

**a)**

begin\_non-structrual  $\rightarrow$  unpaired  
unpaired  $\rightarrow$  unpaired  $x$  | end  $x$

**b)**

begin\_structrual  $\rightarrow$  stem\_pair  
stem\_pair  $\rightarrow$   $x_l$  stem\_pair  $x_r$  |  $x_l$  bifurcation  $x_r$   
bifurcation  $\rightarrow$  emit intermediate  
emit  $\rightarrow$  loop\_&\_bulge | stem\_pair  
loop\_&\_bulge  $\rightarrow$  end  $x$   
intermediate  $\rightarrow$  bifurcation | emit

Figure S5: Production rules of the non-structural component (**a**) and the structural component (**b**). Nomenclature: '|' denotes a choice between different productions;  $x$  denotes single column emissions;  $x_l$  and  $x_r$  denotes the left and right part of pair emissions, respectively. A corresponding graphical overview of these grammar components are given in fig. S6.