CASP14: Critical Assessment of Structure Prediction

- Rigor
- Transparency
- Collaboration
- Communication

Advancing solutions to the Protein Folding Problem
CASP Requirements

• Many Targets.
• Each Participant makes many predictions.
• Many Participants.
• Gold standard
• Head-to-head methods comparison
• Clear Metrics
• Authoritative evaluation.
Founders and Organizers

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CASP14 ASSESSORS

- Topology: Nick Grishin, Lisa Kinch
- High accuracy modeling: Andrie Lupus, Joana Pereira, Marcus Harman
- Refinement: Dan Rigden
- Contacts: Alfonso Valencia, Rosalba Lepore
- Accuracy estimation: Chaok Seok
- Assemblies: Ezgi Karaca
- CAPRI: Marc Lesink, Shoshana Wodak
- Function: Sandor Vadja, Dima Kozakov
How this meeting (should) work

• Main zoom sessions
• Main interface – posters links, How to, link to Airmeet
• Airmeet lounge – help, informal meetings, poster sessions.
• DISCORD channels
• Extra sessions
• Ongoing interest groups
Protein structure
Refinement
Protein Assemblies
Contacts and Distances
Accuracy Estimation
Deriving function
Covid and CASP
The future of deep learning
CASP
Punctuated Equilibrium

The Geological Timescale

- Pre-CASP
- PSIBLAST/HMM
- Servers
- Consensus
- Fragments
- Multi-Template
- Refinement
- Accuracy estimates
- Contacts
- Deep Learning
- No crystallography
Correlated Mutations and Residue Contacts in Proteins

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ABSTRACT The maintenance of protein function and structure constrains the evolution of amino acid sequences. This fact can be exploited to interpret correlated mutations observed in a sequence family as an indication of probable physical contact in three dimensions. Here we present a simple and general method to analyze correlations in mutational behavior between different positions in a multiple sequence alignment. We then use these correlations to predict contact maps for each of 11 protein families and compare the result with the contacts determined by crystallography. For the most strongly correlated residue pairs predicted to be in contact, the prediction accuracy ranges from 37 to 68% and the improvement ratio relative to a random prediction from 1.4 to 5.1. Predicted contact maps can be used as input for the calculation of protein tertiary structure, either from sequence information alone or in combination with experimental information. © 1994 Wiley-Liss, Inc.

Key words: protein structure prediction, predicted contact maps, correlated mutations
Drag image to reposition. Double click to magnify further.

constraint

inference

contact in 3D

correlated
‘So, either this group is close to solving the folding problem or they cheated somehow.’

Nick Grishin
\[ GDT_{TS} = \frac{1}{4N_t} (GDT_1 + GDT_2 + GDT_4 + GDT_8) \]
Convolutional Neural Networks

David Koes, CASP13
Not an end, but a Beginning:
The door is open to?:

- Protein complexes
- Accuracy estimation
- Protein design
- Protein dynamics
- Protein conformational change
- Preferred conformations of disordered proteins
- Mutation interpretation
- Ligand docking