kappaB and JNK signaling in fibroblasts: what thousands of little cells can tell you?

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It is known that even genetically identical cells will behave differently in similar microenvironments. We seek to elucidate the mechanisms behind cellular decision making, by interrogating cells with various cytokines affecting well known cellular signal transduction networks within a novel microfluidic device. We believe that this technique can be used as a used as a universal method to understand the transfer of information within cells.

***Keywords* — cell signal transduction, microfluidics, systems biology.**

I. Purpose

Even genetically identical cells can be and are different in their ability to perceive their micro-environment and make appropriate decisions. But how different are they? And do these differences translate into fundamental limitations in the information processing and decision making. Here, by employing a well understood intracellular signal transduction and processing system, in combination with a novel microfluidic device [1] allowing rapid screening of cell responses, we investigate these questions using complex signaling inputs. We demonstrate how the signal processing capabilities are distributed across the signaling network and how they translate into the fidelity of responses. We also suggest that the role of specific feedback controls might be to exercise a strong effect on the information processing rather than to physically limit or enhance the signals. We argue that the approaches described in this study, which allow assaying hundreds of thousands of cells exposed to complex signaling input profiles over extended periods of time can be a uniquely useful universal approach to understanding the primary function of signaling pathways – transfer of information.

References

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