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Information processing in multi-step signaling pathways AMBHI GANESAN, IBM, ARCHER HAMIDZADEH, Yale University, JIN ZHANG, UCSD, ANDRE LEVCHENKO, Yale University — Information processing in complex signaling networks is limited by a high degree of variability in the abundance and activity of biochemical reactions (biological noise) operating in living cells. In this context, it is particularly surprising that many signaling pathways found in eukaryotic cells are composed of long chains of biochemical reactions, which are expected to be subject to accumulating noise and delayed signal processing. Here, we challenge the notion that signaling pathways are insulated chains, and rather view them as parts of extensively branched networks, which can benefit from a low degree of interference between signaling components. We further establish conditions under which this pathway organization would limit noise accumulation, and provide evidence for this type of signal processing in an experimental model of a calcium-activated MAPK cascade. These results address the long-standing problem of diverse organization and structure of signaling networks in live cells.

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