Translation Dynamics of Single mRNAs in Live Cells

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Translation is the fundamental biological process that converts the mRNA information into proteins. Single molecule imaging in live cells has illuminated the dynamics of RNA transcription, however, it is not yet applicable to translation. We report here the development of Single molecule Imaging of NAscent PeptideS (SINAPS) to assess translation in live cells. As with transcription assays, the approach provides direct readout of the initiation frequency, the elongation rate and the location of translation sites within the cell. We show that mRNAs coding for proteins in the endoplasmic reticulum are only translated when they encounter the membrane. Single molecule fluorescence recovery after photobleaching provides direct measurement of elongation rates. In primary neurons mRNAs are translated in proximal dendrites, but are repressed in distal dendrites with occasional “bursting” translation. This technology enables the quantitative spatial and temporal analysis of translation of single mRNAs in living cells and provides a new tool for addressing mechanism.