





# SoutheRNA - R1260





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- Use Alphafold3 as a starting point
- Refine with SimRNA
- Further refinement by energy minimization in Molecular Dynamics







In R1260:

- Alphafold3, with 25 Mg ions
- Select the most different structures. In this case, two models.
- CHECK ENTANGLEMENTS / correct if needed (not the case) using RNAspider

|   | RNAspider                                      | ? Help                       | i About   | •• Cite us   |                                      |
|---|--|------------------------------|---|--|--------------------------------------|
| Task #7f388c4c-a         Submission time:         Sun, 01 Dec 2024         File List := | f9c-11ef-8ac8-0242a<br>04:26:55 GMT<br>Downloa | <b>c130003</b><br>d <b>±</b> | <b>File info</b><br>File name:<br>Completion time:        | 9CBW_2.3A_consensus_bfactor.pdb<br>Sun, 01 Dec 2024 04:26:59 GMT   | Resubmit with new settings 🛱         |
| <ul> <li>9CBW_2.3A_consensus_bfactor.pdb</li> <li>No entanglements found.</li> </ul>    |  |                              | Sequence<br>>strand_N<br>gGAGGGAAAAGUUAUCAG<br>((((((((() | GCAUGCACCUGGUAGCUAGUCUUUAAACCAAUAGAUUGCAUCGGUUUAAAAGGCAAGACCGUC<br>({{{.))))))).((((((((((((({[[[[]]))))).))))).))))[[[[[. | CAAAUUGCGGGAAAGGGGUCAACAGCCGUUCAGUAC |



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In R1260:

- Alphafold3, with 25 Mg ions
- Select the most different structures. In this case, two models. RMSD < 4.
- CHECK ENTANGLEMENTS
- Perform restrained Molecular Dynamics: The RNA structure is fixed by eRMSD restraints with respect to the original.
- Buffer with salt concentrarion equivalent to the experimental one: Mg and Na ions.



# **RNA challenges**

Our system: two models, differ by RMSD of 2.2 A.

- Perform short plain MD, 10 ns.
- Model 1 and Model 2 simulated under two different water models : TIP3P and SPCE.
- Best structure, provided by the organizers, simulated in water under the same protocol: restrained (BEST) and unrestrained (BEST-ur).



# Models 1 and 2

AlphaFold makes a good job : compared with the best structure, RMSD of 4.4A.

Differences in orientation of stem and conformation of unstructured strand, also in Mg ions



Model 1 vs BEST



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# Models 1 and 2

AlphaFold makes a good job : compared with the best structure, RMSD of 4.4A.

Differences in orientation of stem and conformation of unstructured strand.



solvation shell! (400 molecules)

Model 2

## Water density

#### Minimum distance density function







Generated with Chimera after optimal alignment with BEST structure – 50 selected frames



Differences from water models not significant : 0.6 +- 0.01





Generated with Chimera after optimal alignment with BEST structure – 50 selected frames



Correlation improves with thickness – stagnates in Model 1, around 3A. For BEST, around 5.



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Water model not relevant for structural purposes.

Small changes in unstructured strands and alignment for calculating the correlation are likely to be responsible for the difference. Also, position of the ions has to be analyzed in detail.

Thickness above 3A seems plausible for obtaining reliable results.

