

# How To Organize A Challenge

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# Why Organize a Challenge?

- A. Identify novel methods
- B. Analyze novel data
- C. Build community around an event
- D. Provide an opportunity for learning
- E. All of the above!

# Organizing a Challenge can be... challenging

Most importantly, Challenge organization requires preparation

Risks exist in many areas of Challenge execution:

Data

Question

Metrics

Engagement

Infrastructure

Post Challenge Analysis

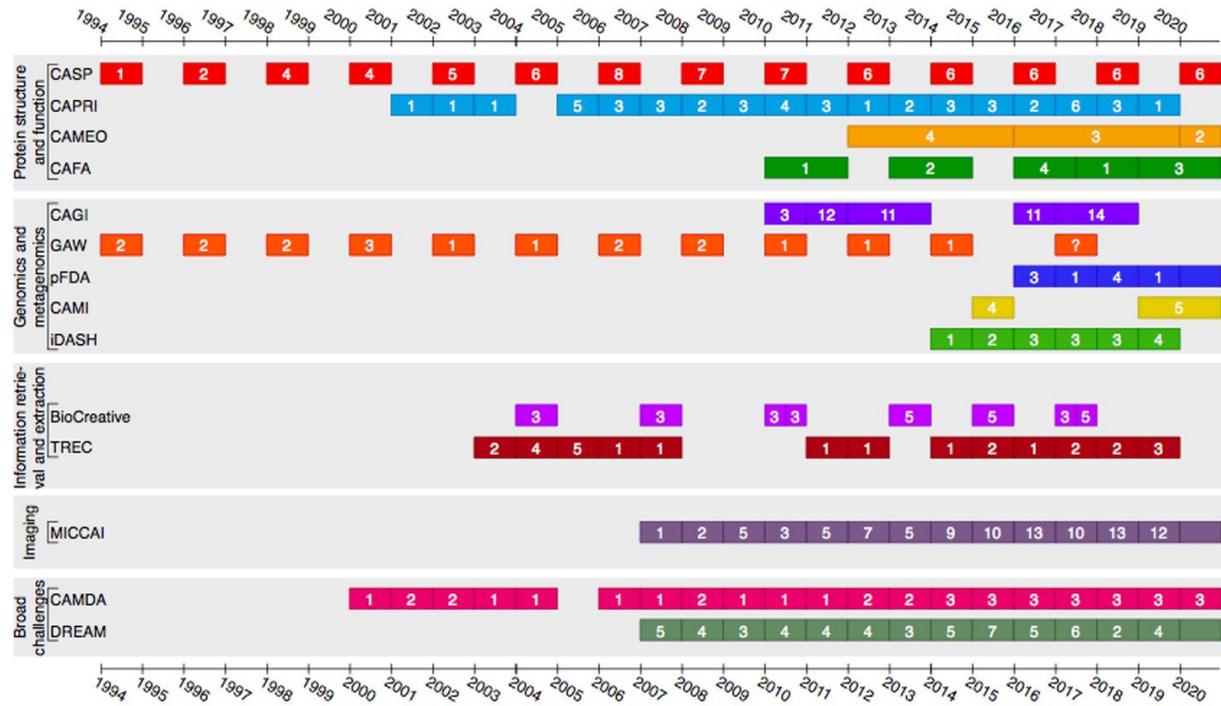


# Increasing number of Challenges = more reward, risk

More domains are adding challenges

Normalization of challenges means more participants, more effort

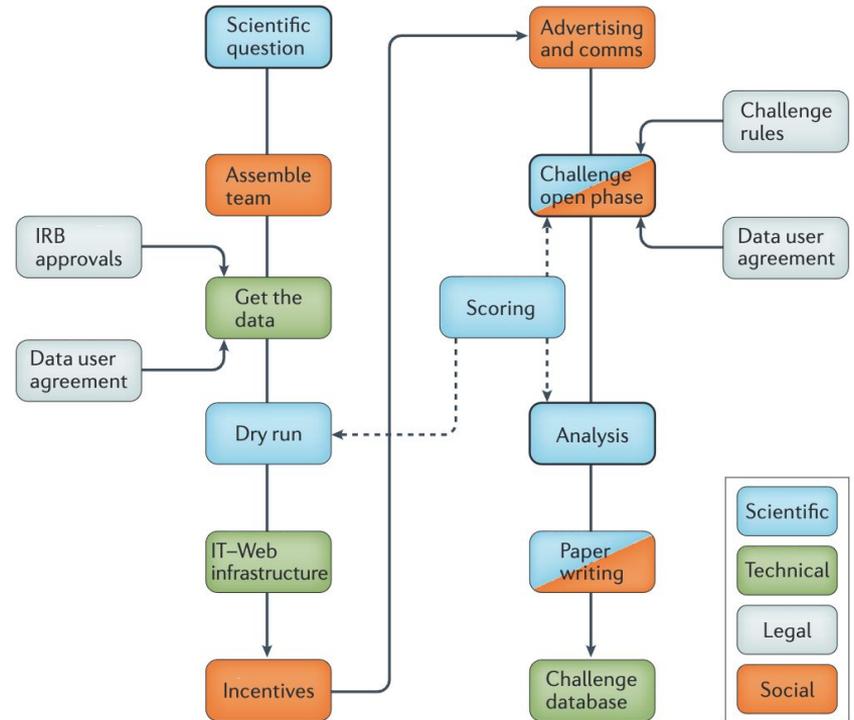
Unsuccessful challenges undermine future participation



# Organizing the Challenge process:

Challenge execution is a process with Scientific, Technical, Legal and Social requirements.

Utilizing established processes can prevent problems with your challenge



# Drivers of a Challenge

For organizers:

 **Data.** High quality, original data

 **Question.** A meaningful question in your field

 **Funding.** Funds for preparing the challenge, including computing and incentives

For participants:

 **Diversity.** Challenge participants and organizers come from all career stages and backgrounds

 **Data.** High quality data is a huge attractor for Challenge participants

 **Growth.** Personal growth opportunities are also motivators for Challenge engagement

 **Trust.** Credibility and consistent communication help foster trust with all stakeholders

# Include minimal information

About the organizers: Name, Summary, URLs

About the challenge: Title, Summary, Sponsors, Organizer, Year, # Participants

About the data: Type, Description, Governance, Post challenge access

About the tasks: Description, Start, End, Status, Incentives, Metrics, Methods

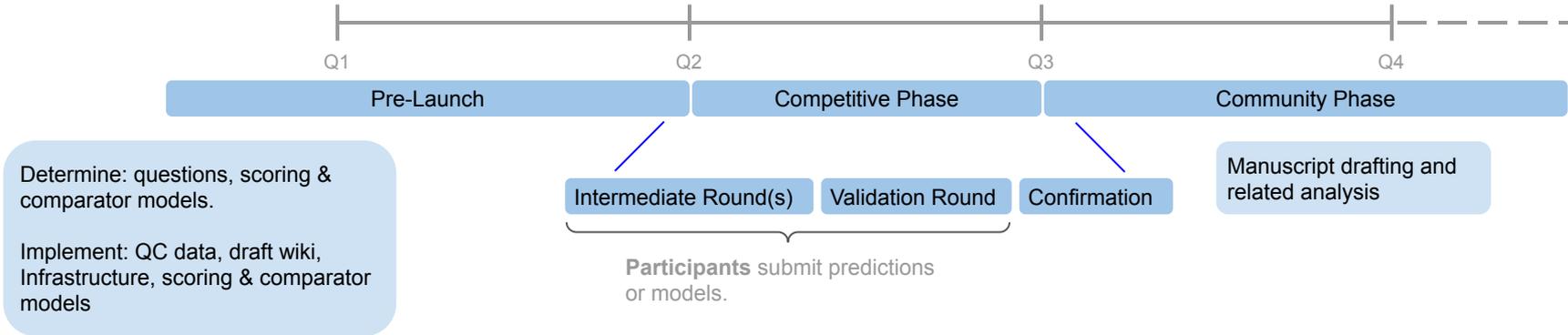
About the results: Publication, Status, URL, Summary , Top performers, # Submissions

See also *BIAS reporting standard for biomedical image analysis challenges*

# Organizers should also provide

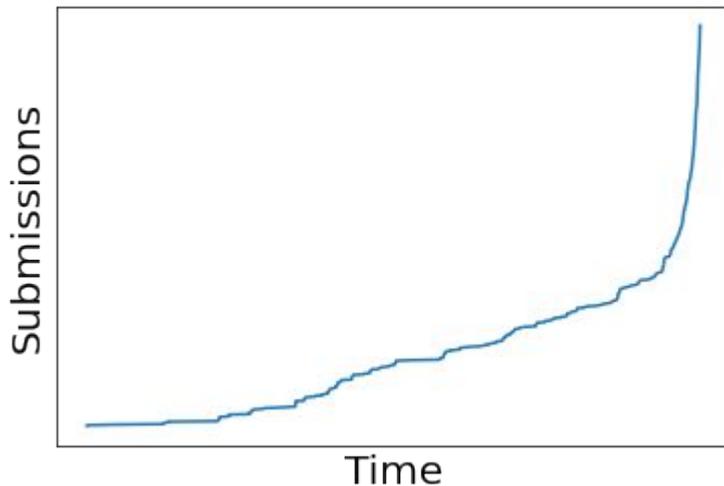
- Annotations (ground truth / gold standard) for Training and Validation
- Ensure that the metrics for validation set can discriminate between submissions
  - Probabilistic classification metrics are best AUC > F1
  - >100s of predictions
- Details on evaluation infrastructure
- Starter kit / reference method
- Incentive for participation
  - Monetary (prize, travel)
  - Publication
  - Presentation
  - Access to new data
  - Other value you can provide- announcements, introductions
- Support through a discussion forum: anticipate FAQs
- Judging of submission writeups

# Simplified Challenge Timeline



# Common Problems During Submission Phase

- Data quality
  - Class imbalance
  - Noisy, missing data
  - Information leaks through leaderboard
- Participant support, cheating
- Infrastructure for evaluation →
- Rules on publication
- Other details:
  - Deadlines using global time UTC or AOE (UTC-12)
  - Specifics on ranking with multiple metrics
  - Consider holidays and school schedules
  - Multiple rounds encourage participation throughout the submission phase
  - Recognize not just top teams, but first time participants and novel approaches



# Post Challenge Analysis

- Teams submit written descriptions of methods
- Test models with new datasets
- Identify top performers, invite to coauthor manuscript
  - Bayes Factor to find equivalent methods ( $BF < 3$ )
- Collaboration phase
  - Ensemble models
  - Meta analysis of solutions

$(B_{10})$	Evidence against $H_0$
1 to 3	Not worth more than a bare mention
3 to 20	Positive
20 to 150	Strong
>150	Very strong

# Value from DREAM

Through DREAM  
Challenge experts can  
review proposals  
offer advice, oversight

Promote through DREAM  
channels and conference

Uses standard rules

The screenshot shows the homepage of DREAM Challenges, powered by Sage Bionetworks. The navigation bar includes links for Home, About, DREAM 101, Challenges, Publications, and Latest News. The main banner features the headline "Solving Problems. Together." and a five-step process: Pose Question, Prepare Data, Engage Solvers, Evaluate Models, and Share Results. Below the banner are two buttons: "LEARN MORE" and "JOIN A CHALLENGE". The main content area states "DREAM Challenges use crowd-sourcing to solve complex biomedical research questions". At the bottom, three statistics are presented: 60+ crowd-sourced challenges benchmarked, 30,000 cross-disciplinary participants, and 105+ academic journal publications.

**DREAM CHALLENGES**  
powered by Sage Bionetworks

Home About DREAM 101 Challenges Publications Latest News

## Solving Problems. Together.

- Pose Question
- Prepare Data
- Engage Solvers
- Evaluate Models
- Share Results

LEARN MORE JOIN A CHALLENGE

### DREAM Challenges use crowd-sourcing to solve complex biomedical research questions

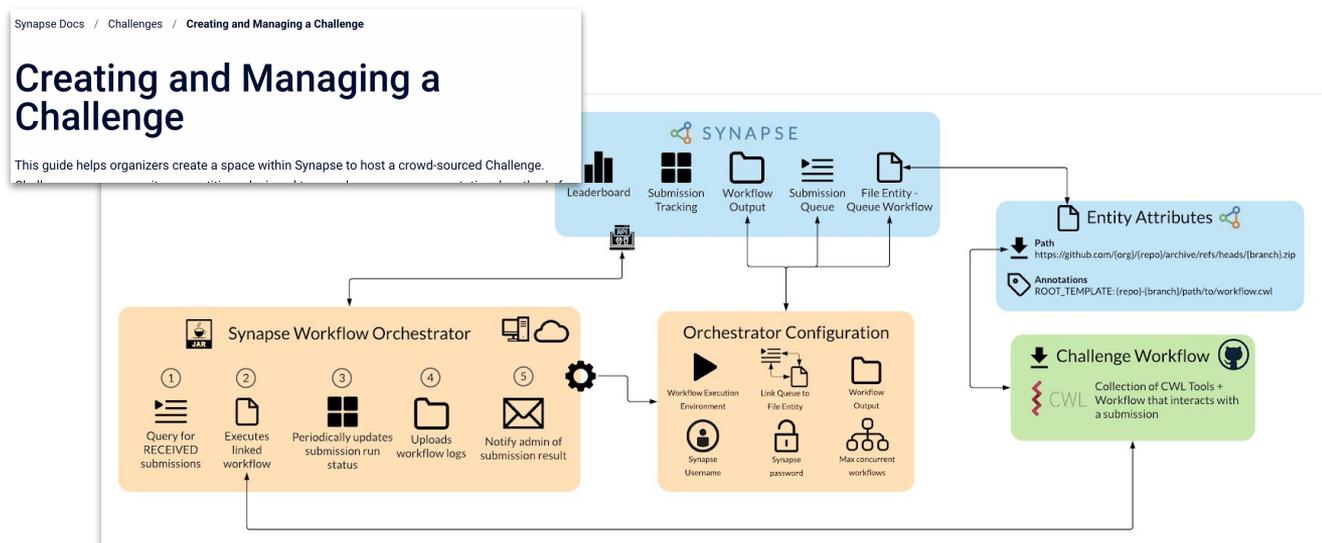
<b>60+</b> Crowd-sourced DREAM Challenges have benchmarked informatic algorithms in biomedicine	<b>30,000</b> Cross-disciplinary participants from around the world have volunteered as solvers.	<b>105+</b> Academic journal publications have resulted from DREAM Challenges covering a range of disease areas
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dreamchallenges.org

# Synapse.org supports general challenge execution

## Synapse projects offer challenge capabilities

- Wiki pages
- Discussion forums
- File storage
- Evaluation queues
- Docker submissions



Registered synapse users can create challenges on their own, some CLI required

# Takeaways

- Consider Challenges to
  - Identify novel methods
  - Analyze novel data
  - Build community around an event
  - Provide an opportunity for learning
- Challenges are time consuming to organize - plan ahead!
- Don't repeat mistakes: read reviews of past challenges in your domain
- Platforms exist to support challenge infrastructure needs- reach out for more information!