NCI-DOE Collaboration – Implementation of the NCI-DOE Collaboration Task Force Recommendations

Doug Lowy and Emily Greenspan, NCI

7th Virtual Meeting of FNLAC

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NIH NATIONAL CANCER INSTITUTE

Topics

- *FNLAC NCI-DOE Collaboration Task Force Charge & Recommendations*
- *Governance and Oversight Implementation*
- *Scientific & Technical Implementation*
  - *Pilot 1: Predictive Modeling for Preclinical Screening*
  - *Pilot 2: RAS Biology on Membranes*
  - *Pilot 3: Precision Cancer Surveillance*
  - *New Projects*

FNLAC NCI-DOE Collaboration Task Force (TF)

- TF established: October 2019 FNLAC meeting
- TF convened: May 2020
- TF final report delivered to FNLAC: October 2020 FNLAC meeting
- Chair: Dr. Joe W. Gray, OHSU
- Charge:
  - Review and assess merits of individual projects
  - Evaluate whether NCI-DOE Collaboration should continue and become a sustainable and stable partnership
  - Recommend future directions for NCI-DOE Collaboration

Overall Task Force Recommendations

- NCI-DOE Collaboration is uniquely suited to address certain critical challenges in cancer research and should continue
- The current pilots are really large, full-scale projects, and should be evaluated as such
- Future projects should be developed and reviewed by a more structured and rigorous approach
- Increase engagement with NCI extramural community
- Establish project-specific advisory groups

Project-Specific Task Force Recommendations

- **Pilot 1 should be concluded:** Insufficient available and pertinent data, insufficient integration with NCI investigators doing predictive modeling
- **Pilot 2 should be continued:** Greater focus on refining the coarse-grain models based on data from the atomic-level simulations and on experimental validation
- **Pilot 3 should be continued:** Greater focus on implementation and multi-institutional deployment of the developed APIs, and expansion beyond SEER

NCI Implementation Plans

Governance and Oversight Implementation Plans

	U.S. DEPARTMENT OF ENERGY | Office of Science **NCI-DOE Collaborations ASCAC Subcommittee**	**NCI-DOE Collaborations Scientific & Technical Advisory Committees**	**NCI-DOE Collaborations Executive Committee**
Number	1	1 per project	1
Member composition	8-12 extramural scientists with expertise across collaboration areas (cancer, biology, advanced computing, data science, etc.)	4-6 scientists per committee with targeted, deep expertise relevant to the assigned project	NCI: Drs. Sharpless, Lowy, Singer DOE: Drs. Binkley & Helland (SC), Dr. Anderson & Ms. Hoang (NNSA)
Member selection	per ASCAC guidance with input from NCI and DOE leadership	by project leads in consultation with Exec Committee	by agency leadership
Meeting Frequency	2 times per year or as determined by Subcommittee chair	Quarterly or as needed	3 times per year
Charge/role	- Assessment of current projects - Assessment of opportunities and challenges - Identification of strategies to address challenges and deliver on opportunities	Project-specific, in-depth scientific and technical guidance and advisement	- Interagency strategic partnership status and relationship health - Overall funding - Program priorities - Implementation of ASCAC recommendations

Pilot 1 Implementation Plans

- Pilot 1 is sunsetting: will conclude July 2021
- **Data release**
  - All Pilot 1 "AI/ML-ready" datasets (gathered, integrated, labeled, normalized, and curated) from multiple cell line studies, NCI ALMANAC, GDC, PDMR, and PDXnet will be publicly released
  - See *NCI Predictive Oncology Model and Data Clearinghouse* (modac.cancer.gov)
- **Model and software release**
  - All Pilot 1 computational models and software associated with publications will be publicly released along with documentation to enable reproducibility by others
  - See *NCI CBIIT website (*datascience.cancer.gov/collaborations/nci-doe-capabilities)

Pilot 2 Implementation Plans

- **Expand multiscale simulation framework**
  - Add modeling capabilities to facilitate discovery of new biology
  - Advance uncertainty quantification methods
  - Perform large-scale (>10M cpu-hrs) RAS-RAF complex multiscale simulation
  - Experimentally validate simulations
- **Outreach**
  - Host a workshop to engage the broader RAS biology research community
  - Continue to work closely with the FNLAC RAS Working Group
  - Work with FNL to identify sub-explorations that can be performed on computational resources that are more widely available

Pilot 3 Implementation Plans

- **Expand AI solutions for precision cancer surveillance**
  - Integrate e-path API into production workflow of 6 SEER registries
  - Expand DL model for capturing recurrent metastatic disease and biomarker data from e-path and radiology reports
  - Enhancements and deployment of privacy preserving APIs for secure model sharing with the broader stakeholder community

- **Outreach**
  - Continue to host hands-on hackathons
  - Continue to present and participate in national cancer and medical informatics conferences
  - Continue existing collaborations and pursue new ones

New Projects

FY22 and beyond

IMPROVE: Innovative Methodologies and New Data for Predictive Oncology Model Evaluation (1)

- **Project Goal:** Create well-documented and well-characterized approaches to constructing, training, and validating predictive cancer drug response computational models
- **Aim 1: Develop a model comparison framework**
  - Models will be developed in context of:
    - Predicting effective drugs and drug combinations for specific cancer types (tumor generalization)
    - Modeling efficacy in AI-driven drug design systems (generalization in drug space)
    - Identifying novel biological hypotheses for drug MOA (advancing model interpretability)
  - NCI will fund 3-5 *extramural model design groups* to actively collaborate with ANL in developing and comparing cancer drug-response DL models

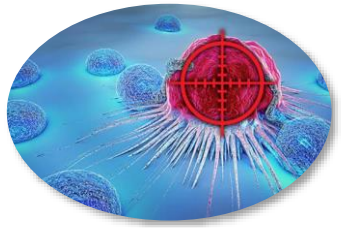
IMPROVE: Innovative Methodologies and New Data for Predictive Oncology Model Evaluation (2)

- **Aim 2: Data Generation to Improve Drug Response Models**
  - Development of ”*experimental campaign proposals*” aimed at elucidating what new experimental data are needed to augment existing training data for improving DL drug response prediction models
  - Open **RFI** process to identify groups that have state-of-the-art high-throughput data generation capabilities in the area of cancer drug response
  - One or more **RFPs** will be generated to support targeted experimental data generation based on RFI feedback along with Aim 1 consensus data generation priorities
  - ANL will fund one or more *data generation groups* from the public and/or private sectors
- **IMPROVE Anticipated Results:** new datasets optimized for improving ML models, a model comparison framework, a deeper understanding of current landscape of drug response modeling, and new and improved predictive oncology models

Envisioning Computational Innovations for Cancer Challenges (ECICC) Community Driven Collaborative and Team Science Activities

ECICC Scoping Meeting
March 2019

>70 computational and cancer scientists;
Four challenge areas:
1) Digital twin,
2) Adaptive treatment,
3) Synthetic data,
4) ML-driven hypothesis generation



Cancer Patient Digital Twin Ideas Lab
July 2020

5-day virtual event
130 applicants
30 attendees
6 experienced mentors
6-month initial seed projects

ECICC Community Site
Created 2019

Over 180 members
Ongoing community platform
Visit website at
https://ncihub.org/groups/cicc

Predictive Rad Onc Workshops
February 2021

Joint NCI and DOE organizing committee
Extramural PI steering committee
Explore frontiers of precision radiation therapy

Resources

- NCI-DOE Collaboration developed capabilities (software, models, data)
  - modac.cancer.gov
- NCI-DOE Collaboration comprehensive capability listing with associated publications
  - https://datascience.cancer.gov/collaborations/nci-doe-capabilities
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- ECICC Scoping Meeting: https://ncihub.org/groups/cicc/pastmeetings/ecicc
- Digital Twins in Cancer Research and Treatment: https://ncihub.org/groups/cicc/digital_twin_ideas_lab
- Advancing Precision Radiation Oncology through Advanced Computing and AI: https://ncihub.org/groups/cicc/radiation_oncology_2021
  - Event website with link to Kickoff Event keynote presentations: https://events.cancer.gov/cbiit/radonc2021

Thank you

Questions & comments?