



Universität Hamburg

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Crystal structure of the inner membrane reductase FoxB

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&

Department of Chemistry

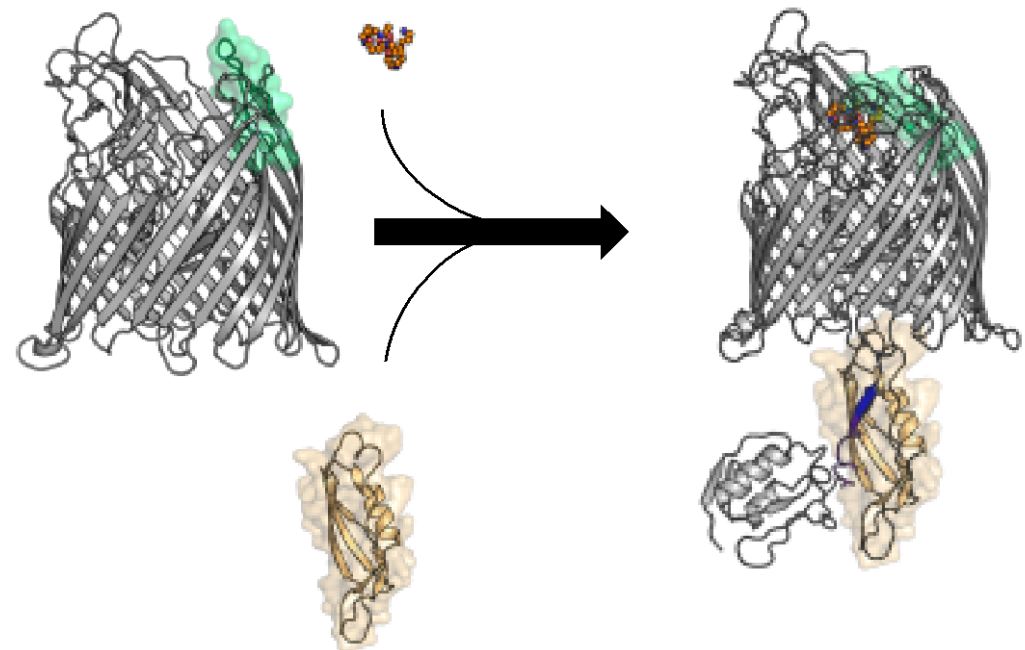
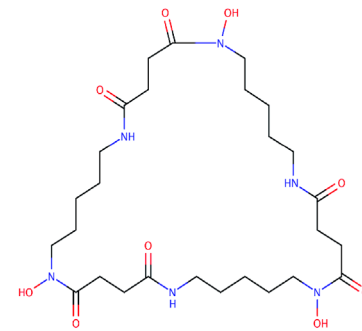
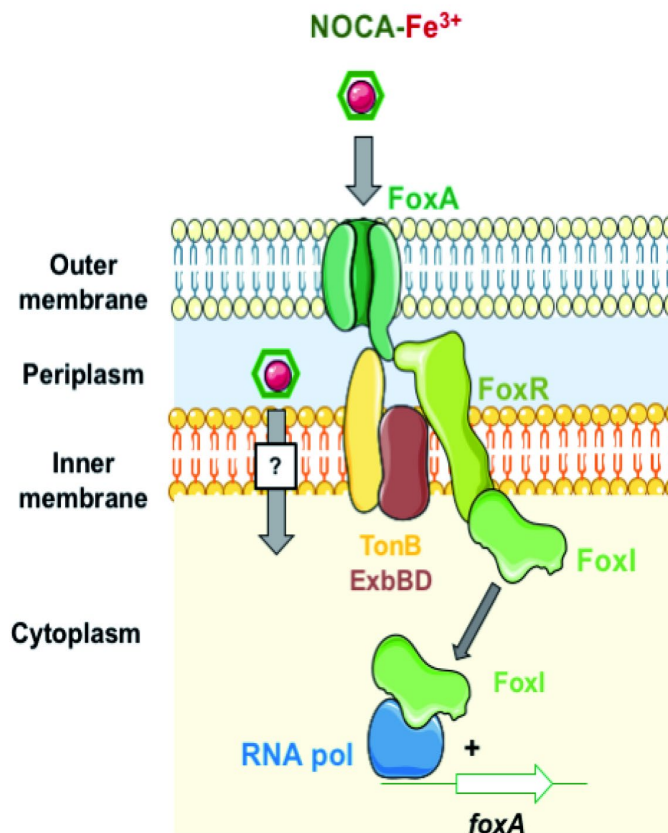
Institute of Biochemistry and Molecular Biology

University of Hamburg

30.11.2020

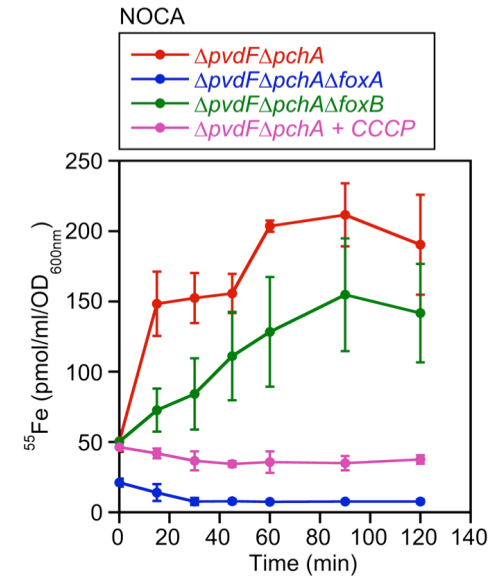
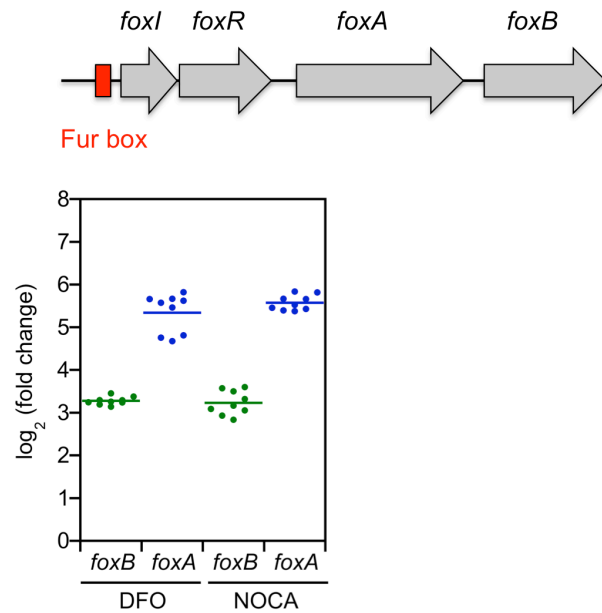
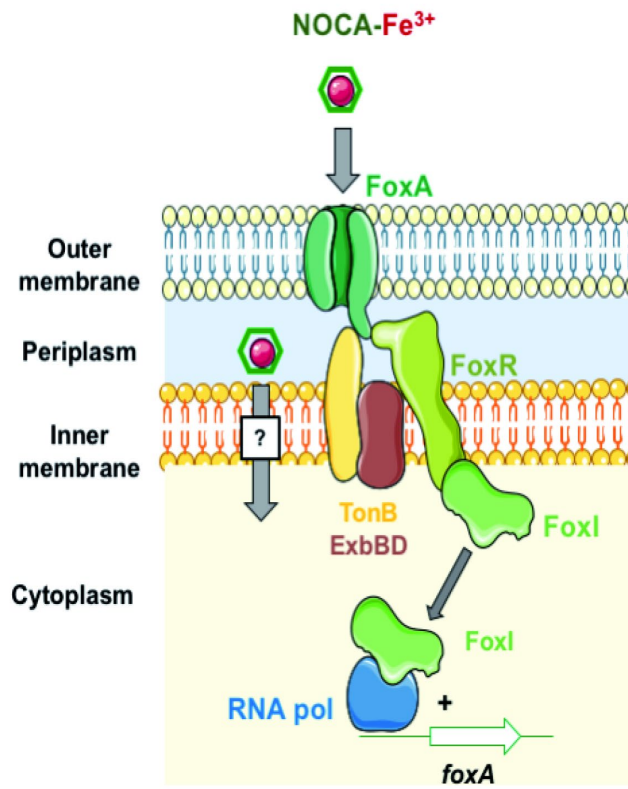
Iron-uptake pathways in Gram-negative bacteria (*P. aeruginosa*)

Ferri-NOCA uptake pathway

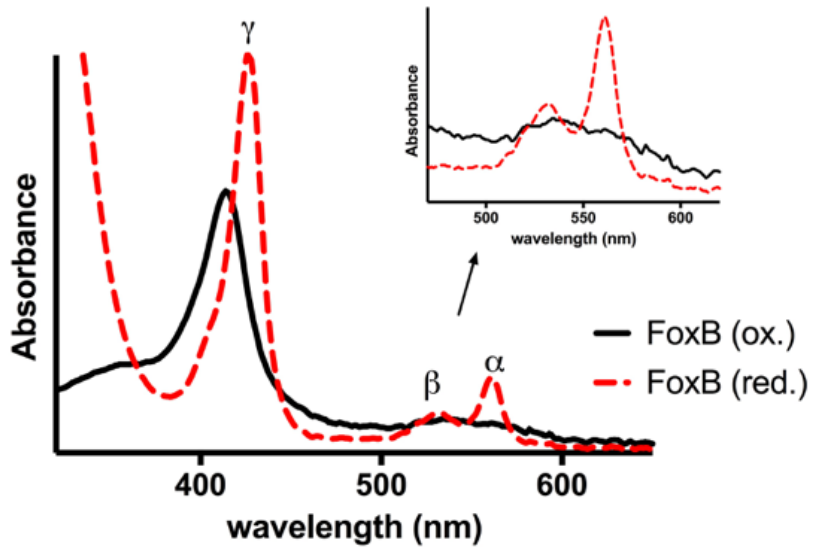
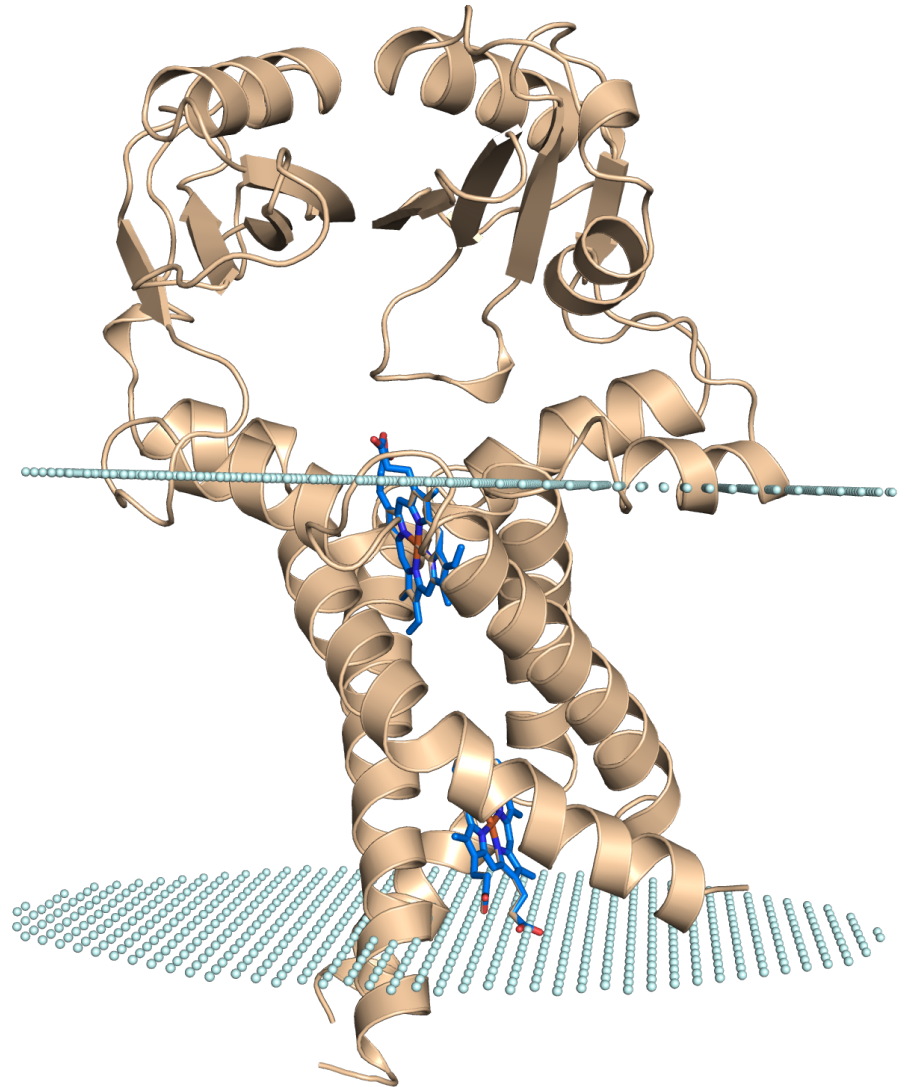
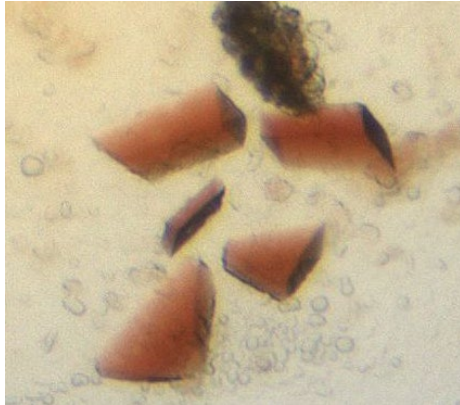


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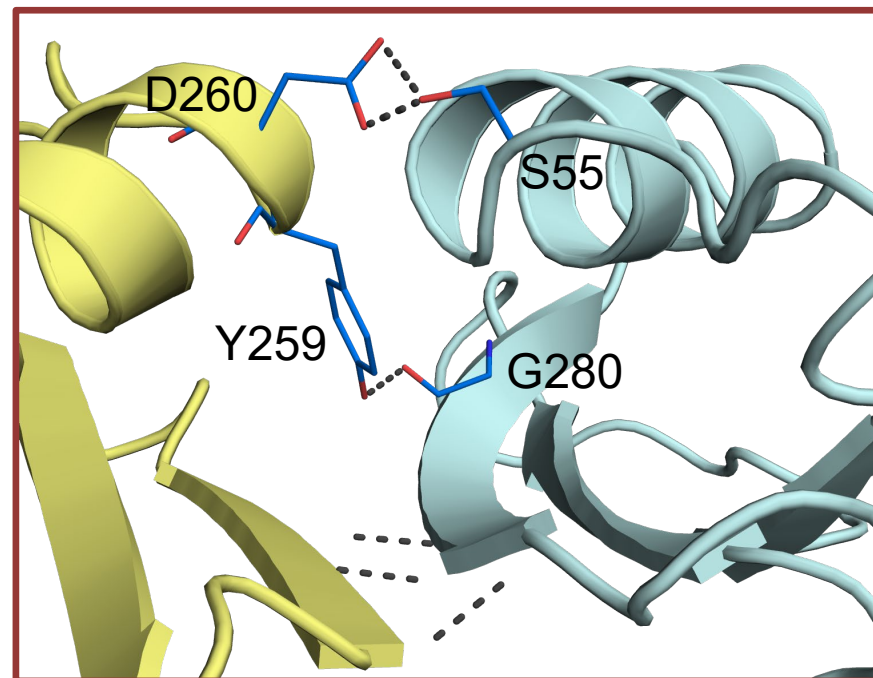
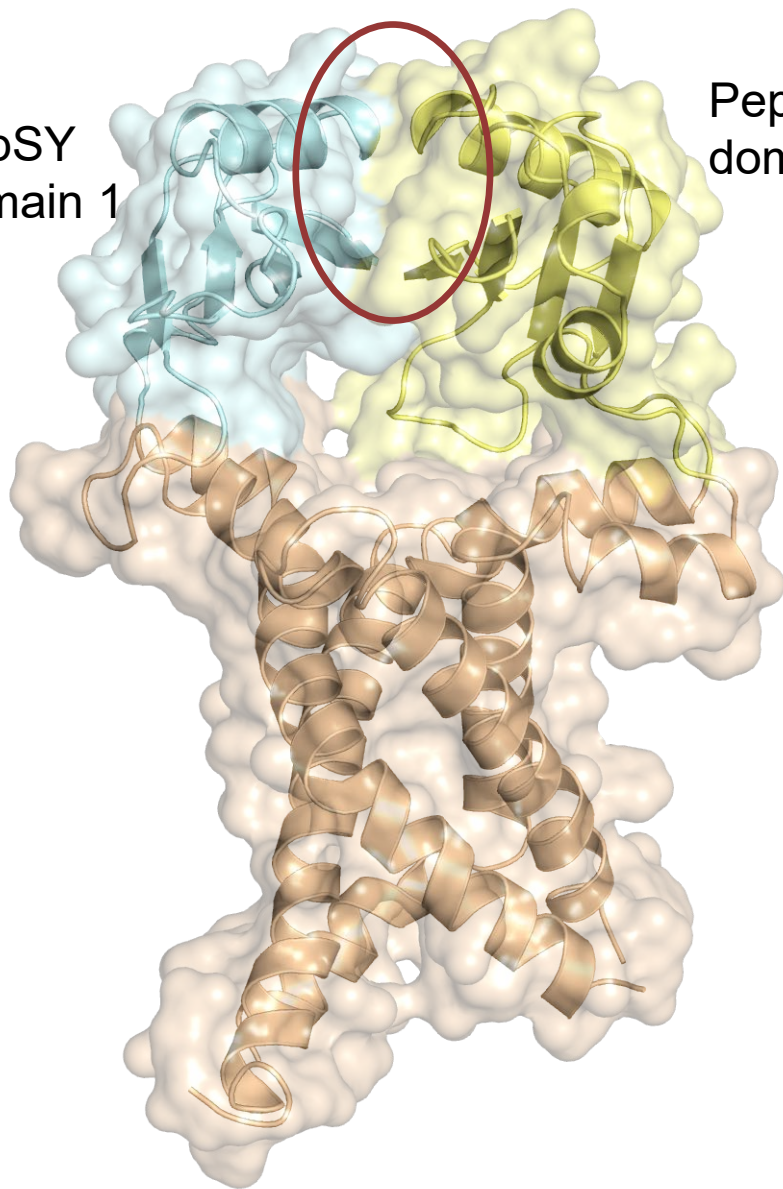


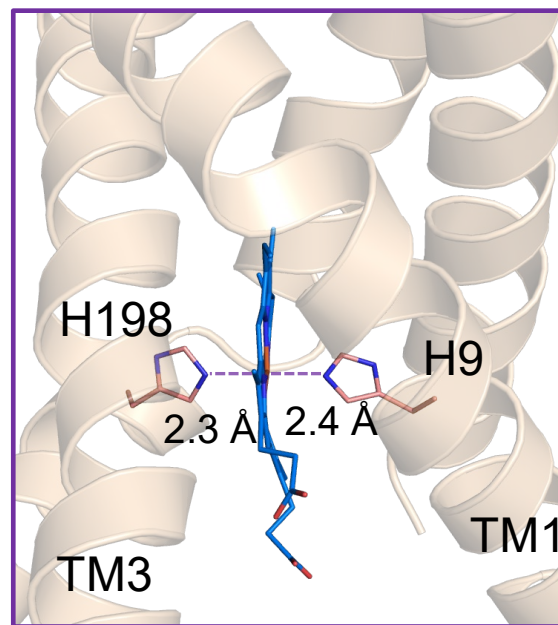
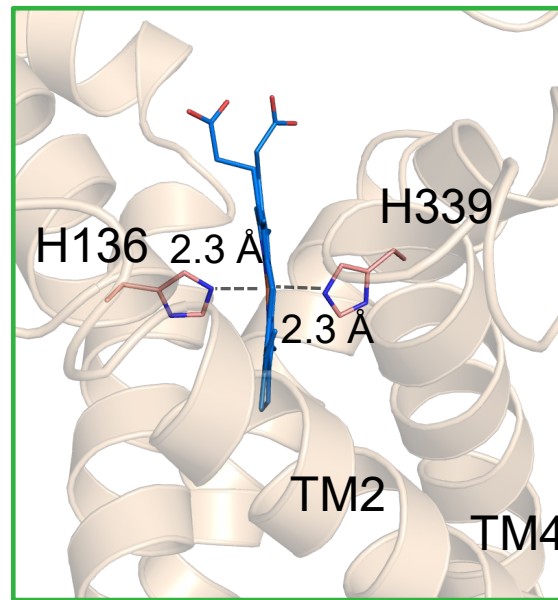
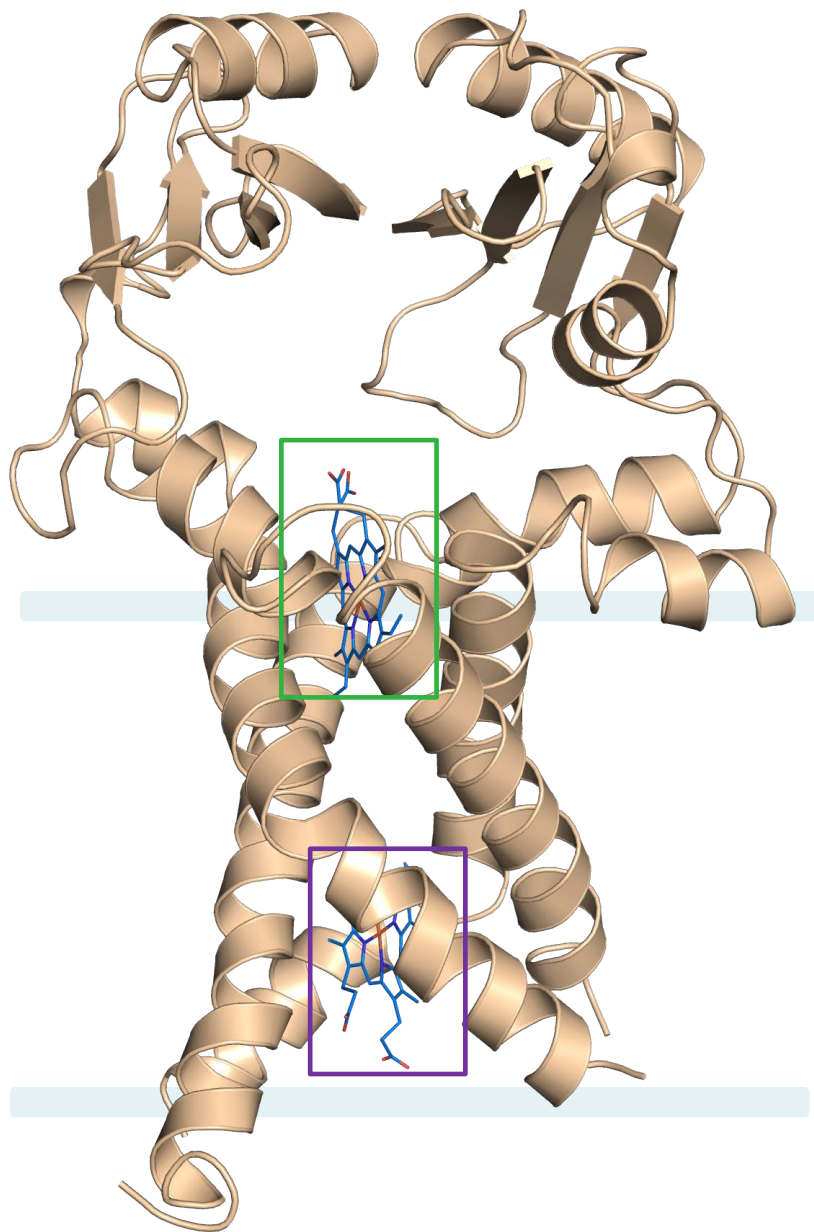
FoxB structure



PepSY
domain 1

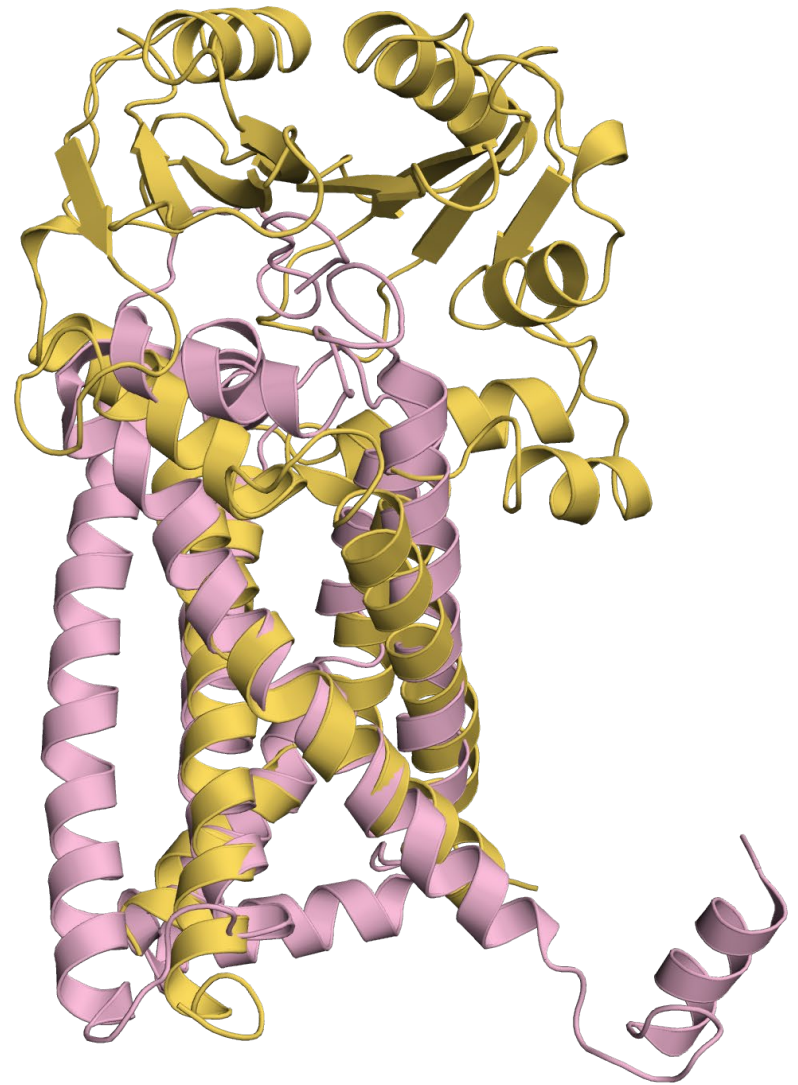
PepSY
domain 2







FoxB (gold) + *E.coli* superoxide oxidase (purple)
pdb:5oc0, rmsd 5.6 Å over the TM domains

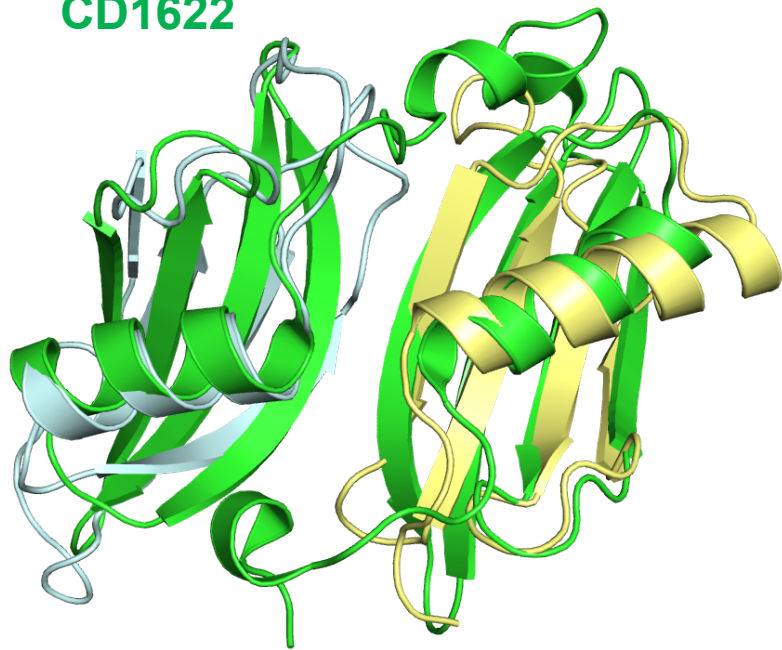


FoxB (gold) + *E.coli* fumarate reductase (pink)
pdb:1e7p, rmsd 5.5 Å over TM domains

PepSY1_{FoxB}

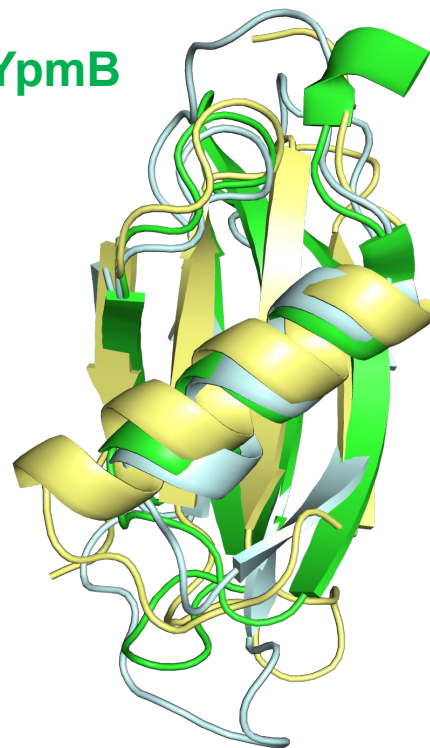
PepSY2_{FoxB}

CD1622



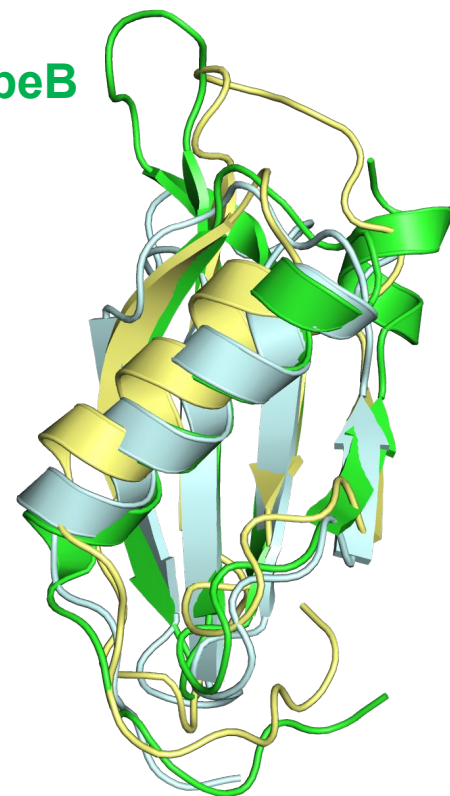
rmsd 3.95 and 3.05

YpmB



rmsd 3.34 and 4

YpeB



rmsd 2.7 and 3.3

How did we solve the structure?

- Native data to 3.1 Å / Se-Met data to 4-5 Å / Fe anomalous data → not enough phasing power
- tried MR with PepSY domains and homology models thereof → no solution
- tried MR with 33 server models (1 model each per participating CASP14 group) → no solution
- Andriy sent me models from “best group” (DeepMind) → clear MR solution!
- Two crystal forms ($P2_12_12_1$ / $P2_12_12$)
- MR-SAD and multiple rounds of manual building and refinement

Statistics for MR with DeepMind model and final statistics for pdb-deposited structure

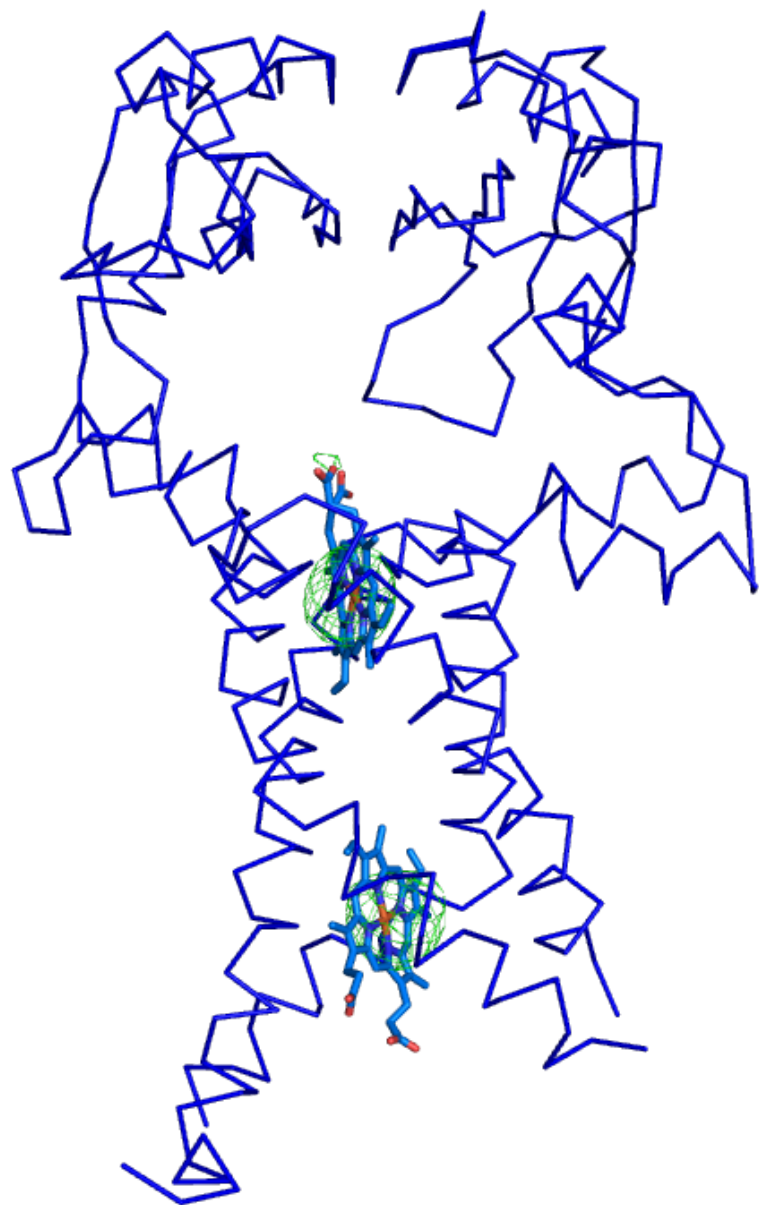
- Molecular replacement using Phaser and your T1058TS427_3.pdb model:

Solution #1 annotation (history):

```
SOLU SET RFZ=5.3 TFZ=6.4 PAK=0 LLG=87 TFZ==10.9 LLG=324 TFZ==18.9
PAK=0 LLG=324 TFZ==18.9
SOLU SPAC P 21 21 21
```

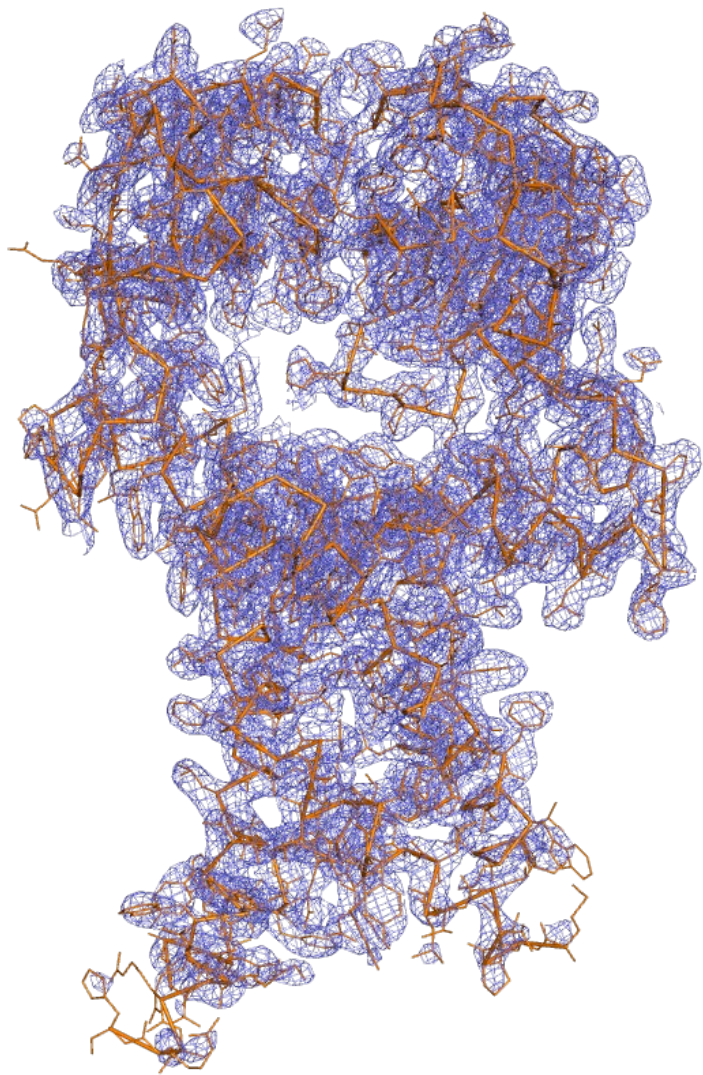
- The other four models gave very similar scores.
- Quick refinement of this solution using Phenix.refine yielded:
Final R-work = 0.4269, R-free = 0.4602
- Final Rwork/free of the structure as submitted to the pdb (3.1 Å resolution; after MR-SAD and multiple rounds of manual building and refinement):
Rwork = 0.27 / Rfree = 0.30

Fe sites

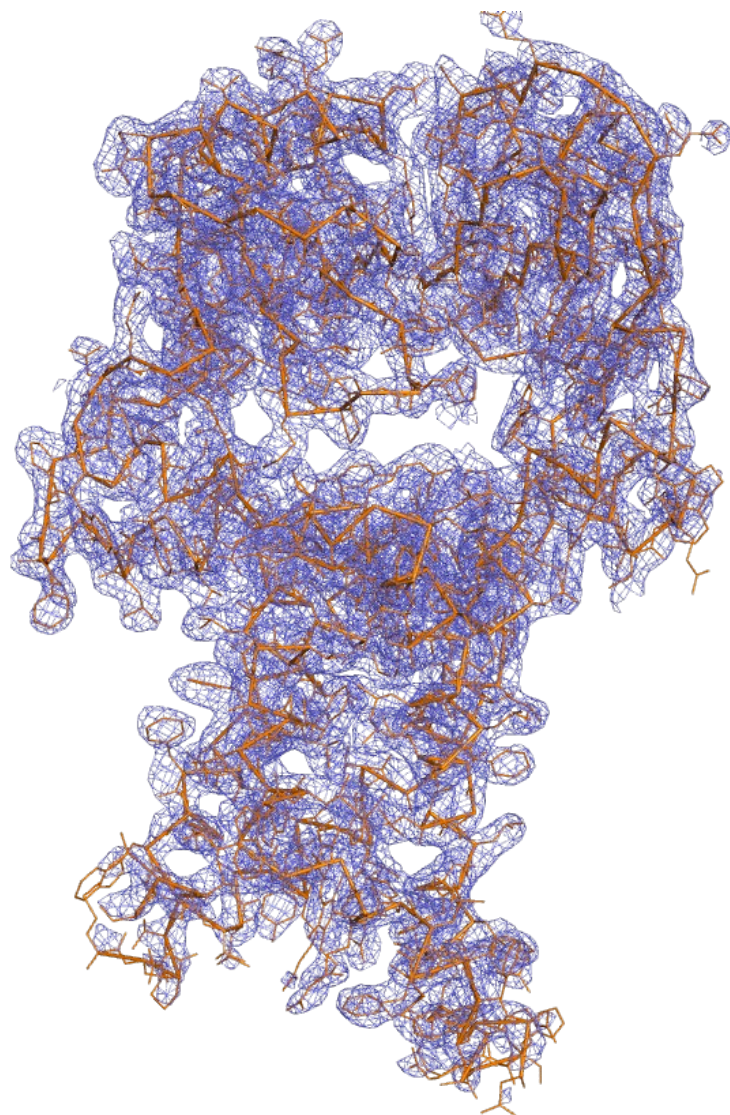


SeMet sites





180°



Why did MR with DeepMind model work but not with server models?

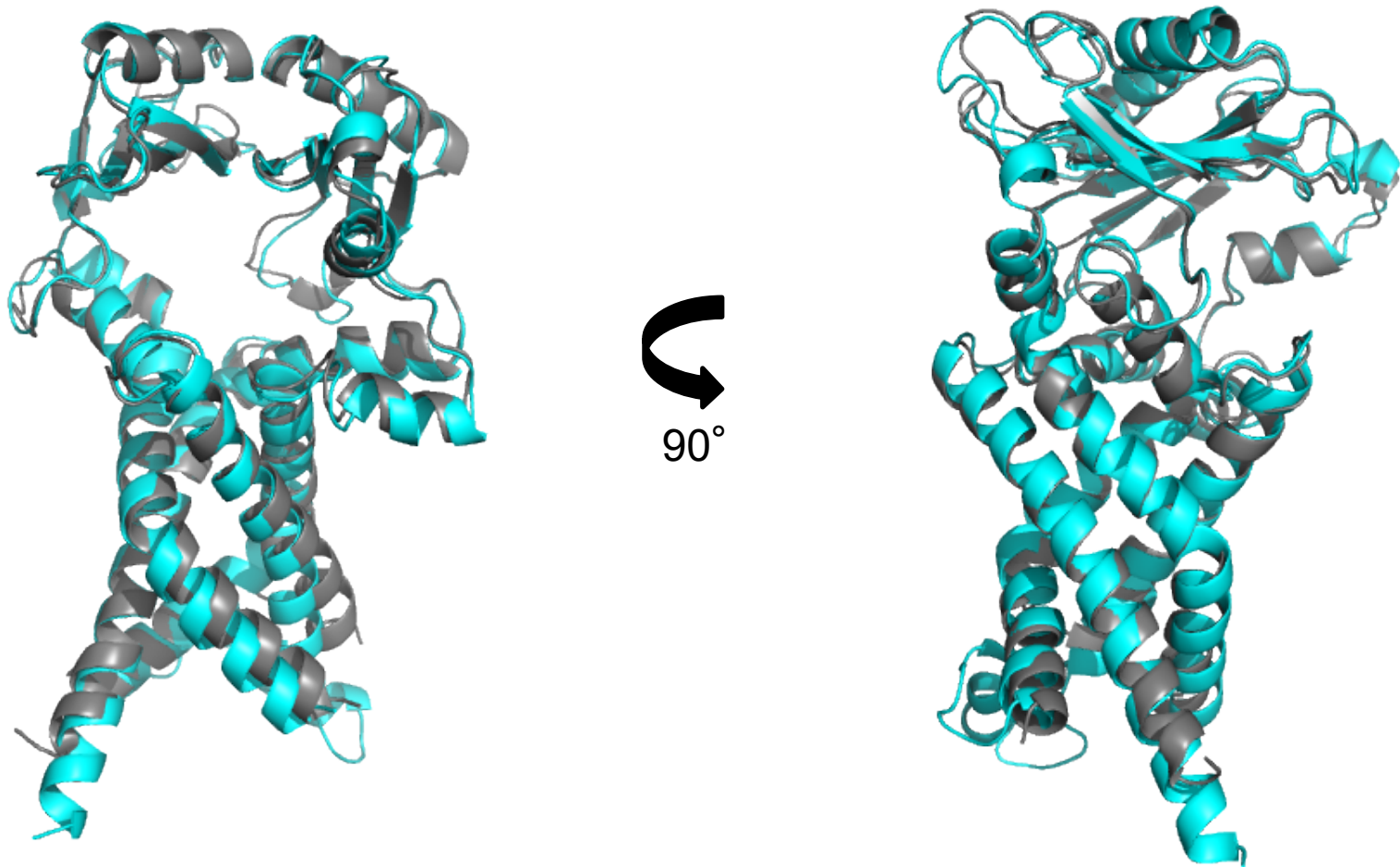


Why did MR with DeepMind model work but not with server models?



Grey: FoxB
Cyan: DeepMind
Magenta: Baker-RosettaServer
Yellow: RaptorX
Salmon: Zhang-Server

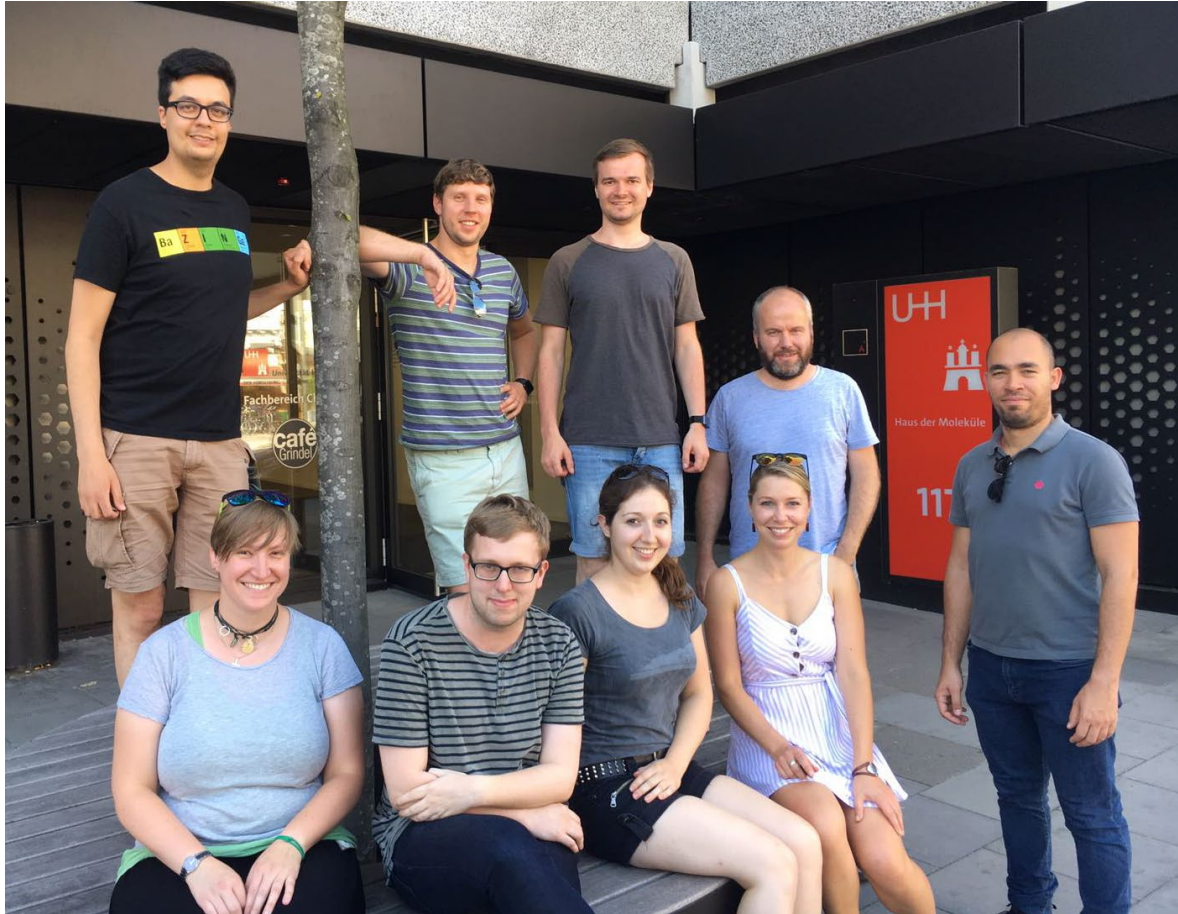
Why did MR with DeepMind model work but not with server models?



Conclusions

- DeepMind model helped to determine the structure of an integral membrane protein
- I have no idea how this model was produced and why it worked better than others, but it was very helpful for us!

Acknowledgements



Tidow group, UHH:

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- Vincent Normant

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- Clemens Meyer / John Jumper and team

CASP14 team:

- Andriy Kryshchak

Beamlines:

- P13, P14 @ EMBL, HH

