Cryo-EM Targets in CASP13

T0990 (h) 4.0 Å
H1022 (h) 3.3-3.5 Å
T0995 (e) 3.15 Å
T0984 (e) 3.4 Å
T1020 (e) 3.3 Å
H1021 (h) variable

Andriy Kryshtafovych, Bohdan Monastyryskyy (UC Davis)
Maya Topf, Sony Malhotra (Birkbeck, U London)
Cryo-EM Targets

T0984 (Xiaochen Bai, UT Southwestern Medical Center, Dallas)

T0990 (Hong Zhou, UCLA)

T0995 (Bryan Trevor Sewell, University of Cape Town)

T0996 (Damian Ekiert, former UCSF, now at Skirball Institute, New York)

T1020 (Oliver Clarke, Columbia University)

H1021 (Ambroise Desfosses, Institut de Biologie Structurale, Grenoble)

H1022 (Ambroise Desfosses, Institut de Biologie Structurale, Grenoble)

H1023 (Adam Frost, UCSF) - no structure
Target T0984(o)
a TM protein (11 helices), dimer, easy, 752 res. in each chain
Density map : 3.4 Å

Target

Template, 6c9a

Best model, TS163_1o

superposition

LDDT=0.64 (multimeric)
GDT_TS=58 (monomeric)

HHSearch alignment
Target T0996(o)
hexamer, medium difficulty, 848 res. in 1 subunit
Density maps (12 different): 3-3.5 Å

CASP:
Images redacted
Target T0996(o)
hexamer, medium difficulty, 848 res. in 1 subunit

Target

CASP: Images redacted

HHSearch alignment

Template, 5uvn

Template, 5uw8, X-ray

Best model, TS366_10
LDDT=0.58

Best model TS366_1 superposition
GDT_TS=37
Target T0990
monomer, very hard, 552 res.

HHSearch alignment

Best model, TS043_1

T0990-D1
(FM) H/S (41.13)
Range: 1-75
GDT=88

T0990-D2
(FM) H/S (19.90)
Range: 77-134, 348-520
GDT=46

T0990-D3
(FM) H/S (15.04)
Range: 135-347
GDT=49
CASP Models on Cryo-EM targets
Evaluation vs Reference Structures
Tertiary structure (3GDT_T + LDDT + CADaa + SG)
CASP Models on Cryo-EM targets
Evaluation vs Reference Structures
Quaternary structure (QSglob + LDDTo + F1 + JaccCoef)

Oligomeric CASP cryo-EM targets (6)

Oligomeric cryo-EM CASP/CAPRI targets (4)

Group number, CASP groups

Group number, CASP and CAPRI* groups
CASP Models on Cryo-EM targets
Evaluation vs Maps
Placing models in map’s frame of reference
(phenix.dock_in_map, Tom Terwilliger
UCSF Chimera)
CASP Models on Cryo-EM targets
Evaluation vs Maps
Model to map fit

TEMPy (Agnel Joseph, Maya Topf)
CCC, LAP, MI, SMOC, MI_overlap, CCC_overlap

PHENIX.model_vs_map (Paul Adams)
3 variants of cross-correlation scores

PHENIX.chain_compare (Tom Terwilliger)

EMRinger (Ben Barad, James Fraser)
Local and global EMRinger scores
CASP Models on Cryo-EM targets
Evaluation vs Maps
Model to map fit

This article is part of the Special Issue on the 2016 CryoEM Challenges
Evaluation system and web infrastructure for the second cryo-EM model challenge

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\textbf{ABSTRACT}

An evaluation system and a web infrastructure were developed for the second cryo-EM model challenge. The evaluation system includes tools to validate stereo-chemical plausibility of submitted models, check their fit to the corresponding density maps, estimate their overall and per-residue accuracy, and assess their similarity to reference cryo-EM or X-ray structures as well as other models submitted in this challenge. The web infrastructure provides a convenient interface for analyzing models at different levels of detail. It includes interactively sortable tables of evaluation scores for different subsets of models and different sublevels of structure organization, and a suite of visualization tools facilitating model analysis. The results are publicly accessible at http://modelcompare.emdbank.org.

0. Introduction

The second cryo-Electron Microscopy Model Challenge (EMMC) was organized to discuss preliminary outcomes. The challenge culminated in a joint participants, assessors and organizers meeting in October 2017, where the results were reviewed and discussed.
## Overall correlation

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<th>MI</th>
<th>LAP</th>
<th>CCC</th>
<th>Emringer</th>
<th>CC(mask)</th>
<th>CC(vol.)</th>
<th>CC(peak)</th>
<th>F1</th>
<th>QS(glob)</th>
<th>LDDT(oligo)</th>
<th>TMscore</th>
<th>GDT_TS</th>
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<td>0.93</td>
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<td>GDT_TS</td>
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<td>0.81</td>
<td>0.59</td>
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Global scores vs. goodness-of-fit scores

$R = \sim 0.5$

$R = \sim 0.9$
Interface vs. goodness-of-fit scores

$R = \sim 0.9$
T0984 – 3.4 Å resolution

329_1o
1st CCC
16th TM
0.338, 0.86

303_5o capri
1st GDT/TM
9th CCC
0.89, 0.328

004_2o
1st TM & CCC
0.87, 0.337

c CCC=0.47
Local scores such as SMOC come to rescue!
004_2o: tm=0.87, ccc= 0.337, F1= 35
343_4: tm=0.88, ccc= 0.313, F1= 50
Conclusions

- At 3-4 Å useful to assess models against map – help identifying local errors in SSE, sidechain, and mis-orientation of sub-structures

- TM and GDT are highly correlated with global cross-correlation scores: a good indicator of overall quality of the model

- The global EMRinger may not be a reliable measure to evaluate CASP models, especially poor models

- Some regions in the target structure may have low accuracy so assessing the models against the map is more reliable in those regions

- Protein structure prediction methods that are assessed in CASP can be adapted for generating starting models prior to EM-based refinement