

Supplemental materials

Supplemental figure legends

Fig. S1. Potential chemical compounds inhibiting MERS-CoV frameshifting.

(A-E) The relative frameshifting ratio of MERS-CoV -1 PRF (solid line, left y-axis), cell viability (dashed line, right y-axis), and IC₅₀ value were shown with increasing concentrations of each compound. Chemical structure of each compound was shown on the right panel. Compound A: 4-[2-Amino-3-cyano-5-oxo-4-(2-thienyl)-5,6,7,8-tetrahydro-1(4H)-quinolinyl]-3-thia-1-azatricyclo[5.2.2.0^{2,6}]undeca-2(6),4-diene-5-carbonitrile; compound B: tert-butyl [4-(1-methyl-2-oxo-1,2-dihydroquinolin-3-yl)phenoxy]acetate; compound C: 2-[(1*r*,4*r*)-4-[4-(6-{[(tert-butoxy)carbonyl]amino}-7-oxo-5*H*,6*H*,7*H*-pyrrolo[3,4-*b*]pyridin-2-yl)phenyl]cyclohexyl]acetic acid; compound D: 3-{[5-(1-Naphthyl)-1,3,4-oxadiazol-2-yl]sulfanyl}propanoic acid; compound E: 4-(4-Methoxy-2,3,6-trimethylbenzyl)-1,8-dioxo-4,11-diazaspiro[5.6]dodecane

Fig. S2. Dose-dependent inhibition of the SARS-CoV-2 frameshifting by KCB261770.

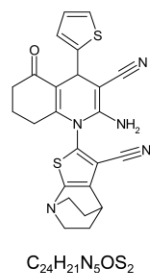
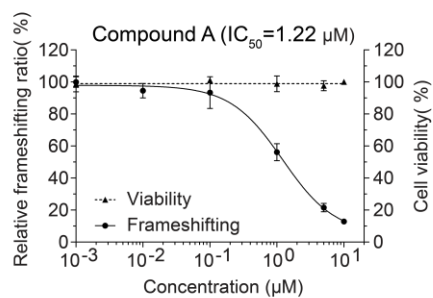
(A) Frameshifting ratio relative to the untreated control was measured with increasing concentration of compound KCB261770 in the SARS-CoV-2 -1 PRF. (B) Cell proliferation of parental A549 cells was measured using CellTiter 96® AQueous one solution cell proliferation assay (Promega, USA). Increasing concentrations of the chemical compounds were used to treat the cells for 2 days. (C) Images of cell morphologies were taken by Nikon Elipse Ti microscope system. Frameshifting ratio or cell proliferation without treatment was set to 100%. ***p*<0.01, ****p*<0.001 vs. control (one-way ANOVA with Dunnett's multiple comparisons test).

Fig. S3. The effect of anisomycin on MERS-CoV frameshifting.

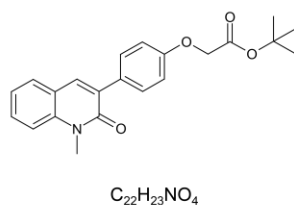
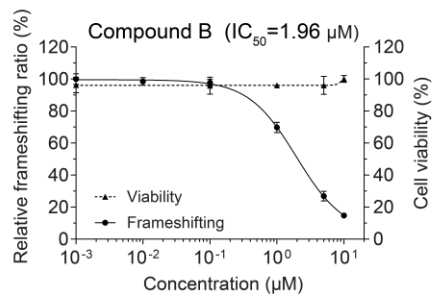
The relative frameshifting ratio of MERS-CoV -1 PRF (solid line, left y-axis) and cell viability (dashed line, right y-axis) were measured with increasing concentrations of anisomycin.

Fig. S1.

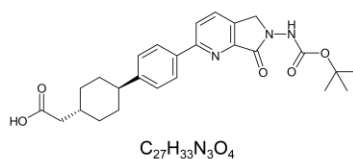
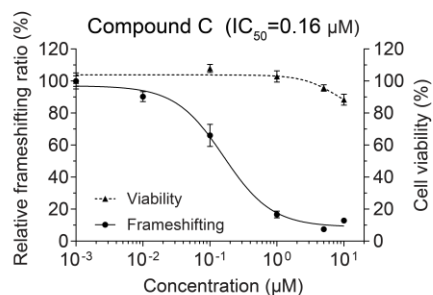
A



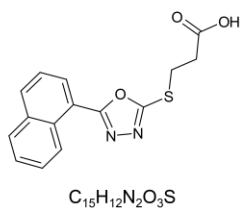
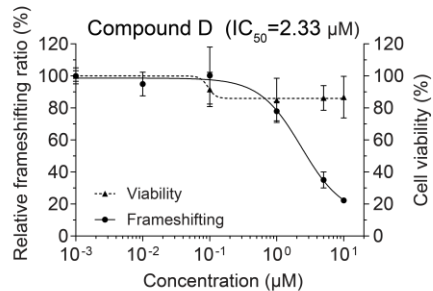
B



C



D



E

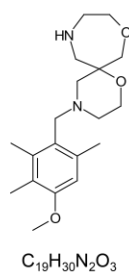
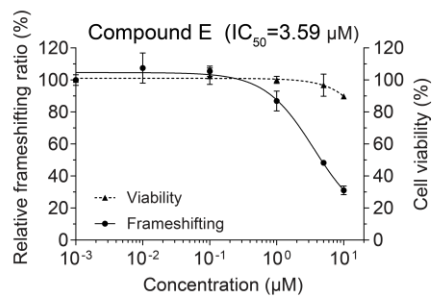


Fig. S2.

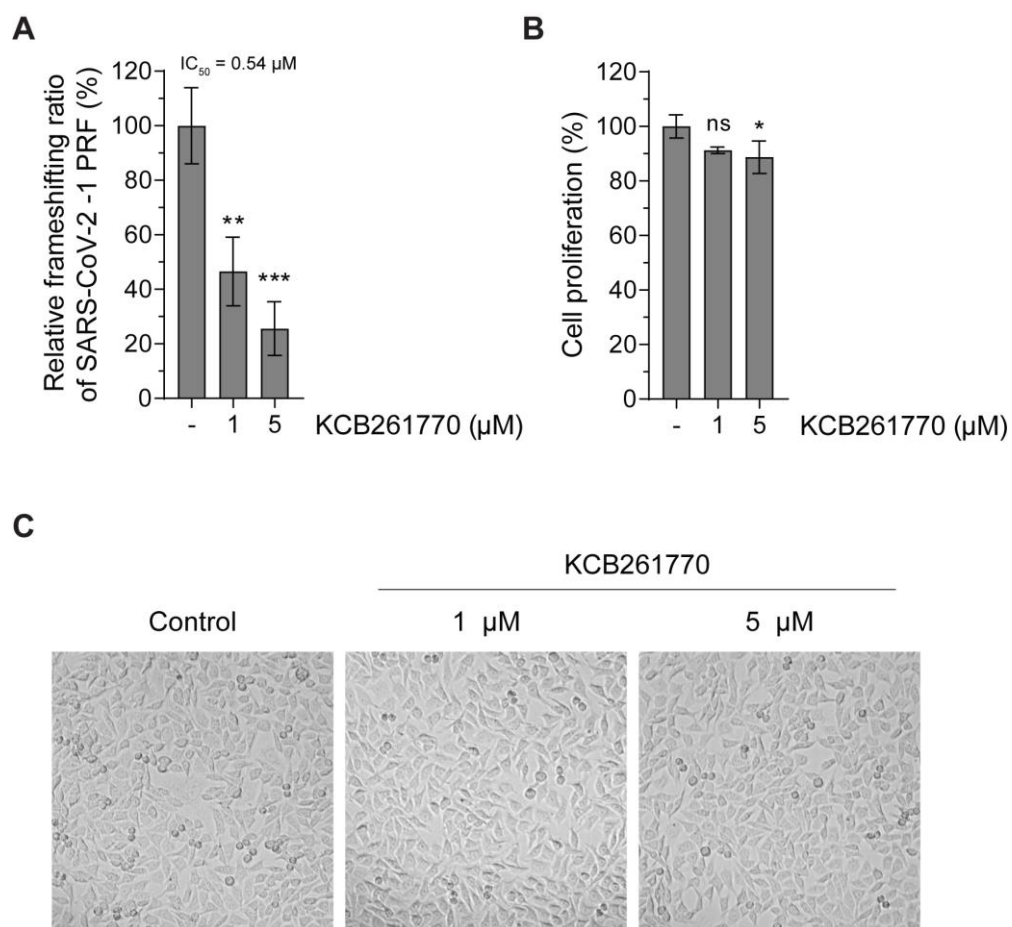


Fig. S3.

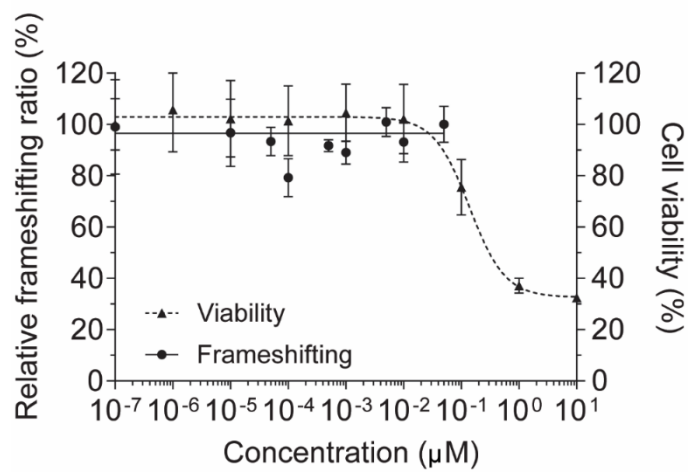
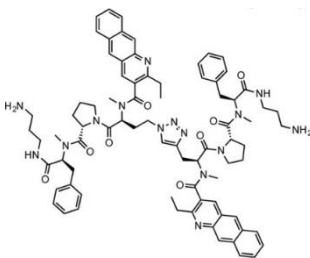
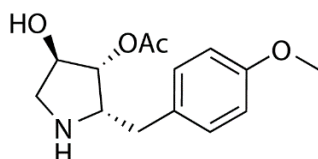
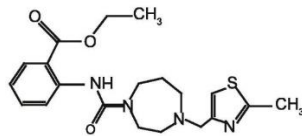
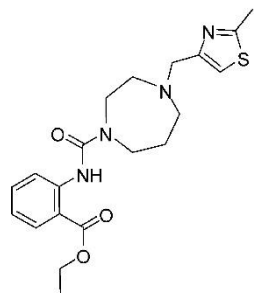
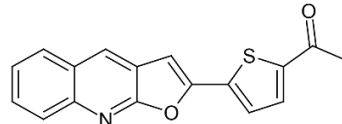


Table S1. Small molecules that have been reported previously.

Target	Chemical structure	Reference
HIV frameshift	 <p>Triazole</p>	Hilimire et al. (2017)
M ₁ dsRNA virus and HIV frameshift	 <p>Anisomycin</p>	Dinman et al. (1997) Rakauskaite et al. (2011)
SARS-CoV-2 frameshift	 <p>MTDB</p>	Neupane et al. (2020)
SARS-CoV frameshift	 <p>a novel compound, named 43</p>	Park et al. (2016)
MERS-CoV frameshift	 <p>KCB261770</p>	This study