CLAIMS

1. A method of differentially tagging target nucleic acids in cells comprising:

selectively delivering a first transposome complex, wherein the transposome complex comprises a transposase and two transposon end compositions comprising transposon end sequences, comprising a first tag to a first cellular compartment selected from the cytoplasm or the mitochondria, wherein the first cellular compartment comprises a first target nucleic acid, and wherein the selective delivering of the first transposome complex to the first cellular compartment comprises treating the cell with a nuclear pore blocker;

reacting the first transposome complex with the first target nucleic acid, wherein the reacting comprises fragmenting the first target nucleic acid into double-stranded nucleic acid fragments and tagging with transferred strands from the transposon end compositions to form first tagged double-stranded nucleic acid fragments;

selectively delivering a second transposome complex, wherein the transposome complex comprises a transposase and two transposon end compositions comprising transposon end sequences, comprising a second tag to the cell nucleus, wherein the cell nucleus comprises a second target nucleic acid; and

reacting the second transposome complex with the second target nucleic acid, wherein the reacting comprises fragmenting the second target nucleic acid into double-stranded nucleic acid fragments and tagging with transferred strands from the transposon end compositions to form second tagged double-stranded nucleic acid fragments, wherein the first and second tags are different.

2. The method of claim 1, further comprising detecting double-stranded nucleic acid fragments or their amplicons.

3. The method of claim 2, wherein the detecting comprises detecting the sequences of the double-stranded nucleic acid fragments or amplicons.

4. The method of claim 1, wherein the selective delivering of the second transposome complex to the cell nucleus comprises treating the cell with a nuclear permeability enhancer.

5. The method of claim 4, wherein the nuclear permeability enhancer increases the permeability of the nuclear envelope without disrupting the nuclear membrane.

6. The method of claim 1, wherein the selective delivering of the first transposome complex occurs without substantial delivery of the first transposome complex to the cell nucleus.

7. The method of claim 1, wherein the first cellular compartment is the cytoplasm and the first target nucleic acid is a cytoplasmic target nucleic acid, and the second cellular compartment is the cell nucleus and the second target nucleic acid is nuclear target nucleic acid.

8. The method of claim 7, wherein the selective delivering of the second transposome complex is done in the presence of a nuclear permeability enhancer.

9. The method of claim 7 or 8, wherein the cytoplasmic target nucleic acid is RNA.

10. The method of claim 7 or 8, wherein the cytoplasmic target nucleic acid is mRNA.

11. The method of claim 7 or 8, wherein the cytoplasmic target nucleic acid is DNA.

12. The method of claim 7 or 8, wherein the cytoplasmic target nucleic acid is cDNA.

13. The method of claim 1, wherein the cell nuclear target nucleic acid is DNA or genomic DNA (gDNA).

14. The method of claim 1, wherein the cell nuclear target nucleic acid is RNA.

15. The method of claim 1, wherein the cell nuclear target nucleic acid is mRNA.

16. The method of claim 1, wherein the cell nuclear target nucleic acid is DNA in an open chromatin state.

17. The method of claim 1, wherein the cell nucleus target nucleic acid is cDNA.

18. The method of claim 1, wherein:

selectively delivering the first transposome complex comprises reacting the first transposome complex with a mitochondrial target nucleic acid to produce a tagged mitochondrial double-stranded nucleic acid fragment; and

selectively delivering the second transposome complex comprises reacting the second transposome complex with a cell nuclear target nucleic acid to produce a tagged nuclear double-stranded nucleic acid fragment.

19. The method of claim 18, wherein the mitochondrial target nucleic acid is DNA.

20. The method of claim 18 or 19, wherein the cell nuclear target nucleic acid is DNA or is genomic DNA (gDNA).

21. The method of claim 1, further comprising lysing the cells to release the tagged double-stranded nucleic acid fragments.