Lantern Pharma Inc.
How AI is Transforming Drug Development

March 20th, 2023

Leveraging A.I., machine learning & genomics to transform the **cost, pace, and timeline** of oncology drug discovery and development

NASDAQ :LTRN

Forward Looking Statements

This presentation contains forward-looking statements within the meaning of Section 27A of the Securities Act of 1933, as amended, and Section 21E of the Securities Exchange Act of 1934, as amended. These forward-looking statements include, among other things, statements relating to: future events or our future financial performance; the potential advantages of our RADR® platform in identifying drug candidates and patient populations that are likely to respond to a drug candidate; our strategic plans to advance the development of our drug candidates and antibody drug conjugate (ADC) development program; estimates regarding the development timing for our drug candidates and ADC development program; expectations and estimates regarding clinical trial timing and patient enrollment; our research and development efforts of our internal drug discovery programs and the utilization of our RADR® platform to streamline the drug development process; our intention to leverage artificial intelligence, machine learning and genomic data to streamline and transform the pace, risk and cost of oncology drug discovery and development and to identify patient populations that would likely respond to a drug candidate; estimates regarding patient populations, potential markets and potential market sizes; sales estimates for our drug candidates and our plans to discover and develop drug candidates and to maximize their commercial potential by advancing such drug candidates ourselves or in collaboration with others. Any statements that are not statements of historical fact (including, without limitation, statements that use words such as "anticipate," "believe," "contemplate," "could," "estimate," "expect," "intend," "seek," "may," "might," "plan," "potential," "predict," "project," "target," “model,” "objective," "aim," "upcoming," "should," "will," "would," or the negative of these words or other similar expressions) should be considered forward-looking statements. There are a number of important factors that could cause our actual results to differ materially from those indicated by the forward-looking statements, such as (i) the impact of the COVID-19 pandemic, (ii) the risk that our research and the research of our collaborators may not be successful, (iii) the risk that none of our product candidates has received FDA marketing approval, and we may not be able to successfully initiate, conduct, or conclude clinical testing for or obtain marketing approval for our product candidates, (iv) the risk that no drug product based on our proprietary RADR® AI platform has received FDA marketing approval or otherwise been incorporated into a commercial product, and (v) those other factors set forth in the Risk Factors section in our Annual Report on Form 10-K for the year ended December 31, 2022, filed with the Securities and Exchange Commission on March 20, 2023. You may access our Annual Report on Form 10-K for the year ended December 31, 2022 under the investor SEC filings tab of our website at www.lanternpharma.com or on the SEC's website at www.sec.gov. Given these risks and uncertainties, we can give no assurances that our forward-looking statements will prove to be accurate, or that any other results or events projected or contemplated by our forward-looking statements will in fact occur, and we caution investors not to place undue reliance on these statements. All forward-looking statements in this presentation represent our judgment as of the date hereof, and, except as otherwise required by law, we disclaim any obligation to update any forward-looking statements to conform the statement to actual results or changes in our expectations.

Current Oncology Drug Development is Costly, Risky, and Inefficient

A perfect problem area for artificial intelligence & machine learning

Challenges in drug development…

3.4%
Avg. success rate of oncology drugs

$2.8B
R&D investment to bring a new cancer drug to market 2019

12X
Success rate of oncology trials using biomarker

20,000+
Oncology trials conducted from 2012-2022

…are being met by data-driven, and A.I.-enabled approaches & technology

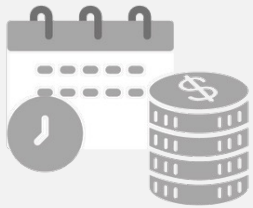
Using AI, Lantern is Transforming Drug Discovery Timelines and Cost

Lantern has launched **9 programs** in two years, and is anticipating launching Multiple Phase 1 trials in 2023

Lantern's Drug Development Model

Large Scale/Multi-omics Oncology Data

Proprietary AI platform RADR®



Accelerated timeline and reduced cost

Transforming Early Stage Discovery & Development

	Traditional Model	Lantern's Model
Time	**3 – 5 +** Years	**2** Years
Cost	**$10 – 50 +** Million	**$1-5** Million

Reduces **Significant** Time & Cost

*"In around **two years**, Lantern has progressed its GBM program from initial RADR® insights, to wet lab validation, to late stage IND enabling studies - significantly cutting typical drug development timelines and cost"*

(Biopharmatrend, 2022)

Sharpening Later Stage Clinical Trials

	Traditional Model	Lantern's Model
Time	**6 – 12 +** Years	**3-5** Years
Cost	**$100 – 500 +** Million	**$25-100** Million

Reduces **Significant** Time & Cost

*"**AI-driven patient stratification** helps to focus clinical trials with potentially fewer and more select patients, which are more likely to respond, ultimately saving time and money"*

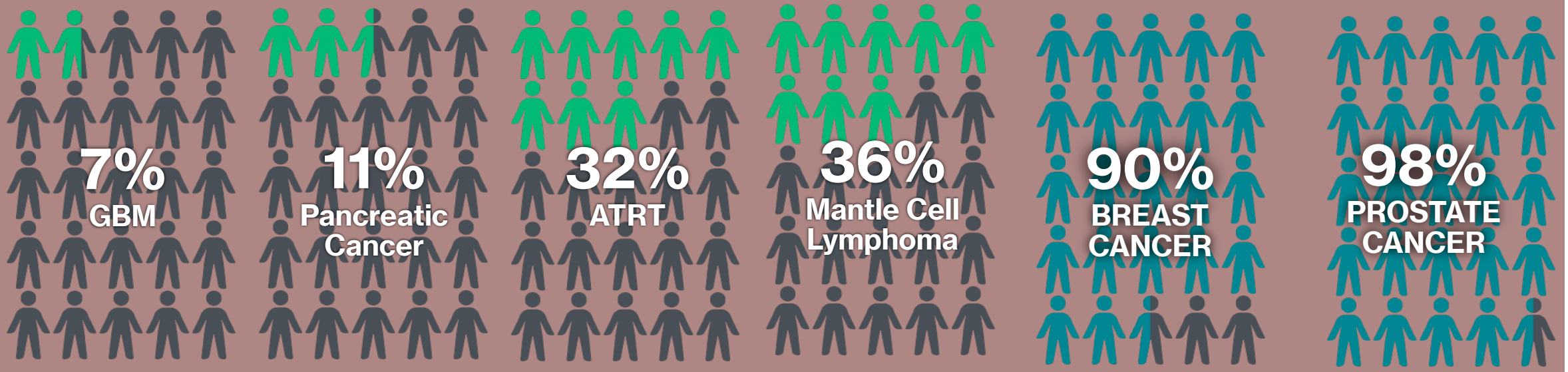
(Panna Sharma)

Drug Development Advances are Needed To Improve Outcomes for Rare Cancer Patients

Rare Cancer Facts and Statistics:

- Rare cancers are 25% of all cancer cases and and are the leading cause of cancer related deaths
- The number of rare cancers is growing, there are over 500 types of rare cancers
- Rare cancer 5-year survival rates are worse compared to more common cancers
- There is a lack of of rare cancer samples, genetic biomarkers, and therapies

5 Year Survival Rates of Rare Cancers Remain Low… Despite Survival Improvements in Other Solid Tumors

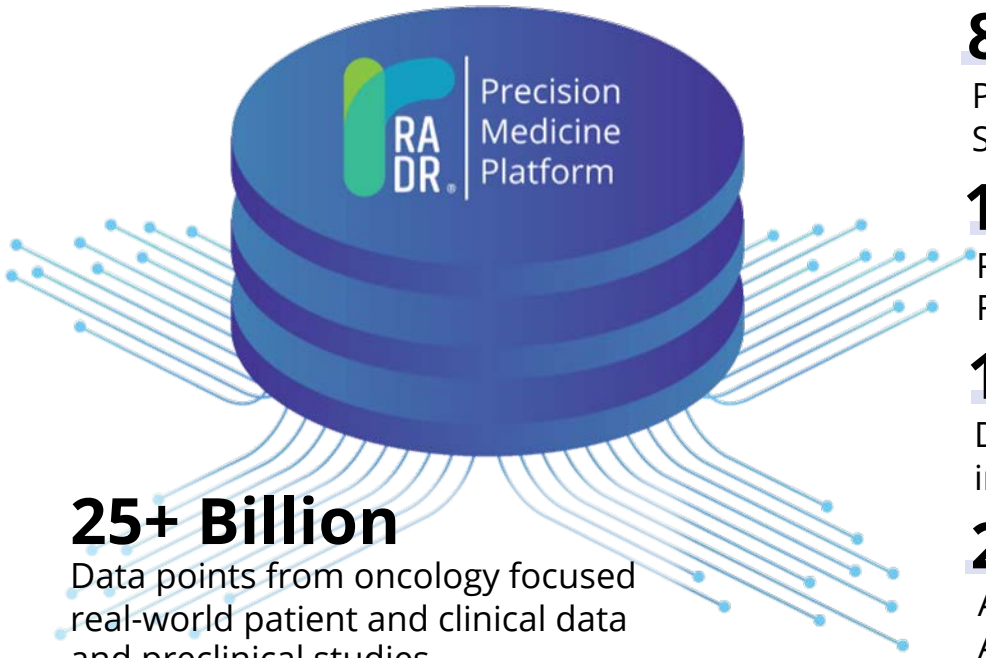


RADR® is Lantern's AI and ML Platform that Powers Oncology Drug Discovery and Development

RADR® Precision Medicine Platform

Response **A**lgorithm for **D**rug Positioning & **R**escue

A proprietary integrated data analytics, experimental biology, oncology-focused, machine-learning-based platform focused on drug development



25+ Billion
Data points from oncology focused real-world patient and clinical data and preclinical studies

80%+
Prediction Success

130K+
Patient Records

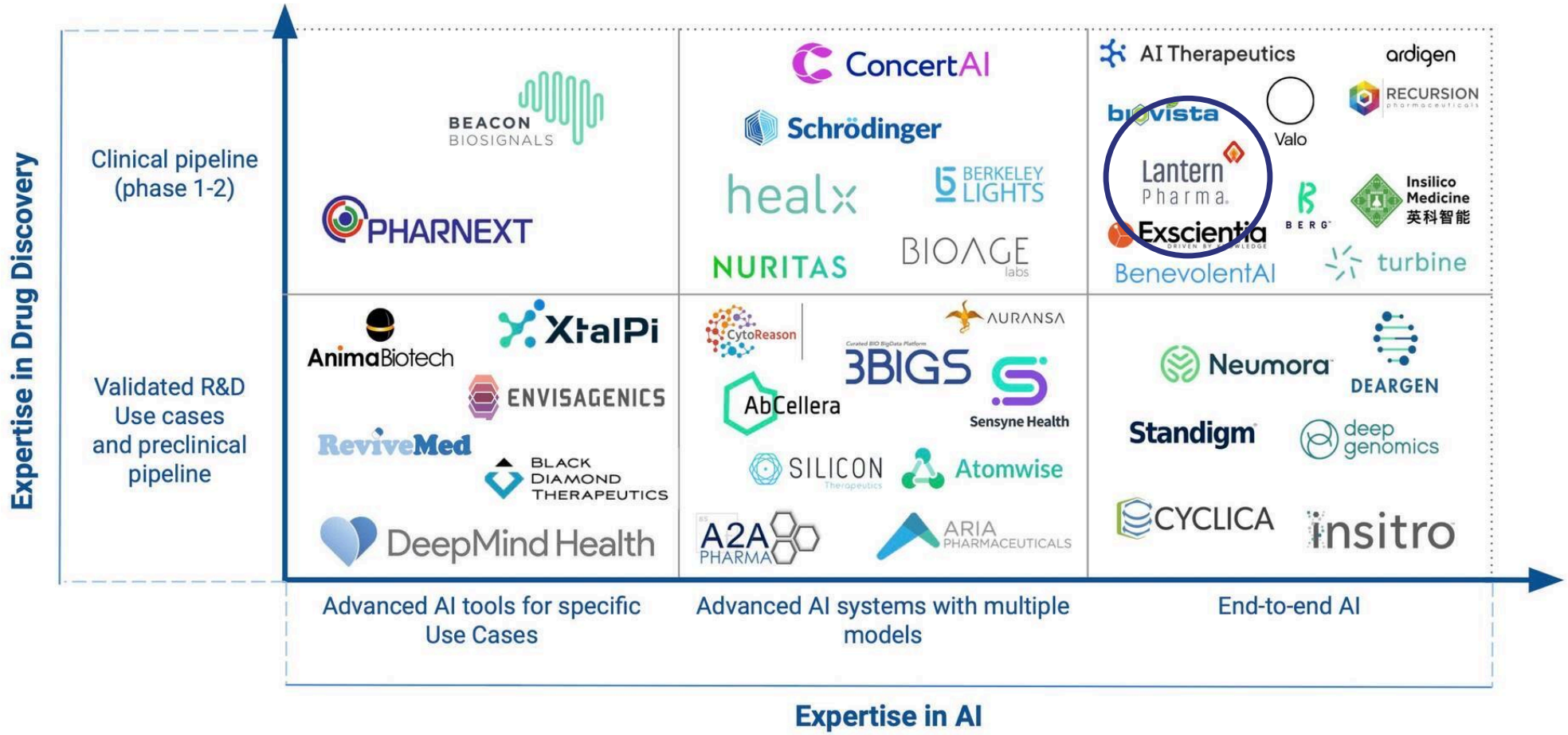
154+
Drug-tumor interactions

200+
Advanced ML Algorithms

- **Leverages** cutting edge machine-learning approaches and techniques to generate powerful data-driven insights
- **Enables** rapid informatics based hypothesis generation which can be validated in wet-lab
- **Uses** biology driven machine-learning algorithms to achieve higher prediction accuracy in real world settings
- **Employs** a platform that is scalable, robust, expanding and replicable to support a range of drug development needs

Lantern Pharma is a Top 10 End-to-End AI Drug Discovery Company

Comparison of Top-40 Leading AI for Drug Discovery Companies Expertise in Drug Discovery R&D

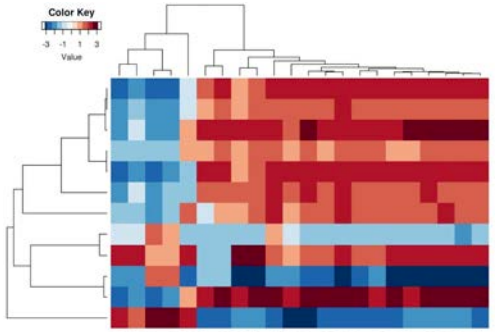


DEEP PHARMA INTELLIGENCE

According to Deep Pharma Intelligence (May 04, 2022)

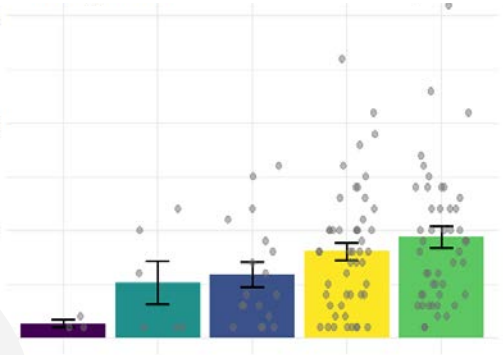
RADR® has 4 Multi-Faceted Modules that are Facilitating Oncology Drug Discovery and Development of Lantern and its Collaborators

Discover Mechanism of Action



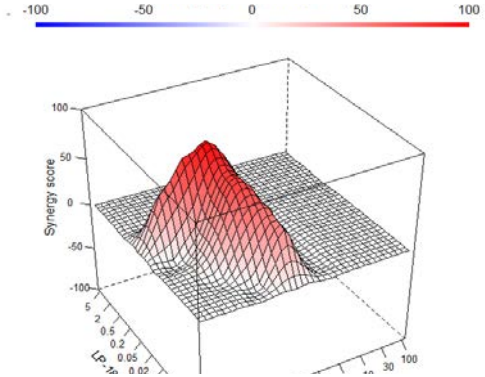
Use RADR® to find **potential Mechanism of Action (MoA)** of the Compound / Drug

Identify New Disease Indications



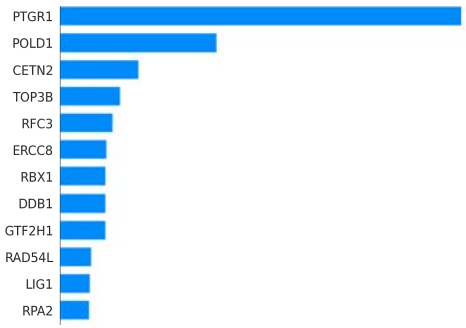
Identify and prioritize type/subtype of cancer for your compound with use of RADR®

Determine Optimal Drug Combinations



Use different algorithms and methods from RADR® to find **potential Drug combinations**

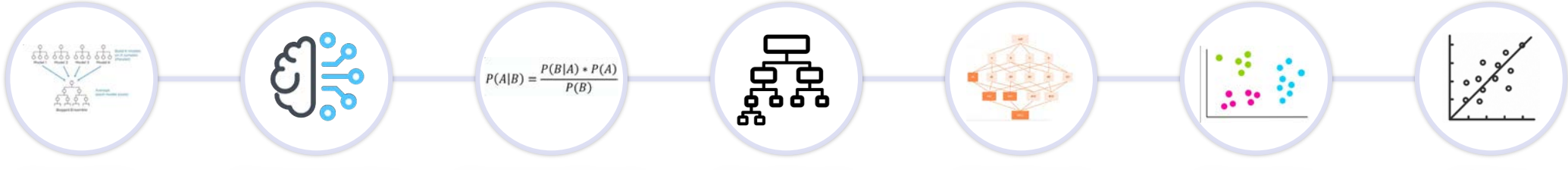
Generate ML-Driven Biomarker Signatures for Patient Selection

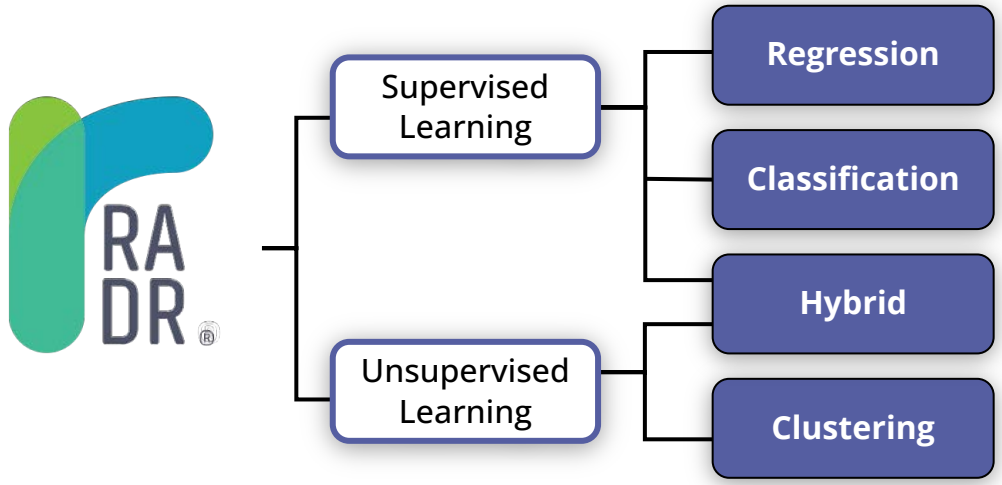


RADR® can derive Machine Learning based **gene signatures,** which can guide biomarker strategies and CDx (Companion Diagnostics)

RADR®'s Library of Over 200+ Advanced Algorithms Powers its Multi-Faceted Modules

Example RADR® Algorithms





Examples

- Predicting drug sensitivity values, e.g. IC50
- Predicting blood brain barrier (BBB) permeability of a compound
- Predicting synergy values by combining compounds
- Identifying patient populations that can be targeted through a MoA
- Stratifying patients as responder, partial-responder, or non-responder
- Biomarker pattern-based patient clustering
- Predicting outcomes for companion diagnostic usage in a clinical trial

- Diversity of algorithms allow us to handle various input data types and solve different biological problems
- Lantern has filed patents for ensemble algorithms in cancer drug development

RADR®'s Framework to Develop Actionable AI Insights Using Billions of Datapoints

Input Data

NIH NATIONAL CANCER INSTITUTE

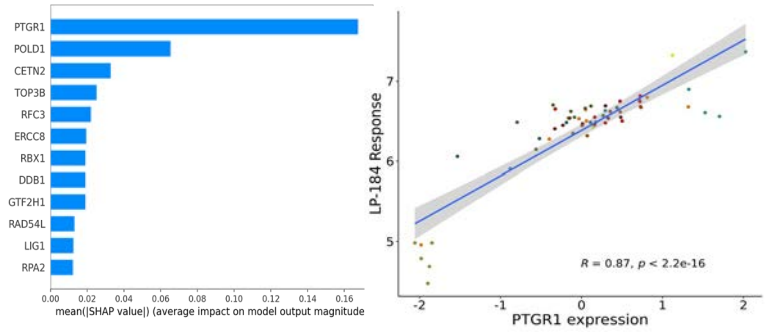
CCLE Cancer Cell Line Encyclopedia

TCGA

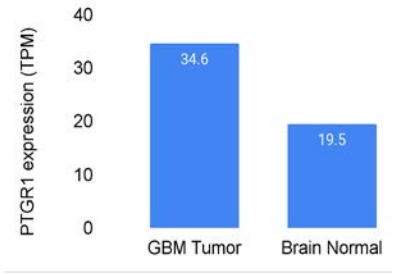
Drug response

Multi-omics

RADR® Derived Insights

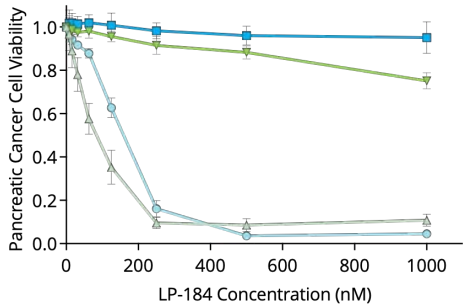


Identified PTGR1 as a biomarker that predicts LP-184 response

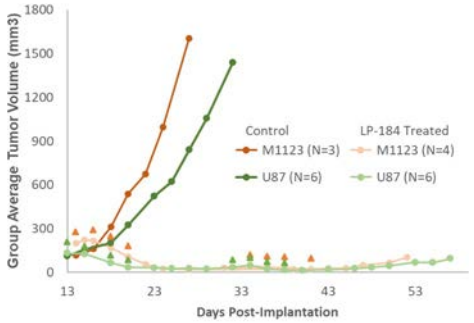


Identified glioblastoma as target indication using PTGR1

Validation of RADR® Derived Insights



PTGR1 validation using gene knockdown



Validation of LP-184's efficacy in GBM animal models

Actionable Insights

FDA

FDA Orphan Drug Designation

Phase I clinical trial in planning

Lantern's Collaborators are Leveraging RADR® to Accelerate the Development of their Drug Candidates

Actuate Therapeutics, Inc. is a private clinical stage biopharmaceutical company focused on the development of compounds for use in the treatment of cancer, and inflammatory diseases leading to fibrosis.

TTC Oncology is an emerging biotechnology company founded in 2015. TTC Oncology's mission is to develop and bring to market a novel, small-molecule therapy, TTC-352, to address the unmet needs of breast cancer patients. TTC has a license from the University of Illinois at Chicago covering the therapy.

Key RADR® AI insights for elraglusib (9-ING-41)*

- Developed a model of patient sensitivity to identify potential responders and non-responders
- Discovered actionable genetic biomarkers
- Insights and biomarkers are informing design of an upcoming Phase 2 clinical trial

Future directions of collaboration

- Highlights from the ongoing success of this collaboration are planned to be shared in an upcoming webinar
- Development and application of novel RADR® algorithms and computational methods
- Incorporation of new elraglusib patient data including: RNA, ctDNA, and protein biomarkers
- Lantern received equity in Actuate as part of the collaboration

**elraglusib is a widely researched GSK-3β inhibitor. Currently, elraglusib is in multiple active Phase I/II clinical trials as a monotherapy and in combination with other agents (NCT03678883)*

Collaboration details

- RADR® driven collaboration to uncover efficacy-associated biological signatures and biomarkers to advance the clinical development and positioning of TTC's leading drug candidate, TTC-352

Initial aims of collaboration

- Identify biomarker or gene signatures to power potential patient selection for an upcoming TTC-352 Phase 2 clinical trial
- Further characterize TTC-352's mechanism of action
- Discover additional treatment indications for TTC-352

Terms of collaboration

- Lantern Pharma is receiving an exclusive right to license TTC-352, including any collaboration intellectual property (IP), during an exclusive option period
- Lantern and TTC will each participate in upfront, milestone, and royalty payments in the event a third party licenses IP resulting from the collaboration

RADR® Facilitates the Rapid and Cost-effective Development of Drug Assets

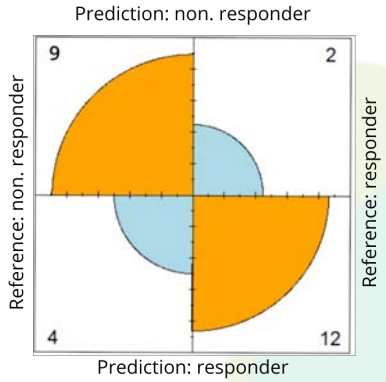
Framework of Lantern's RADR® collaboration with Actuate Therapeutics

Input Data

ACTUATE THERAPEUTICS

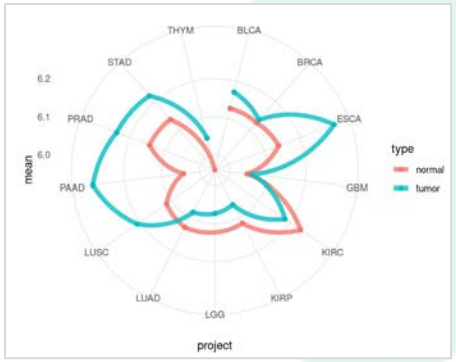
- Drug response
- Patient survival
- In vitro potency
- Patient mutation panel

RADR® Derived Insights

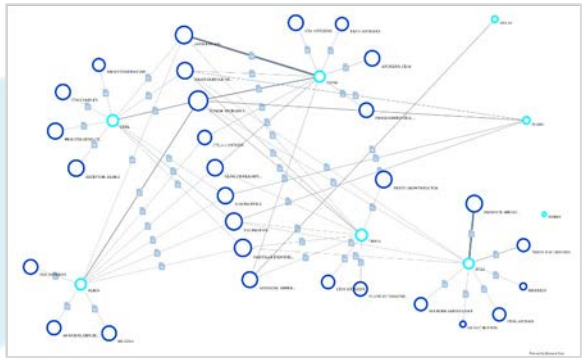


A neural network model for patient response prediction

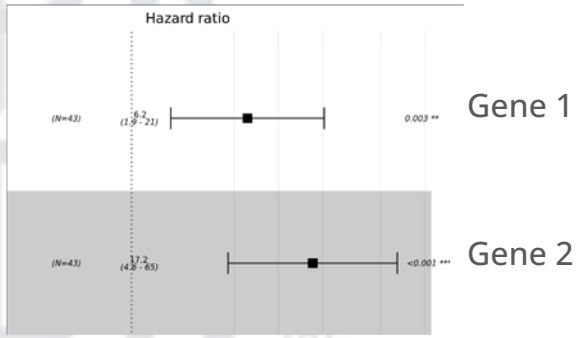
(accuracy =0.8)



Model for prediction-based drug indication expansion



A biomarker connectivity network to map MoA



Survival modeling using selected biomarkers

Actionable Insights

ACTUATE THERAPEUTICS

Developing a biomarker panel for use in **Phase II** clinical trials

Proposing **additional indications** in cancers that have high likelihood of response

RADR®'s Capabilities Enhanced with Increased Focus on the Development of Antibody Drug Conjugates

What are Antibody Drug Conjugates (ADCs)?

Antibody Drug Conjugates (ADCs) are highly specific cancer-targeted antibodies linked to potent anti-tumor small molecules and designed for the treatment of cancer

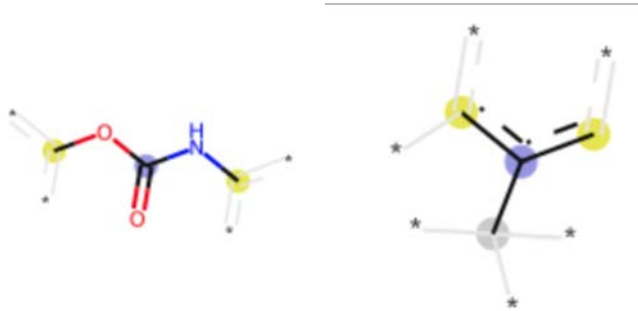
Highlights of RADR®'s ADC Development Roadmap

- Development of additional algorithms that can boost prediction of optimal combinations of ADC components including antibodies, antibody linkers, payloads, and ADC combinations with other anticancer small molecules
- Generation of additional ML-based ADC biomarker signatures that can predict a cancer's sensitivity to an ADC and guide future patient selection for clinical trials
- Use of RADR® guided selection of new molecule payloads with features of synergy or properties to overcome resistance from existing ADC payloads
- Creation of AI modules to predict the immunogenicity of ADC antibodies to cancer cell surface antigens
- Expansion of RADR®'s 25+ billion oncology-focused data points with the addition of immuno-oncology (IO) datasets

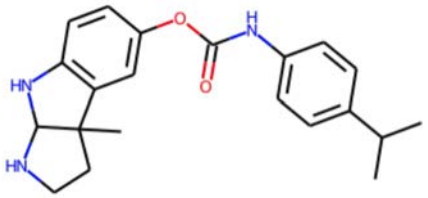
RADR® Is a Top Performing A.I. Platform for Predicting a Drug's Blood Brain Barrier Permeability

Using the drug SMILE structure information, RADR® can create more than 4500 features that represent the atomic properties of a drug, including fingerprints and descriptors

Drug	SMILEs
cloxacillin	Cc1onc(-c2ccccc2Cl)c1C(=O)N[C@@H]1C(=O)N2[C@@H...
cefoperazone	CCN1CCN(C(=O)N[C@@H](C(=O)N[C@@H]2C(=O)N3C(C(=...



Drug Structure →



Drug Fingerprints

↓

	Drug_ID	target	Morgan_1	Morgan_2	Morgan_3	Morgan_4	Morgan_5	Morgan_6	Morgan_7	Morgan_8
1	Terbutylchlorambucil	Permeable	0	0	0	0	0	0	0	0
8	diltiazem	Permeable	0	0	0	0	0	1	0	1
13	24959	Permeable	0	1	0	0	0	0	0	0
14	methadone	Permeable	0	1	0	0	0	0	0	0
20	2-Methylpentane	Permeable	0	1	0	0	0	0	0	0

← Mapping Back to Molecule Sub-structure

Comparing the RADR derived model performance using the TDC (Therapeutics Data Commons)

TDC.Pgp_Broccatelli Leaderboard
TDC.BBB_Martins Leaderboard
TDC.PPBR_AZ Leaderboard
TDC.VDss_Lombardo Leaderboard
TDC.CYP2C9_Veith Leaderboard
TDC.CYP2D6_Veith Leaderboard
TDC.CYP3A4_Veith Leaderboard
TDC.CYP2C9_Substrate_CarbonMangels Leaderboard

Rank	Model	AUROC
1	Treebag	0.928

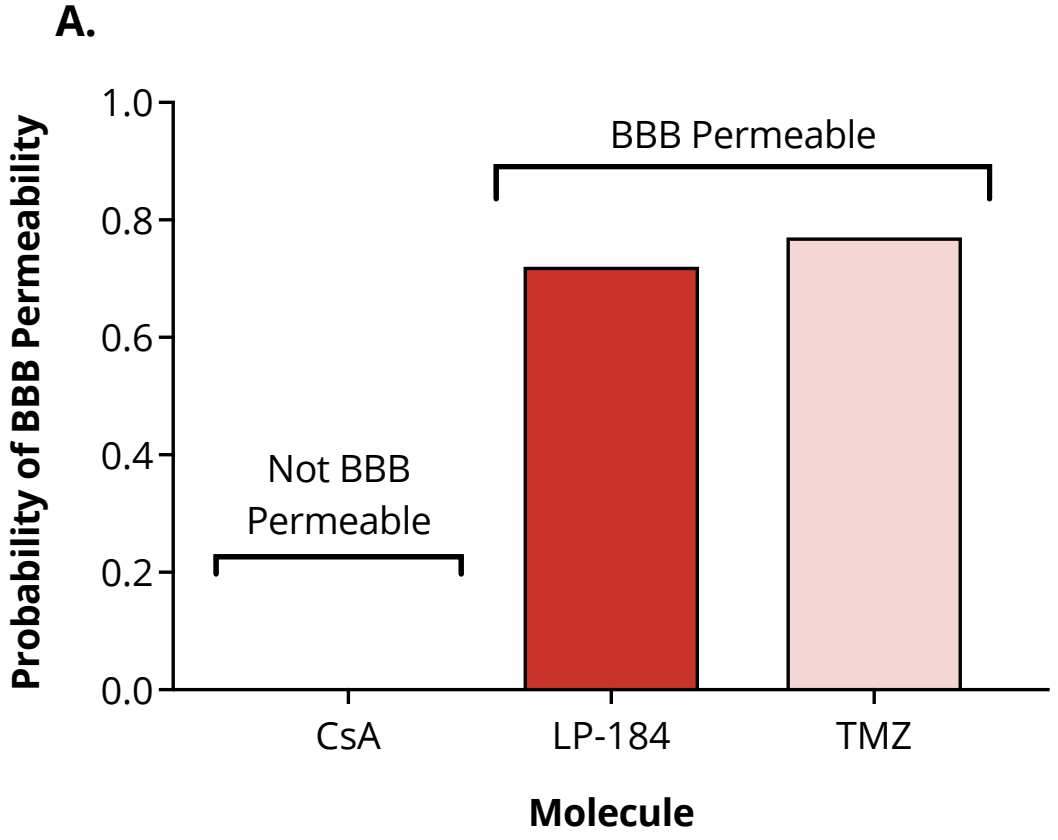
Leaderboard

Rank	Model	Contact	Link	#Params	AURC
1	BaseBoosting	Andrew Li	GitHub, Paper	23	0.923
2	XGBoost	Hao Tian	GitHub, Paper	29	0.905
3	SimGCN	Suman Kalyan Bera	GitHub, Paper	1,103,000	0.901

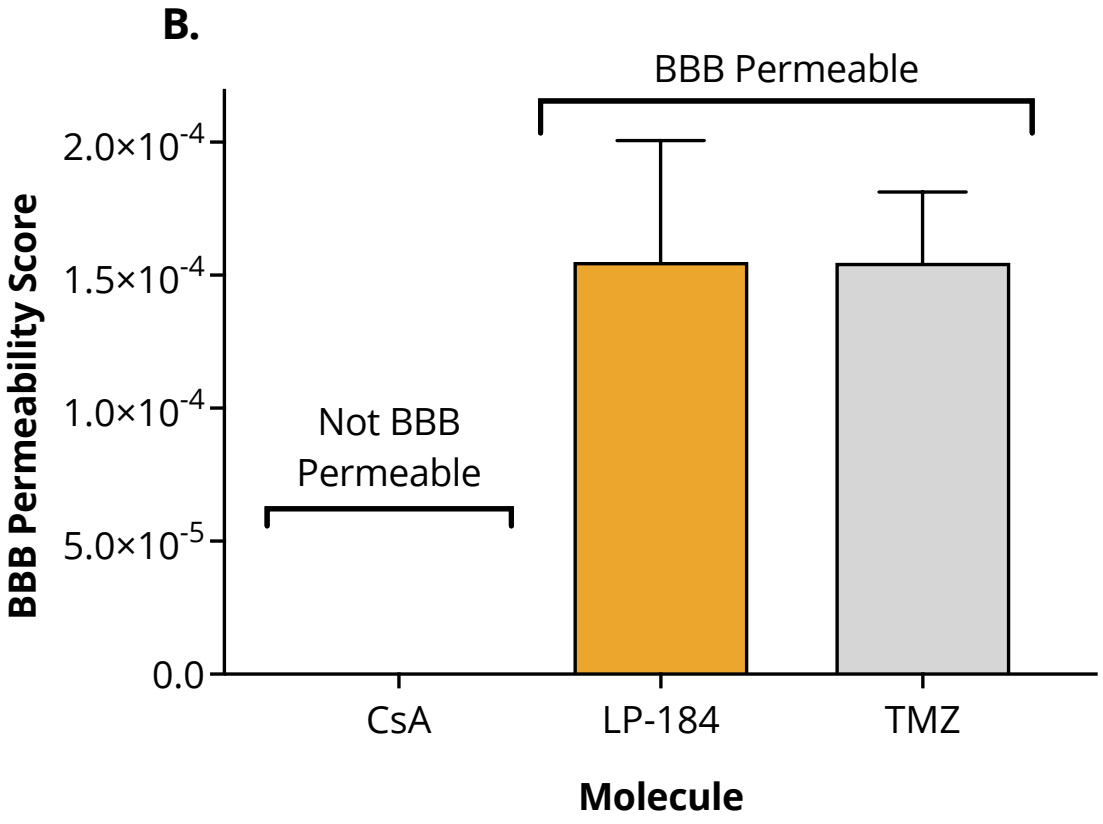
RADR® derived model is the top ranked model on the TDC leaderboard

RADR®'s Blood Brain Barrier Predictions Validated in the Wet Lab

RADR®, *in silico*, Predicted Blood Brain Barrier Permeability of LP-184



Wet Lab, *in vitro*, validated Blood Brain Barrier Permeability of LP-184



Lantern's Diverse & Unique AI Driven Pipeline of Drug Programs

Lantern has 12 disclosed drug programs including an ADC program and the Phase 2 Harmonic™ trial

Program	Indication		Discovery	Optimization	Preclinical	Pre IND	Phase I	Phase II
LP-300	Non-Small Cell Lung Cancer (NSCLC)							harmonic
LP-100	Homologous Repair Deficient Cancers (In combination with PARPi therapy)							
LP-184	**Solid Tumors**	Pancreatic Cancer						
		Bladder Cancer						
		TNBC						
LP-284	**Non-Hodgkin's Lymphomas**	Mantle Cell						
		Double Hit						
ADC	Select Solid Tumors							
starlight therapeutics	**STAR-001** (LP-184 for CNS and Brain indications only)	Glioblastoma (GBM)						
		Brain Mets (Lung, Breast, Skin)						
		ATRT						
		Pediatric Brain Cancers						

Rescued Drug | Newly Developed Molecules | Antibody Drug Conjugate

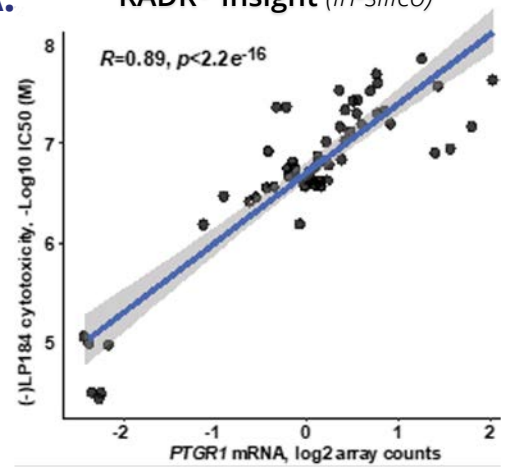
LP-184 has a Unique Mechanism of Action Leveraging Synthetic Lethality

LP-184's MoA was predicted by RADR® and validated with in-vitro/in-vivo studies

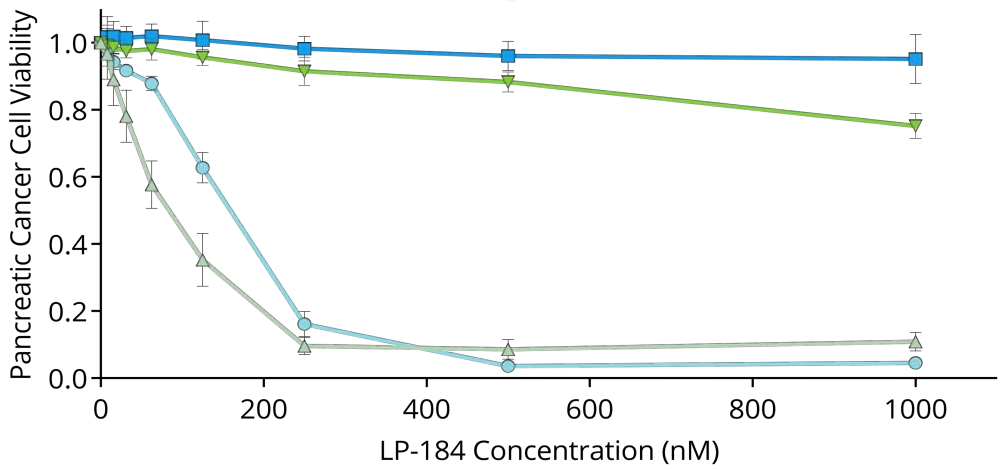
PTGR1 activates LP-184 into its highly potent and cytotoxic form

In-vitro experiments confirmed the RADR® insight and that LP-184 was highly potent in cells with overexpression of PTGR1

A. **RADR® Insight** *(in-silico)*



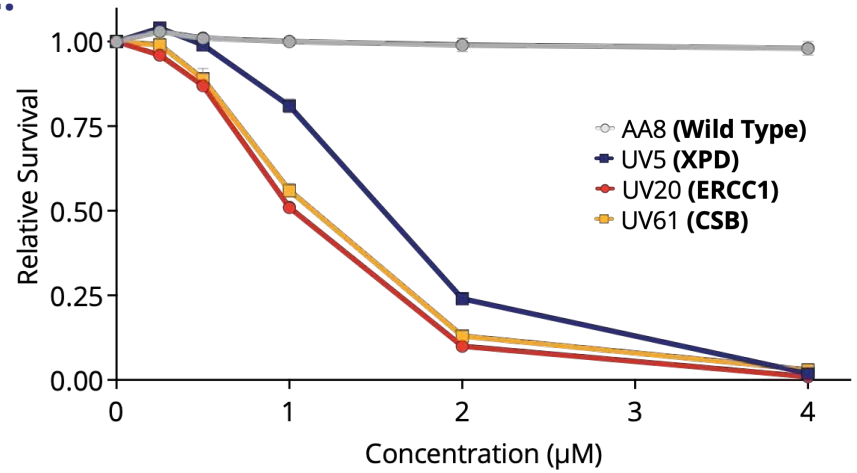
B. **In-vitro Gene Editing Studies** *(CRISPR)*



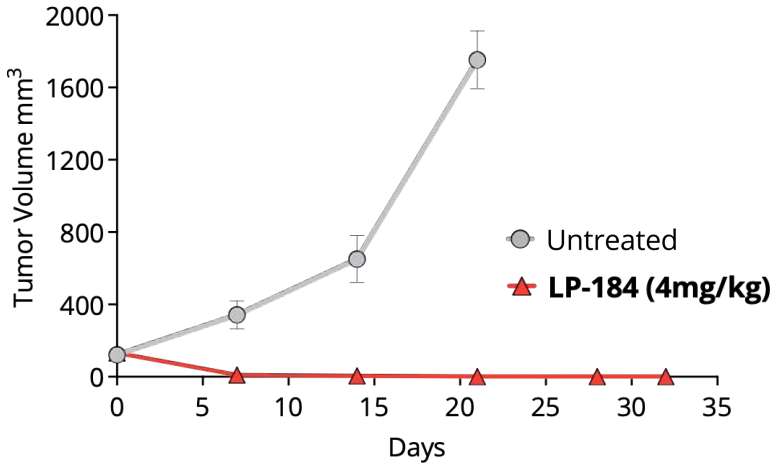
LP-184 shows exquisite potency in cancers with deficiencies in DNA damage repair (DDR) pathways

including cancers with nucleotide excision repair (NERD) and homologous repair deficiencies (HRD)

C. **LP-184 in NERD Cancers**



D. **LP-184 in HRD Cancers**

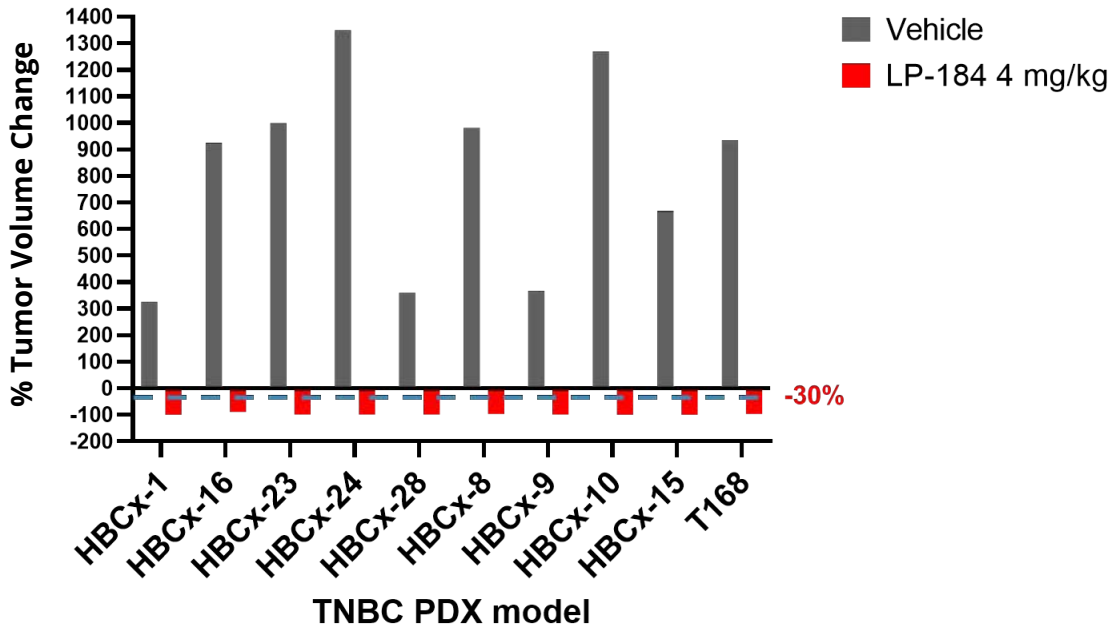


Cancer Models with Common DNA Damage Response Deficiencies are Highly Sensitive to LP-184 Treatment

PDX model	Cancer type	IC50 (nM)	DDR Mutations
ctg1194	NSCLC	31	ATM
ctg2440	Prostate	31	PMS2
ctg1522	Pancreatic	45	ATR, BRIP1, PARP1
ctg2532	NSCLC	54	CHEK1, FANCA, NBN, RAD50
ctg3167	Prostate	54	BRCA2, ATM, FANCA, FANCI, FANCM
ctg3537	Prostate	54	BRCA2, CDK12, FANCI, RAD54L,
ctg0166	NSCLC	57	ATM, FANCD2, NBN
ctg1643	Pancreatic	57	BRCA1, BRIP1,
ctg2429	Prostate	92	ATM, ATR, PALB2,
ctg0302	Pancreatic	110	BRCA2, ATM, BLM, FANCA
ctg1680	NSCLC	140	PARP2
ctg0192	NSCLC	200	BRCA1, RAD54L
ctg3337	Prostate	230	RAD51C
ctg0314	Pancreatic	270	BRCA2, CDK12, PALB2
ctg0381	Pancreatic	2,900	ATM, BRCA1, BRCA2

- PDX-derived cell lines with mutations in key HR and NER genes are **highly sensitive to LP-184**
- Only 1 model was not highly sensitive to LP-184 (highlighted in blue)

LP-184 Completely Inhibits Tumor Growth in Triple Negative Breast Cancer (TNBC) PDX Mouse Models



- Across 10 TNBC PDX mouse models LP-184 treatment resulted in 107-141% tumor growth inhibition
- All 10 TNBC PDX models were HR deficient
- 7/10 TNBC models were resistant to PARP inhibitors Olaparib/ Niraparib and to doxorubicin/ cyclophosphamide

Lantern and NCI A.I.-Driven Collaboration Identify ATRT Sensitivity to LP-184 – Published in Frontiers in Drug Discovery

- Systematic comparison of drug activity demonstrated key differences among alkylating agents that inform positioning
- Integrated multi-omic data bioinformatic analysis provides a rationale to examine potential use of LP-184 in cancers with loss of *SMARCB1* and *SMARCA4*, such as ATRT
- Using small number of patient tumor RNA-seq samples, RADR® predicted extreme drug responsivity of LP-184 for ATRT
- RADR® A.I. Insights were validated by *in vitro* and *in vivo* experiments.
- **A.I. driven models for drug discovery can be widely used for other rare cancers.**

Atypical Teratoid Rhabdoid Tumors (ATRT) are ultra-rare and highly malignant pediatric central nervous system (CNS) tumors

6-12 months
median survival

30%
5 year
survival rate

ATRTs are caused by genetic mutations in ***SMARCB1*** (90%) or **SMARCA4** (< 2.0%)

600 living patients in the US
+ 60 new diagnosed annually

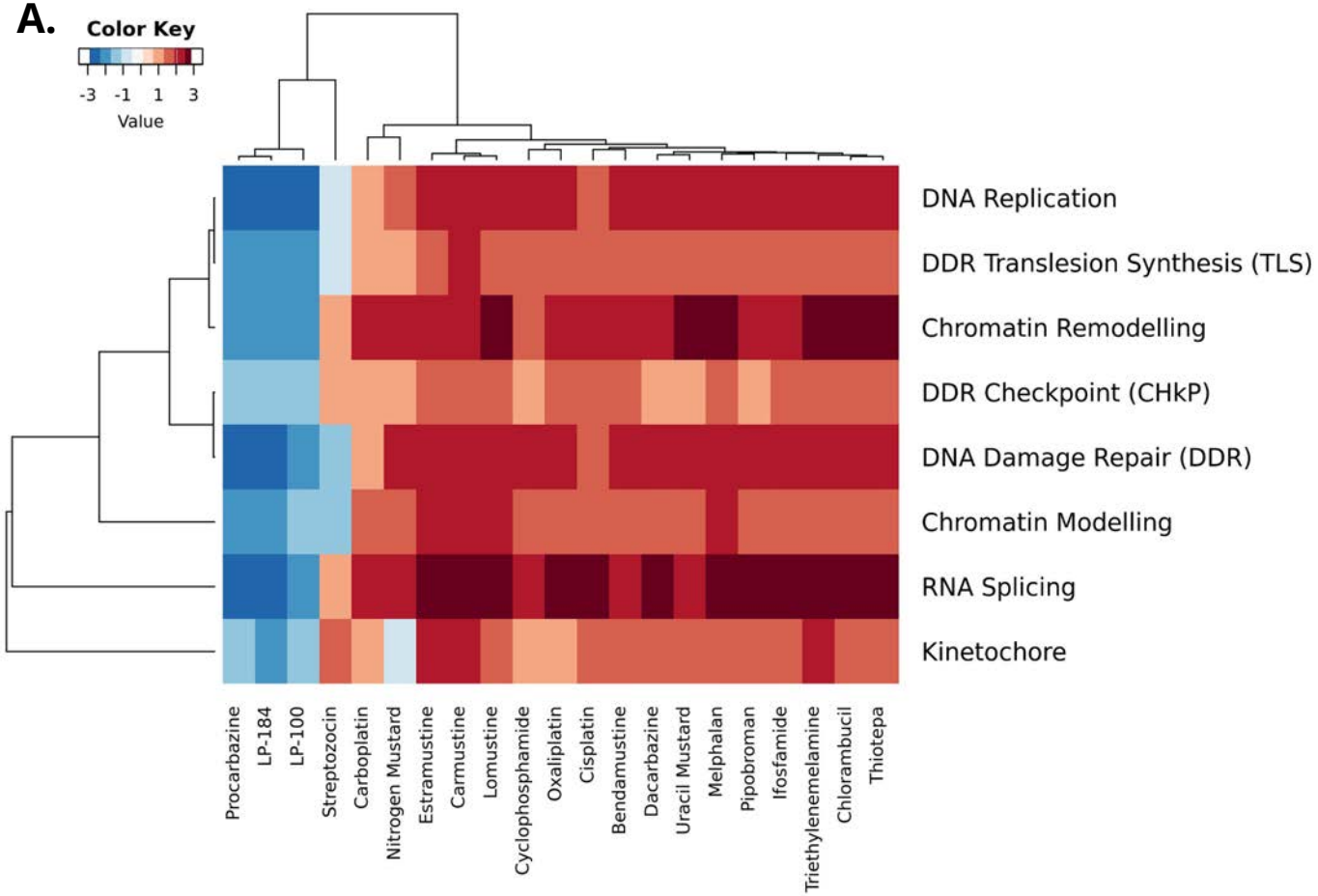
75% cases in children **less than 3 years old**

There is **NO STANDARD OF CARE** for ATRT patients. New lines of therapy that are **SAFE** and **Effective** are critically needed to improve the lives and outcomes of these patients

Gene Enrichment Analysis Predicts Cancers Deficient in DNA Damage Repair/Chromatin Remodeling to be Uniquely Sensitive to LP-184

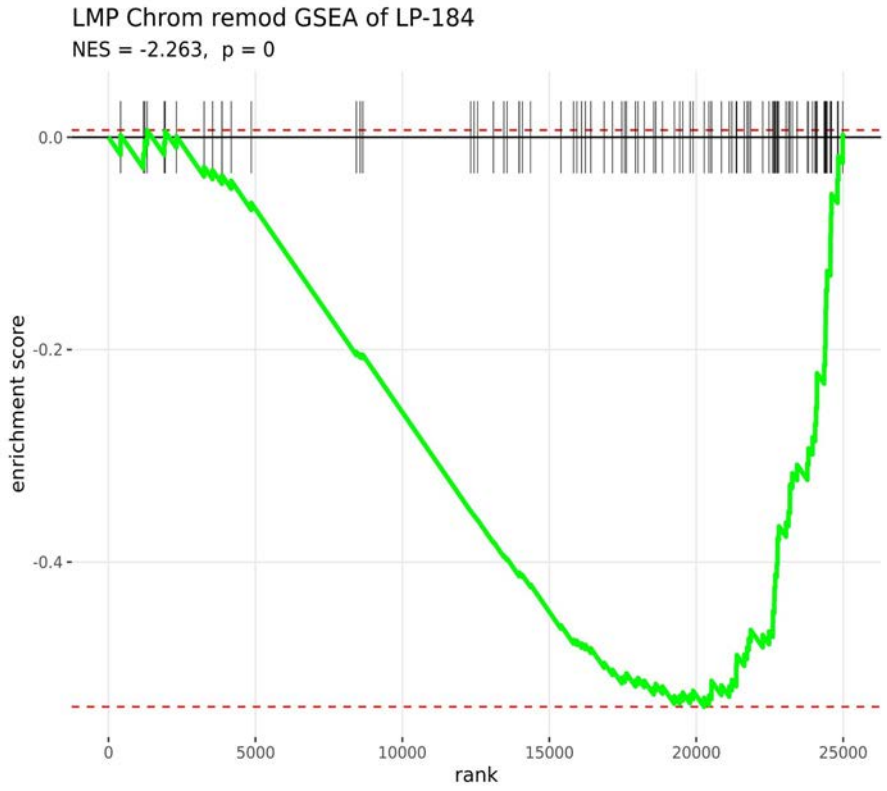
LP-184 Response is Strongly Correlated With Gene Sets Involved with DNA Repair and Chromatin Remodeling

A.



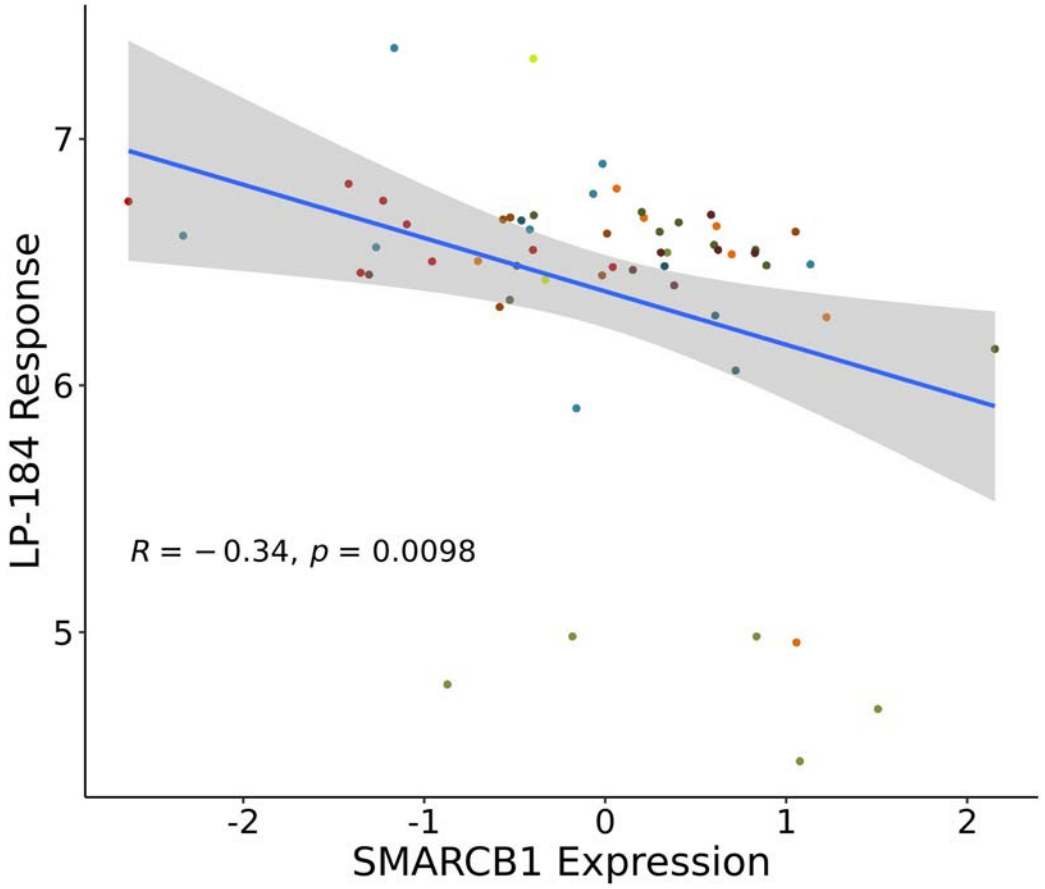
Gene's Associated with Chromatin Remodeling are Strongly Negatively Correlated with LP-184

B.

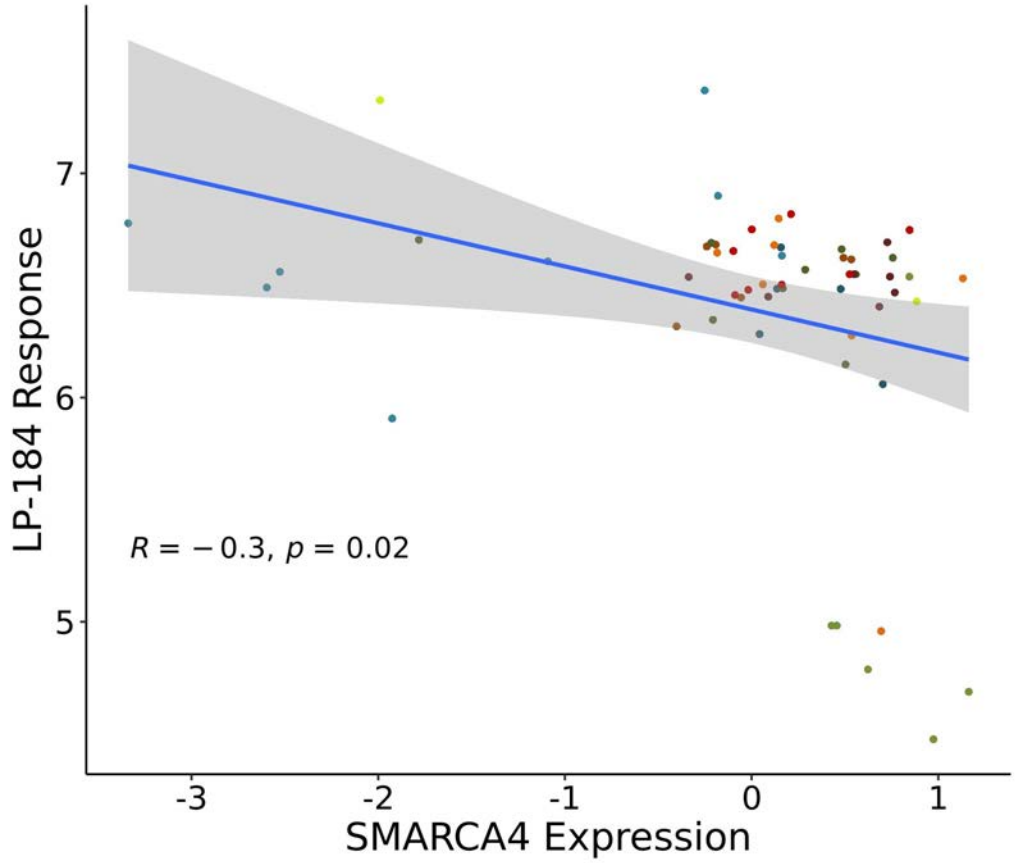


Sensitivity to LP-184 is Significantly Negatively Correlated With Driver Mutations of ATRT

A. LP-184 Sensitivity is Negatively Correlated with SMARCB1 Gene Expression



B. LP-184 Sensitivity is Negatively Correlated with SMARCA4 Gene Expression

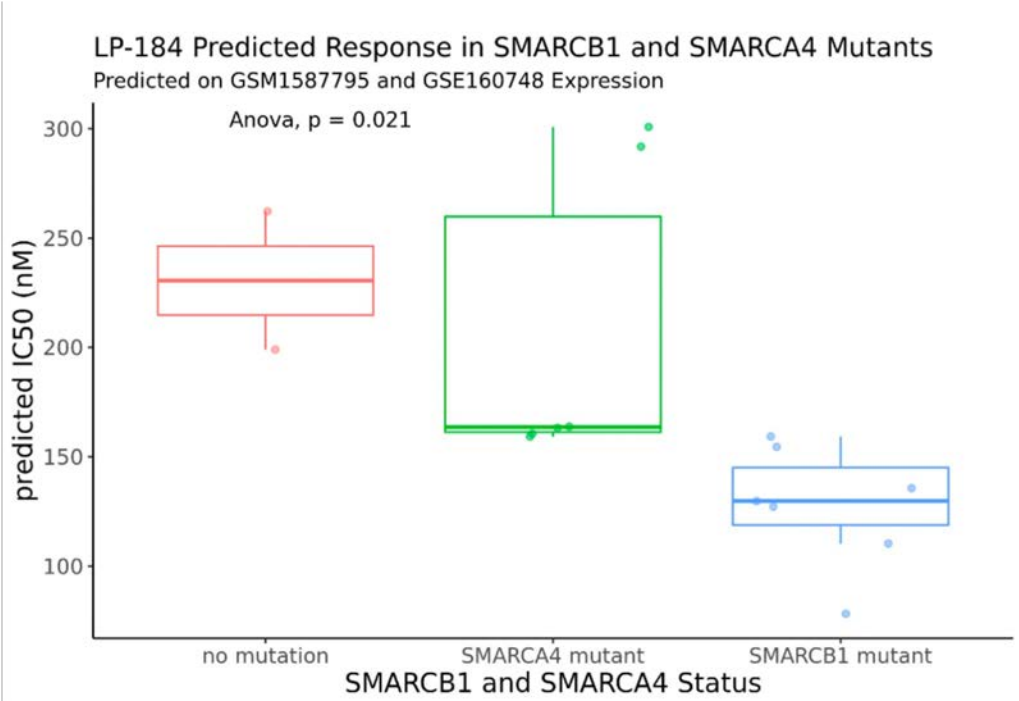


RADR® Predicts ATRT Sensitive in Patients with Limited Patient Gene Expression Data

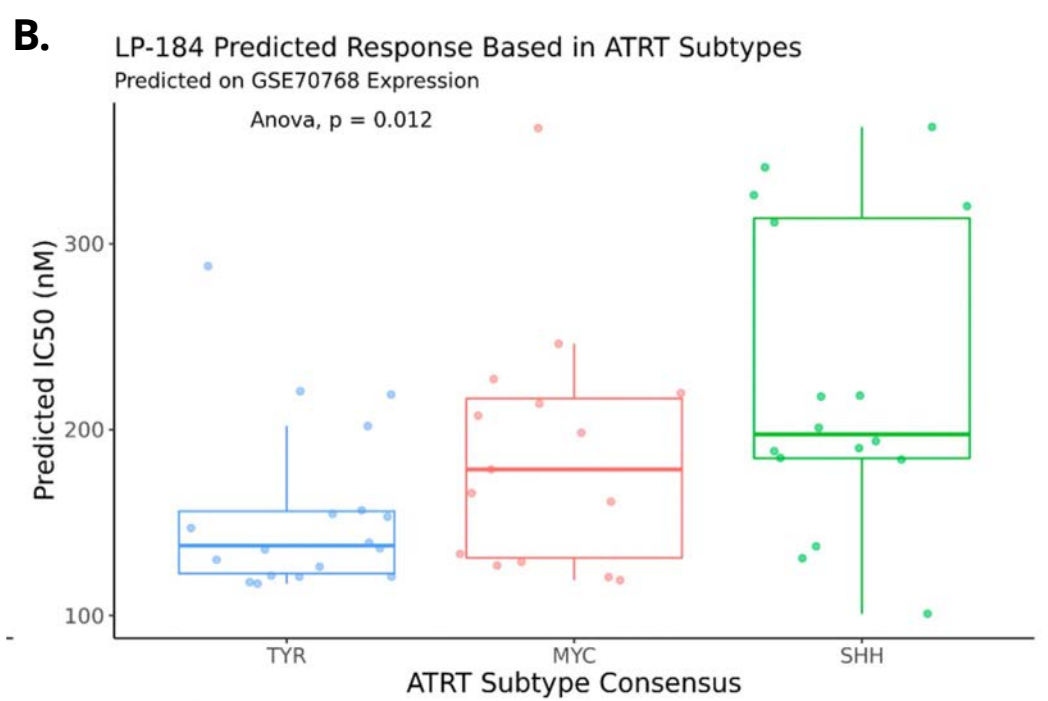
M.L. model prediction of LP-184 sensitivity in ATRT patients with either no SMARC mutation, a SMARCB1, or SMARCA4

M.L. prediction of LP-184 sensitivity in ATRT patients with different genetic SMARCB1 genetic subtypes

A.



B.



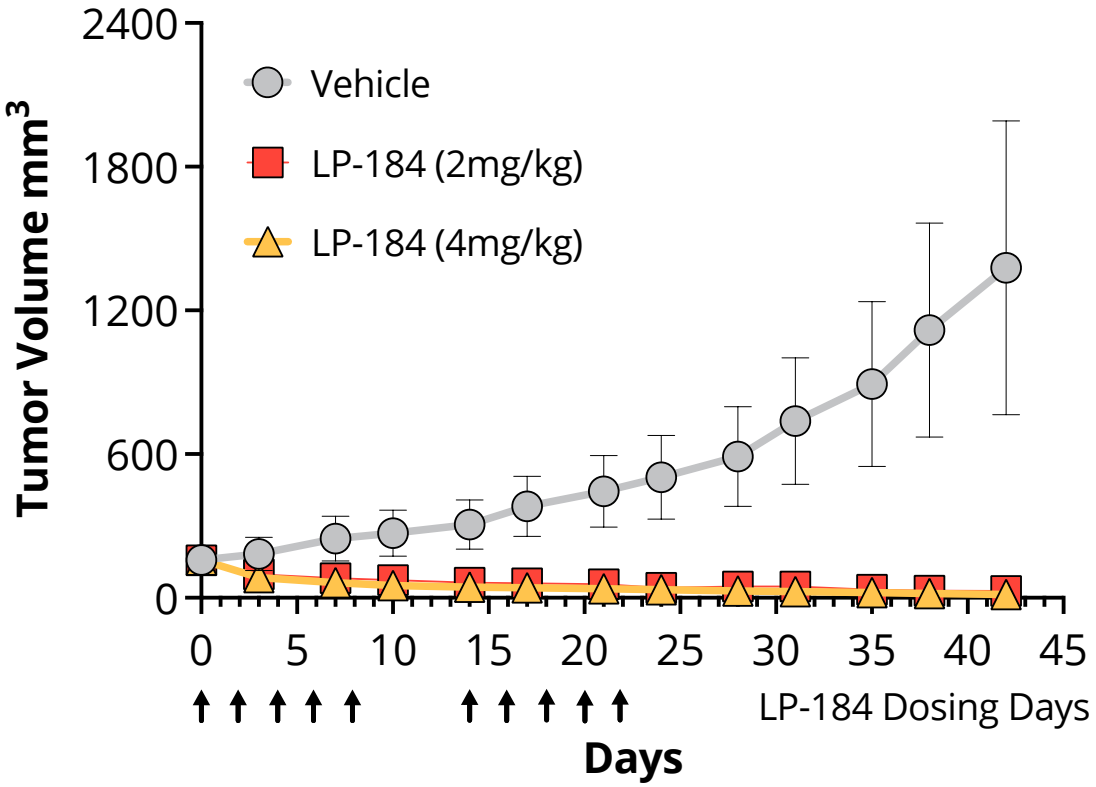
Atypical Teratoid Rhabdoid Tumor Cancer Cells are Exceptionally Sensitive to LP-184 – Validating RADR® Predictions

CDX ATRT mouse model treated with LP-184

LP-184 treatment leads to near-complete tumor regression in ATRT mouse xenograft models

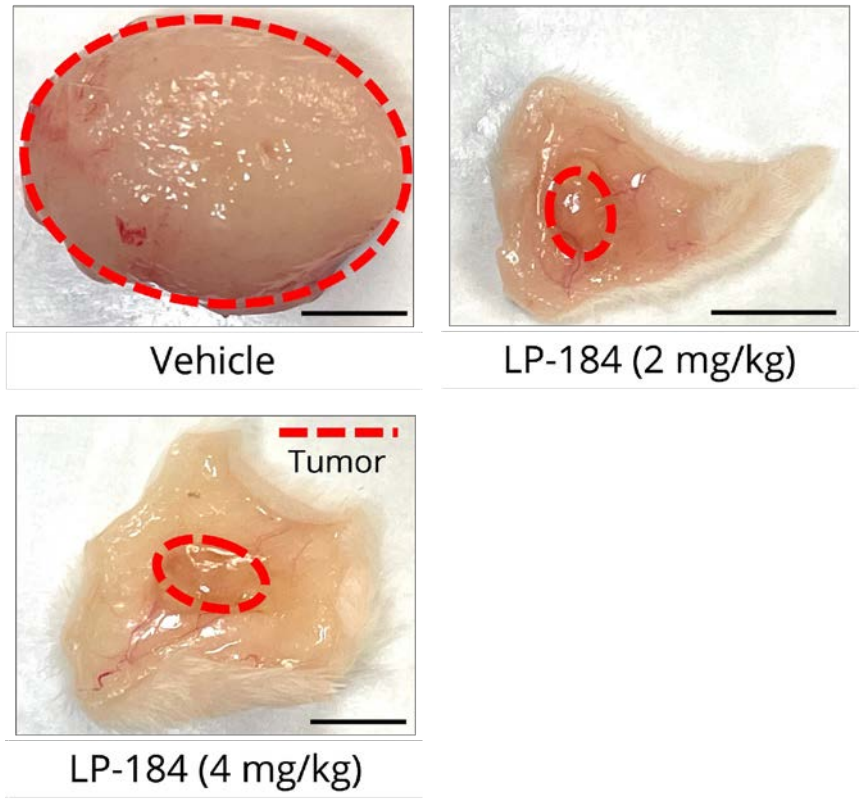
A.

Time Course of ATRT CDX Mouse Tumors Treated with LP-184



B.

Terminal ATRT Mouse Tumor Sizes After Treatment of Vehicle or LP-184



Lantern's A.I.-Driven Collaborative Model for the Rapid and Cost-effective Development of Drug Candidates

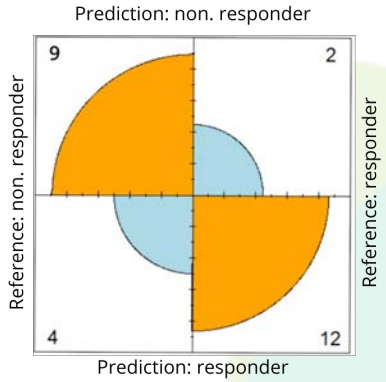
Framework of Lantern's RADR® collaboration with Actuate Therapeutics

Input Data

ACTUATE THERAPEUTICS

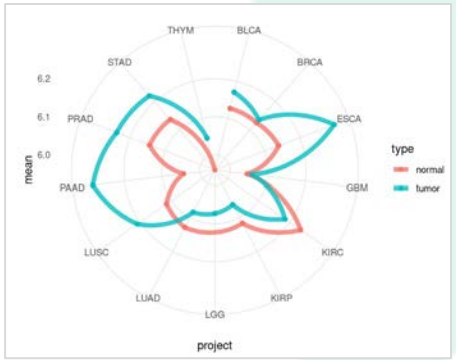
- Drug response
- Patient survival
- In vitro potency
- Patient mutation panel

RADR® Derived Insights

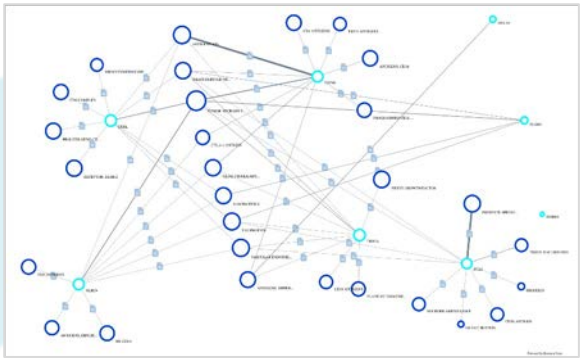


A neural network model for patient response prediction

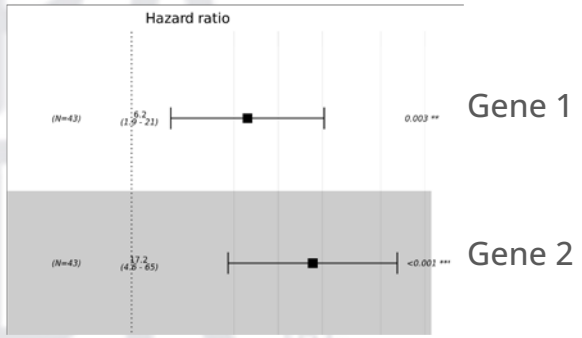
(accuracy =0.8)



Model for prediction-based drug indication expansion



A biomarker connectivity network to map MoA



Survival modeling using selected biomarkers

Actionable Insights

ACTUATE THERAPEUTICS

Developing a biomarker panel for use in **Phase II** clinical trials

Proposing **additional indications** in cancers that have high likelihood of response

RADR® and A.I. Technologies Have the Potential to Make Rapid and Meaningful Advancements for Therapies for Rare Cancer Patients

How A.I. and M.L.. Can Help Drug Development for Rare Cancers:

- **Build** M.L. models of drug response from existing preclinical/clinical data
- **Generate** M.L.-driven biomarker signatures for patient selection
- **Discover** a drug's mechanism of action for a rare disease
- **Identify** potential responders and non-responder patients with small amount of patient data
- **Contact Lantern if You or Your Organization Would Be Interested in an A.I.-Driven Collaboration**

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