Matrix *sb*

(a)

The background model

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| 1 | A | A | A | A | A | A | C | A | G |
| 2 | A | A | A | A | A | C | A | G | G |
| 3 | A | A | A | A | C | A | G | G | T |
| 4 | A | A | A | C | A | G | G | T | G |
| 5 | A | A | C | A | G | G | T | G | A |
| 6 | A | C | A | G | G | T | G | A | G |
| 7 | C | A | G | G | T | G | A | G | T |
| 8 | A | G | G | T | G | A | G | T | A |
| 9 | G | G | T | G | A | G | T | A | A |
| 10 | G | T | G | A | G | T | A | A | A |
| 11 | T | G | A | G | T | A | A | A | A |
| 12 | G | A | G | T | A | A | A | A | A |
| 13 | A | G | T | A | A | A | A | A | A |
| 14 | G | T | A | A | A | A | A | A | A |
| 15 | A | A | A | A | A | A | A | A | A |
| 16 | G | G | G | G | G | G | G | G | G |
| 17 | C | C | C | C | C | C | C | C | C |
| 18 | T | T | T | T | T | T | T | T | T |

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| G | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| A | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| T | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| C | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

**+**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| G | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| A | 8 | 7 | 7 | 7 | 7 | 7 | 7 | 8 | 8 |
| T | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| C | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1e-17 | 1e-17 |

**=**

(b)

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| G | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| A | 9 | 8 | 8 | 8 | 8 | 8 | 8 | 9 | 9 |
| T | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| C | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 |

Matrix *b* (PFM)

# Merging a null model into the existing background PFM

**Merging a null model into the existing background PFM.** (**a**) shows the sb matrix composed of sequences taken from z and the sequences that generate the null model. (**b**) The counts generated by the four sequences of the null model are added to the existing background PFM. The addition of the null model increases the counts evenly in the new PFM. Notice that this action preserves the proportionality between the original frequencies.