

$p_{10-12}p_{5-6}ILp_{2-3}Ep_{9-12}p_{2-5}c_6^{22}p_{7-12}c_1^3p_{2-6}c_7^3p_{8-6}c_7p_{8-5}c_6^{95}p_{6-9}c_{10}^{26}Kc_{12}^3\text{LINE}p_{1-7}c_8^{128}p_{11-7}c_8^2p_{11-7}c_8^{11}p_{11-7}c_8p_{11-7}c_8p_{11-7}c_8$
 $p_{11-7}c_8^{11}Kc_{12}^8p_{7-5}c_6^2p_{6-11}c_{12}p_{7-10}c_{11}^{50}p_{12-6}c_7^{174}p_{1-9}c_{10}^{240}p_{1-9}c_{10}^8p_{12-9}c_{10}^{18}p_{12-9}c_{10}^8p_{12-9}c_{10}^{19}p_{12-9}c_{10}^8p_{12-9}c_{10}^{13}p_{1-9}c_{10}p_{1-11}c_1$
 $2^{41}p_{7-11}c_{12}^6p_{7-11}c_{12}^5p_{7-11}c_{12}^7p_{7-11}c_{12}^{16}p_{7-11}c_{12}^4p_{7-3}c_4^{13}p_{5-3}c_4^{21}Ec_6^{14}p_{7-3}c_4^{52}p_{5-2}c_3^{42}p_{11-5}c_6^{57}p_{6-12}c_1^4p_{8-11}c_{12}^3p_{8-11}c_{12}p_{8-12}c_1p_8$
 $-4c_5^{32}p_{6-2}c_3p_{5-1}c_2^{24}p_{3-4}c_5^2p_{6-4}p_{6-12}c_1^{94}p_{2-12}c_1^{11}p_{2-7}c_8^{14}p_{9-7}c_8^5p_{9-7}c_8^{21}p_{11-4}c_5^{28}p_{6-2}c_3^{87}Dp_{9-10}$

Figure 7. Decomposition of cenX into HORs. The 12-monomer HOR for cenX is represented as $M_1, \dots, M_{12}=AB\dots KL$. The monomer-set includes these 12 frequent monomers as well as hybrid monomers M (a hybrid of monomers J and H) and N (a hybrid of monomers K and J) identified in Dvorkina et al., 2020. Each occurrence of this HOR that starts from the monomer M_i is labeled as c_i (shown in red). Each occurrence of a partial HOR that includes monomers from i to j is labeled as $p_{i,j}$. We use the notation c^m (p^m) to denote m consecutive occurrences of a canonical (partial) HOR. The most frequent partial monomers p_{3-7} , p_{7-3} , and p_{5-2} in cenX are colored in blue, green, and brown, respectively. The HOR decomposition of cenX has a length 72 and includes 1486 complete HORs that form 34 HOR-runs. Only 257 out of 18089 (1.4%) monomer-blocks in cenX are not covered by complete HORs. The “LINE” entry shows the position of the LINE element. To ensure that all monomers are shown in the forward strand, we decompose the reverse complement of cenX and take reverse-complements of all monomers in cenX (Supplementary Note 4).