Deborah Plana

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EDUCATION

Harvard Medical School (HMS)/MIT MD-PhD Program ▪ Boston, MA *Jun. 2017-current*
Candidate for MD in Harvard-MIT Program in Health Sciences and Technology (HST)
Candidate for PhD in Harvard Systems, Synthetic, and Quantitative Biology Program

Massachusetts Institute of Technology ▪ Cambridge, MA *Jun. 2013-Jun. 2017*
Bachelor of Science in Biological Engineering *GPA 4.9/5.0*
Minor in Statistics and Data Science

AWARDS

Ruth L. Kirschstein National Research Service F30 Award ▪ National Cancer Institute *Jun. 2021-May 2024*
Harvard Graduate Prize Fellowship ▪ HMS *Mar. 2019*
Quantitative Sciences in Drug Development Best Poster ▪ Novartis *Aug. 2018*
Presidential Scholar ▪ HMS *Aug. 2017, Aug .2018*
Medical Scientist Training Program ▪ National Institutes of Health *Jun. 2017-May 2024*
Reddy Family Undergraduate Research Opportunities Fund ▪ MIT *Dec. 2016*
Tau Beta Pi Engineering Honor Society ▪ MIT *Sep. 2016*
James E. Cunningham (1957) Memorial Scholar ▪ MIT *Dec. 2015*
Industrial Advisory Council for Minority Education Student Prize ▪ MIT *Dec. 2015*
MIT Biological Engineering Department Barry M. Goldwater Scholarship Nominee ▪ MIT *Nov. 2015*
Ilona Karmel Writing Prize ▪ MIT *May 2015*
Exceptional Research Opportunities Program Grant ▪ Howard Hughes Medical Institute *Jan. 2015*

RESEARCH EXPERIECE

Sorger and Palmer Laboratories ▪ HMS Laboratory of Systems Pharmacology ▪ Boston, MA *Jan. 2018-current*
HMS/MIT MD-PhD Program

- Invented a new statistical tool to identify treatment-sensitive tumor subgroups in 'basket trials' of cancer therapies.
- Established an online repository of individual participant survival data in oncology: cancertrials.io.
- Showed that a parametric form accurately describes patient survival data in oncology and that use of that distribution (Weibull) helps precisely estimate therapeutic efficacy for small patient cohorts.
- Identified drug-response biomarkers in ovarian cancer and T-cell lymphoma using patient-derived xenograft (PDX) data.

Lauffenburger Laboratory ▪ MIT Department of Biological Engineering ▪ Cambridge, MA *Jan. 2015-Jun. 2017*
Undergraduate Research Opportunities Program (UROP) and Summer Research Trainee Program (SRTP)

- Constructed and collected cytokine data from a triculture and three-dimensional hydrogel model of endometriosis.
- Used a mixed-effects model of cytokine data to investigate the role of different cell types in endometriosis.
- In collaboration with the Massachusetts General Hospital (MGH) Cancer Center, developed blood-based CLIA assays for prognosticating patient resistance to targeted therapies.
- Analyzed RNA-Seq and microarray data from melanoma patient tumor tissue and exosome samples to predict patients' response to immune-checkpoint inhibitors.

Cepko Laboratory ▪ HMS Department of Genetics ▪ Boston, MA *Jun. 2015-Aug. 2015*
Howard Hughes Medical Institute Exceptional Research Opportunities Program (ExROP)

- Cloned and tested novel DNA reporter plasmids to understand the role of putative *Otx2* DNA enhancer elements in retinal development.
- Performed mouse retinal dissections, in-vivo and explant electroporations to characterize novel retinal cell subpopulations.

Tonegawa Laboratory, MIT Picower Institute for Learning and Memory ▪ Cambridge, MA *Jan. 2014-Dec. 2014*
Undergraduate Research Opportunities Program (UROP)

- Performed mouse behavioral training, virus injections, implants, and brain perfusions to optogenetically label neurons active in memory formation.
- Used vibratome sectioning, immunohistochemistry, and confocal microscopy to dissociate the functional role of different brain regions involved in memory formation.

Beth Israel Deaconess Medical Center Faculty Hour ▪ Boston, MA *Jan. 2014-Mar. 2014*
Faculty Hour Team Member

- Collected, analyzed, and presented data on patients' clinical conditions and waiting times.
- Assisted in writing official hospital protocols, such as hospital guidelines on the care of post-anesthesia care unit patients.

WORK EXPERIENCE

Longitude Capital ▪ Research Fellow ▪ Boston, MA *Aug. 2020-Feb. 2021*
Sourced and evaluated early-stage companies for biotechnology investment team.
Investigated therapeutic areas of interest and created presentation materials to summarize research findings.

PEER-REVIEWED PUBLICATIONS AND PREPRINTS

1. **Plana, D.**, Fell, G., Alexander, B. M., Palmer, A. C.*, & Sorger, P. K.* (2021). *Cancer patient survival can be accurately parameterized, revealing time-dependent therapeutic effects and doubling the precision of small trials*. bioRxiv, 2021.05.14.442837. https://doi.org/10.1101/2021.05.14.442837. *Co-corresponding authors.
2. Kothakonda, A.*, Atta, L.*, **Plana, D**.*, Ward, F. *, Davis, C., Cramer, A., Moran, R., Freake, J., Tian, E., Mazor, O., Gorelik, P., Van, C., Hansen, C., Yang, H., Li, Y., Sinha, M. S., Li, J., Yu, S. H., LeBoeuf, N. R., & Sorger, P. K. (2021*). De Novo Powered Air-Purifying Respirator Design and Fabrication for Pandemic Response.* Frontiers in Bioengineering and Biotechnology, 9, 725. https://doi.org/10.3389/fbioe.2021.690905. *These authors contributed equally.
3. **Plana, D.***, Tian, E.*, Cramer, A. K.*, Yang, H.*, Carmack, M. M., Sinha, M. S., Bourgeois, F. T., Yu, S. H., Masse, P., Boyer, J., Kim, M., Mo, J., LeBoeuf, N. R., Li, J., & Sorger, P. K. (2021). *Assessing the quality of nontraditional N95 filtering face-piece respirators available during the COVID-19 pandemic*. BMC Infectious Diseases, 21(1), 712. https://doi.org/10.1186/s12879-021-06008-8. *These authors contributed equally.
4. Cramer, A. K.*, **Plana, D.***, Yang, H.*, Carmack, M. M., Tian, E., Sinha, M. S., Krikorian, D., Turner, D., Mo, J., Li, J., Gupta, R., Manning, H., Bourgeois, F. T., Yu, S. H., Sorger, P. K., & LeBoeuf, N. R. (2021). *Analysis of SteraMist ionized hydrogen peroxide technology in the sterilization of N95 respirators and other PPE*. Scientific Reports, 11(1), 2051. https://doi.org/10.1038/s41598-021-81365-7. *These authors contributed equally.
5. Antonini, M.-J.*, **Plana, D.***, Srinivasan, S.*, Atta, L., Achanta, A., Yang, H., Cramer, A. K., Freake, J., Sinha, M. S., Yu, S. H., LeBoeuf, N. R., Linville-Engler, B., & Sorger, P. K. (2021). *A Crisis-Responsive Framework for Medical Device Development Applied to the COVID-19 Pandemic*. Frontiers in Digital Health, 3, 617106. https://doi.org/10.3389/fdgth.2021.617106. *These authors contributed equally.
6. Kothakonda, A.*, Atta, L.*, **Plana, D.***, Ward, F.*, Davis, C., Cramer, A., Moran, R., Freake, J., Tian, E., Mazor, O., Gorelik, P., Van, C., Hansen, C., Yang, H., Sinha, M. S., Li, J., Yu, S. H., LeBoeuf, N. R., & Sorger, P. K. (2021). *De novo Powered Air-Purifying Respirator Design and Fabrication for Pandemic Response*. medRxiv. https://doi.org/10.1101/2021.03.25.21252076. *These authors contributed equally.
7. McAvoy, M.*, Bui, A.-T. N.*, Hansen, C.*, **Plana, D.***, Said, J. T., Yu, Z., Yang, H., Freake, J., Van, C., Krikorian, D., Cramer, A., Smith, L., Jiang, L., Lee, K. J., Li, S. J., Beller, B., Huggins, K., Short, M. P., Yu, S. H., … LeBoeuf, N. R. (2021). 3D Printed frames to enable reuse and improve the fit of N95 and KN95 respirators. BMC Biomedical Engineering, 3(1), 10. https://doi.org/10.1186/s42490-021-00055-7 *These authors contributed equally.
8. Kassamali, B., Yu, Z., Davis, C., Carmack, M., Bui, A.-T. N., Said, J. T., **Plana, D.**, Yang, H., Sorger, P., LeBoeuf, N. R., & LaChance, A. H. (2021). *Conversion of Existing UVB Phototherapy Units to UVC Germicidal Chambers for N95 Decontamination: Lessons Learned*. Photobiomodulation, Photomedicine, and Laser Surgery, 39(2), 83–85. https://doi.org/10.1089/photob.2020.4968.
9. Palmer, A. C.*, **Plana, D.***, Gao, H.*, Korn, J. M., Yang, G., Green, J., Zhang, X., Velazquez, R., McLaughlin, M. E., Ruddy, D. A., Kowal, C., Muszynski, J., Bullock, C., Rivera, S., Rakiec, D. P., Elliott, G., Fordjour, P., Meyer, R.,

Loo, A., … Sorger, P. K. (2020). *A Proof of Concept for Biomarker-Guided Targeted Therapy against Ovarian Cancer Based on Patient-Derived Tumor Xenografts*. Cancer Research, 80(19), 4278–4287. https://doi.org/10.1158/0008-5472.CAN-19-3850. *These authors contributed equally.

10. Palmer, A. C.*, **Plana, D.***, & Sorger, P. K. (2020). *Comparing the Efficacy of Cancer Therapies between Subgroups in Basket Trials*. Cell Systems, 11(5), 449-460.e2. https://doi.org/10.1016/j.cels.2020.09.003. *These authors contributed equally.
11. Mostaghimi, A.*, Antonini, M.-J.*, **Plana, D.***, Anderson, P. D., Beller, B., Boyer, E. W., Fannin, A., Freake, J., Oakley, R., Sinha, M. S., Smith, L., Van, C., Yang, H., Sorger, P. K., LeBoeuf, N. R., & Yu, S. H. (2020). *Regulatory and Safety Considerations in Deploying a Locally Fabricated, Reusable Face Shield in a Hospital Responding to the COVID-19 Pandemic*. Med, 1(1), 139-151.e4. https://doi.org/10.1016/j.medj.2020.06.003. *These authors contributed equally.
12. Tyan, K., Levin, A., Avalos-Pacheco, A., **Plana, D.**, Rand, E. A., Yang, H., Maliszewski, L. E., Chylek, L. A., Atta, L., Tye, M. A., Carmack, M. M., Oglesby, N. S., Burgin, S., Yu, S. H., LeBoeuf, N. R., & Kemp, J. M. (2020). *Considerations for the Selection and Use of Disinfectants Against SARS-CoV-2 in a Health Care Setting*. Open Forum Infectious Diseases, 7(ofaa396). https://doi.org/10.1093/ofid/ofaa396
13. Shi, A., Kasumova, G. G., Michaud, W. A., Cintolo-Gonzalez, J., Díaz-Martínez, M., Ohmura, J., Mehta, A., Chien, I., Frederick, D. T., Cohen, S., **Plana, D.**, Johnson, D., Flaherty, K. T., Sullivan, R. J., Kellis, M., & Boland, G. M. (2020). *Plasma-derived extracellular vesicle analysis and deconvolution enable prediction and tracking of melanoma checkpoint blockade outcome*. Science Advances, 6(46), eabb3461. https://doi.org/10.1126/sciadv.abb3461
14. Koch, R., Christie, A. L., Crombie, J. L., Palmer, A. C., **Plana, D.**, Shigemori, K., Morrow, S. N., Van Scoyk, A., Wu, W., Brem, E. A., Secrist, J. P., Drew, L., Schuller, A. G., Cidado, J., Letai, A., & Weinstock, D. M. (2019). *Biomarker-driven strategy for MCL1 inhibition in T-cell lymphomas*. Blood, 133(6), 566–575. https://doi.org/10.1182/blood-2018-07-865527
15. Schrier, S. B., Hill, A. S., **Plana, D.**, & Lauffenburger, D. A. (2016). *Synergistic Communication between CD4+ T Cells and Monocytes Impacts the Cytokine Environment*. Scientific Reports, 6(1), 34942. https://doi.org/10.1038/srep34942

ABSTRACTS, FEDERAL COMMENTS, AND DIGITAL PUBLICATIONS

1. Peterson, J. S., **Plana, D.**, Bitterman, D. S., Johnson, S. B., & Kann, B. H. (2021). *Growth in eligibility criteria content and failure to accrue among National Cancer Institute (NCI)-affiliated clinical trials*. Journal of Clinical Oncology, 39(15_suppl), 1515–1515. https://doi.org/10.1200/JCO.2021.39.15_suppl.1515
2. **Plana, D.**, Arfe, A., & Sinha, M. S. (2020). *FDA-2020-D-1106-0139, Re: FDA Guidance on Conduct of Clinical Trials of Medical Products during COVID-19 Pandemic; Guidance for Industry, Investigators, and Institutional Review Boards*. Retrieved June 3, 2021, from https://www.regulations.gov/document/FDA-2020-D-1106-0139
3. **Plana, D**., Arfè, A., & Sinha, M. S. (2020). *Re-Envisioning Clinical Trials During The COVID-19 Pandemic | Health Affairs Blog*. Retrieved June 3, 2021, from https://www.healthaffairs.org/do/10.1377/hblog20200702.963588/full/
4. Shi, A., Cintolo-Gonzalez, J. A., Chien, I., Frederick, D. T., Alpatov, R., Michaud, W., **Plana, D.**, Panka, D., Corcoran, R., Flaherty, K., Sullivan, R., Kellis, M., & Boland, G. (2018). *Abstract B25: Exosomal transcriptomic signatures tracks and predicts response to checkpoint blockade immunotherapy*. Systems Immuno-Oncology, B25–B25. https://doi.org/10.1158/2326-6074.TUMIMM17-B25
5. Kasumova, G. G., Kim, M. S., Shi, A., Chein, I., Frederick, D. T., Alpatov, R., Michaud, W. A., **Plana, D.**, Panka, D. J., Corcoran, R. B., Flaherty, K. T., & Sullivan, R. J. (2018). *Society of Surgical Oncology 71st Annual Cancer Symposium: Exosomal PD-L1 Protein Expression Correlates with Targeted Therapy Resistance in Melanoma*. Annals of Surgical Oncology, 25(S1), 1–230. https://doi.org/10.1245/s10434-018-6349-1
6. Shi, A., Kasumova, G., Chien, I., Cintolo-Gonzalez, J., Frederick, D. T., Alpatov, R., Michaud, W. A., **Plana, D.**, Corcoran, R., Flaherty, K., Sullivan, R., Kellis, M., & Boland, G. (2018). *Abstract 4282: Deconvolution of plasma-derived exosomes for tracking and prediction of immunotherapy across multiple tissues*. Bioinformatics and Systems Biology, 4282–4282. https://doi.org/10.1158/1538-7445.AM2018-4282
7. Kasumova, G. G., Shi, A., Cintolo-Gonzalez, J. A., Chein, I., Frederick, D. T., Alpatov, R., Michaud, W. A., **Plana, D.**, Panka, D. J., Corcoran, R. B., Flaherty, K. T., Sullivan, R. J., Kellis, M., & Boland, G. M. (2018). *Abstract A35: BRAF inhibition increases exosomal PD-L1 protein expression in melanoma*. Checkpoints and Immunomodulation, A35–A35. https://doi.org/10.1158/2326-6074.TUMIMM17-A35

8. Cohen, S., Cintolo-Gonzalez, J. A., **Plana, D.**, Sullivan, R., & Boland, G. (2017). *Society of Surgical Oncology 70th Annual Cancer Symposium: Mixed Responder Cohort of Metastatic Melanoma Patients Treated with Anti Programmed Cell Death-1*. Annals of Surgical Oncology, 24(S1), 1–202. https://doi.org/10.1245/s10434-017-5785-7
9. Cintolo-Gonzalez, J. A., Cohen, S., Michaud, W. A., **Plana, D.**, Panka, D. J., Sullivan, R., & Boland, G. (2017). *Society of Surgical Oncology 70th Annual Cancer Symposium: Use of Circulating Microvesicles, Exosomes, as a Biomarker to Track Response to Immunotherapy*. Annals of Surgical Oncology, 24(S1), 1–202. https://doi.org/10.1245/s10434-017-5785-7

ORAL PRESENTATIONS

1. **Plana, D.,** Palmer, A.C., Sorger, P.K. *Advancing the design and interpretation of cancer clinical trials through systematic data mining and analysis.* HMS Ludwig Cancer Center. Virtual. June 2021.
2. **Plana, D.** *Making Precise Estimates of Drug Efficacy from Small Amounts of Patient Data.* Tumor Therapeutics and Resistance Session; Junior Investigator Meeting for the NCI Cancer Systems Biology Consortium, Physical Sciences-Oncology Network, and the Big Data Scientist Training Enhancement Program. Virtual. August 2020.
3. **Plana, D.** *Introduction to PanFab: Mobilizing a volunteer response to COVID-19* (Speaker); *Resiliency and Trust: Local, regional, and national response to PPE Shortages* (Panelist). Harvard-MIT Center for Regulatory Science Pandemic Response: Resilience and Recovery in the Era of COVID-19. Virtual. June 2020.
4. **Plana, D.** *Parametric fitting of over 100,000 individual patient events from clinical trials in oncology*. Harvard-MIT Center for Regulatory Science Doctoral Student Symposium. Boston, MA. February 2020.
5. **Plana, D.** *Of mice and (small numbers of) men: Improving estimates of drug efficacy in oncology.* Harvard Systems Biology Department Pizza Talk. Boston, MA. October 2019.
6. **Plana, D.** *Parametric fitting of clinical trial data in oncology*. Harvard Institute for Therapeutic Sciences Symposium. Boston, MA. October 2019.
7. **Plana, D.** *Using blood-based assays and RNA data to predict melanoma patient response to therapy*. Summer Research Trainee Program at the Massachusetts General Hospital. Boston, MA. June 2016.

POSTER PRESENTATIONS

1. **Plana, D.**, Fell, G., Alexander, B. M., Palmer, A. C. , & Sorger, P. K. *Cancer patient survival can be accurately parameterized, revealing time-dependent therapeutic effects and doubling the precision of small trials.* Keystone Symposia, Precision Oncology: Translating Discovery to the Clinic. Virtual. June 2021.
2. **Plana, D.**, Palmer, A. C., Sorger, P.K**.** *Making Precise Estimates of Drug Efficacy from Small Amounts of Patient Data*. NCI Center for Cancer Systems Pharmacology Annual Investigators Meeting. Virtual. September 2020.
3. **Plana, D.**, Palmer, A. C., Sorger, P.K**.** *Predicting patient response to cancer combination therapies from clinical trial data*. Novartis-Academia Conference on Quantitative Sciences in Drug Development. Cambridge, MA. August 2018.
4. **Plana, D.**, Hill, A., Cook, C., Griffith, L., Lauffenburger, D. *Characterizing a 3-D hydrogel model of the human endometrium and its interactions with immunological factors using mixed effects modeling*. Biomedical Engineering Society Conference. Minneapolis, MN. October 2016.
5. Cintolo-Gonzalez, J., Michaud, W., Cohen, S., **Plana, D.**, Panka, D., Sullivan, R., Boland, G. *Use of Circulating Microvesicles, Exosomes, as a Biomarker to Track Disease Burden in Melanoma*. Massachusetts General Hospital Clinical Research Day. Boston, MA. October 2016.
6. **Plana, D.**, Wang, S., Cepko, C. *Characterization of retinal cell subpopulations expressing distinct Otx2 enhancers.* Howard Hughes Medical Institute Exceptional Research Opportunities Program Meeting. Chevy Chase, MD. May 2016.
7. **Plana, D.**, Hill, A., Cook, C., Griffith, L., Lauffenburger, D. *Creating a 3-D hydrogel model of the human endometrium and its interactions with immunological factors*. New England Science Symposium. Cambridge, MA. April 2016.
8. **Plana, D.**, Cocchi, Sundar, Pleumann, Grzybinski, Shaefi, Brogna, Sisti, Butler, Small, Cain, Muret-Wagstaff, Foley, Talmor, Ma, Whyte, Kleinman, Simon. *Early Identification and Care of the Critically Ill Post-Operative Patient*. Beth Israel Deaconess Medical Center Silverman Symposium. Boston, MA. April 2015.

PROFESSIONAL ACTIVITIES

Ad hoc refereeing: BMJ Open
Memberships: American Association for Cancer Research, American Society of Clinical Oncology, Massachusetts

Medical Society**,** Harvard Center for Cancer Systems Pharmacology Executive Committee, Harvard-MIT Center for Regulatory Science, HMS Medical Student COVID-19 Curriculum Committee

LEADERSHIP AND TEACHING

Greater Boston Pandemic Fabrication Team ▪ Founding Member, Coordinator ▪ Harvard-MIT *Mar. 2020-current*
Coordinated team of ~100 scientists, clinicians, and engineers in responding to medical supply shortages during the COVID-19 pandemic. Guided preparation and publication of multiple open-source research articles on the creation, reuse, and clinical testing of personal protective equipment during a crisis, available at panfab.org.

Medical School Admissions Committee for Harvard-MIT HST ▪ Member ▪ HMS *Jul. 2019-Mar. 2021*
Reviewed applications, participated in interviews, contributed to discussions at subcommittee meetings, and submitted interview reports for medical school applicants.

Principles and Practices of Drug Development ▪ Teaching Assistant ▪ HMS and MIT *Aug. 2020-Dec. 2020*
Created and presented course materials on pharmacology fundamentals, preclinical drug discovery, clinical trials, manufacturing and regulatory issues, as well as financing and marketing of new therapies.

Crimson Care Collaborative ▪ Co-Director ▪ HMS *Mar. 2018-Mar. 2019*
Directed quality improvement efforts across seven clinical sites in the Greater Boston Area. Implemented projects to register patients to vote and reduce clinic no-show rates. Managed about 300 volunteers consisting of medical, dental, and undergraduate students.

Fields, Forces and Flows (2.793/6.023/20.330) ▪ Teaching Assistant ▪ MIT *Jan. 2017-May 2017*
Taught weekly recitations and office hours. Organized review sessions, graded exams, and moderated Piazza forum. Course topics taught included electric fields, fluid flows, transport phenomena and their application to biological systems. Received 7.0/7.0 instructor rating.

Latino Cultural Center (LCC) ▪ President ▪ MIT *May 2016-May 2017*
Official representative of about 150 students to the MIT administration and outside organizations.

Rune Literary Magazine ▪ Editor-In-Chief ▪ MIT *May 2015-May 2016*
Organized membership of over 30 students. Ensured magazine printing, publicity, funding and distribution.

CLINICAL CLERKSHIP ROTATIONS COMPLETED

Neurology, Radiology, and Psychiatry ▪ Medical student ▪ BWH and McLean Hospital *Apr. 2019- Jun. 2019*

TECHNICAL SKILLS

Programming and data analysis: Mathematica, MATLAB, Python, R
Image editing: Adobe Creative Suite (including Illustrator, Photoshop, InDesign)

LANGUAGE SKILLS

English (Native/Bilingual proficiency), Spanish (Native/Bilingual proficiency), Italian (Limited working proficiency)