

Inventory of Supplementary Information-

Supplementary Data 1: SINEB2 sequences tested as effector domain (ED) in **(a)** long SINEUP and **(b)** in miniSINEUP-GFP.

Supplementary Data 2: List of base-stacking positions in SINE RNA 3D models.

Supplementary Data 3: List of non-canonical interactions identified in SINE RNA 3D models.

Supplementary Data 4: Intermolecular interactions of SINEUPs with RNAs other than rRNA in PARIS2 data.

Supplementary Data 5: **a** Primers used for QuikChange II site-directed mutagenesis. **b** Primers used for PCR-cloning of miniSINEUP-GFP constructs.

Supplementary Data 6: Oligos used in **(a)** icSHAPE, **(b)** seCLIP, and **(c)** PARIS library preparation.