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Lantern Pharma Inc. (LTRN - NASDAQ)

Reviving Failed Oncology Drugs with AI

Based on our DCF model which uses a 15% discount rate, Lantern Pharma is valued at approximately $28.00 per share. Our model applies a 25% probability of ultimate approval and commercialization for LP-300 in never-smoker NSCLC. The model includes contributions from the United States, EU and rest of world.

Current Price (10/9/2020)	$20.11
Valuation	**$28.00**

INITIATION

Lantern Pharma is a new type of drug development company using AI & data to identify patients most likely to respond and uncover mechanisms of action. It is developing lead candidate LP-300 for non- & never smoker NSCLC as well as two other candidates. LP-100 for mCRPC which has been outlicensed to Allarity Therapeutics and LP-184 which is in preclinical development for tumors defined by biomarkers and GBM.

Lantern uses AI & machine learning to identify failed and abandoned compounds that may work in certain subpopulations. RADR® is the firm's AI platform which integrates data from clinical trials, genomics, transcript-omics and other resources to identify new candidates, uncover new mechanisms of action & generate new combinations.

Lantern is planning to launch a Ph2 trial for LP-300 in 1H:21. We expect it to lead into a Ph3 study that will generate registrational data in 2024, US & EU regulatory submission in 2025 & subsequent commercialization in 2026.

LP-300 targets a subpopulation of NSCLC which is not well served by standard of care & is different genomically from smoking related NSCLC. Lantern has identified a subpopulation in the indication that may benefit from the differentiated mechanism of action of LP-300.

SUMMARY DATA

52-Week High	**21.99**
52-Week Low	**10.40**
One-Year Return (%)	**N/A**
Beta	**N/A**
Average Daily Volume (sh)	**42,957**
Shares Outstanding (mil)	**6.2**
Market Capitalization ($mil)	**125.0**
Short Interest Ratio (days)	**0.6**
Institutional Ownership (%)	**N/A**
Insider Ownership (%)	**60.5**
Annual Cash Dividend	**$0.00**
Dividend Yield (%)	**0.00**
5-Yr. Historical Growth Rates	
Sales (%)	**N/A**
Earnings Per Share (%)	**N/A**
Dividend (%)	**N/A**
P/E using TTM EPS	**N/A**
P/E using 2020 Estimate	**N/A**
P/E using 2021 Estimate	**N/A**
Zacks Rank	**N/A**

Risk Level	**Above Average**
Type of Stock	**Small-Growth**
Industry	**Med-Biomed/Gene**

ZACKS ESTIMATES

Revenue

(In millions of USD)

	Q1 (Mar)	Q2 (Jun)	Q3 (Sep)	Q4 (Dec)	Year (Dec)
2019	$0.0 A	$0.0 A	$0.0 A	$0.0 A	$0.0 A
2020	$0.0 A	$0.0 A	$0.0 E	$0.0 E	$0.0 E
2021					$0.0 E
2022					$0.0 E

Earnings per Share

	Q1	Q2	Q3	Q4	Year
2019	-$0.23 E	-$0.32 A	-$0.31 A	-$0.37 A	-$1.23 A
2020	-$0.24 A	-$0.31 A	-$0.29 E	-$0.36 E	-$1.25 E
2021					-$1.52 E
2022					-$1.41 E

INITIATING COVERAGE

We are initiating coverage of Lantern Pharma Inc., (NASDAQ: LTRN) with a current valuation of $28.00 per share. Lantern is a new type of drug development company employing artificial intelligence and big data to identify critical biomarkers and relevant indications for previously investigated compounds. This approach can reduce cost, advance development timelines and improve the probability of success for candidates. We base our valuation primarily on our estimates for a successful commercialization of LP-300 in non- or never smoker adenocarcinoma non-small cell lung cancer (NSCLC). Other candidates include LP-100 which is being developed by a partner to target prostate cancer and LP-184, a pre-clinical candidate seeking indications in glioblastoma and solid tumors with a specific biomarker profile. Lantern Pharma uses its proprietary Response Algorithm for Drug Positioning and Rescue (RADR®) platform to identify drug candidates that have previously failed clinical trials or have been abandoned by sponsors in late stage trials. RADR is able to synthesize information from a broad variety of genomic, clinical and response data sets to classify patient subgroups that demonstrate characteristics associated with improved drug response. The AI platform is also able to help clarify mechanisms of action, identify effective drug combinations and find better pathways for seeking approval of late stage candidates.

The drug development industry faces many hurdles in the modern era including declining returns, increasing costs, fewer blockbuster indications and long timelines to generate data needed to obtain regulatory approval. There are also large amounts of data, improving computing power, new biomarkers and Artificial Intelligence (AI) and Machine Learning (ML). AI and ML have the potential to solve some of the difficulties in drug development by uncovering or repurposing therapeutic candidates that could be more effective when used in a personalized approach with genetic markers guiding their use.

The principal reasons that drugs fail is due to lack of efficacy (57%) or safety (17%).[1] For clinical trials that cost up to and in excess of a billion dollars to run, tools that can help improve on these metrics are extremely valuable. The drug development setting provides fertile ground for AI technology which can improve efficacy by targeting those patients that will benefit the most and by analyzing large data sets to isolate early safety signals.

The benefit of AI is in saving time and money as the tool allows for rapid identification of populations that will respond best to a therapy. The approach guides construction of smaller trials that include only those patients with a complementary genomic, transcriptomic, epigenomic or proteomic profile. Using AI in drug repurposing is an attractive and efficient route. A repurposed drug in a new indication is able to build off of previous human safety and toxicology work and in most cases allow for a direct start to a Phase II trial. Drug repurposing or rescue can be a more profitable and efficient approach that is effective when the candidates have an abundant history of safety and biometric data collected in patients.

While LP-100 is the company's most advanced program, its development has been outlicensed to a partner. Lantern's lead in-house product is LP-300 which targets non- or never smoker adenocarcinoma NSCLC. Lung cancer in never smokers is frequently lumped in with the broader NSCLC population despite presenting a distinct pathology that does not respond as well to NSCLC therapies such as immune checkpoint inhibitors. LP-300 has been investigated in over 1,000 patients providing valuable safety and efficacy data that will guide the design of the upcoming Phase II. The drug has demonstrated potential to reduce the toxic side effects of chemotherapeutics and act as a chemoenhancer. The agent is expected to be used in combination with chemotherapy or adjuvant in front line, second line or salvage therapy. Lantern is currently designing the Phase II trial and defining the appropriate biomarkers that will be used to identify the patient population and measure efficacy when the trial begins.

LP-184 is undergoing preclinical analysis and may be advanced in several cancers including glioblastoma and genomically defined solid tumors. LP-184 is a non-hormone, non-chemotherapy, next generation alkylating agent with nanomolar potency that preferentially damages DNA in cancer cells overexpressing certain biomarkers. Biomarker, cell line sensitivity and fresh tumor biopsy studies are underway which will support investigational new drug (IND) development efforts. IND submission is expected in 2021 and the launch of a Phase I is expected in late 2021 or early 2022.

Lantern's pipeline of three oncology assets target specific subpopulations using the company's RADR platform which may address unmet needs in prostate cancer, lung cancer, glioblastoma and other biomarker defined tumors.

[1] Hwang, TJ, *et al.* Failure of investigational drugs in late-stage clinical development and publication of trial results. JAMA Internal Med, 176 (12) (2016), pp. 1826-1833

INVESTMENT THESIS

Lantern Pharma occupies the space between big data and drug development, employing artificial intelligence (AI), machine learning (ML) and genomic data to guide promising compounds towards approval. These candidates have existing preclinical and clinical data, but failed to meet endpoints. Drug development is expensive, time consuming and has a low success rate when compared with other industries. With the explosion of available data in recent years, it may now be possible to analyze the complex relationships among the information sets to isolate subpopulations that can benefit from a previously failed drug.

This approach has the advantage of building upon substantial work that has already been completed. This includes preclinical, investigational new drug (IND)-enabling efforts and clinical trials that have demonstrated the pharmacodynamic and pharmacokinetic features of the drug and successfully characterized its safety profile.

Lantern has developed its RADR platform to analyze a variety of data types to identify relevant genomic signatures that will respond to a drug and the benefitting population. This is done through culling various types of data from historical studies, scientific publications in a data-driven, genomically-targeted and biomarker-guided approach. AI and ML can compress the drug development process, allow for smaller more targeted trials and improve the likelihood of success for drug candidates. Over 500 million data points have already been curated for the RADR platform.

Lead in-house candidate LP-300 targets never smoker non-small cell lung cancer (NSCLC) adenocarcinoma and is preparing to enter a Phase II trial to evaluate safety and efficacy. LP-300 was in-licensed and acquired from BioNumerik Pharmaceuticals and Lantern is advancing the candidate towards a targeted trial in combination with chemotherapy under an existing IND. The company also has a financial interest in LP-100 which has been outlicensed to the Danish firm Oncology Venture, now known as Allarity Therapeutics. The drug is being investigated in a Phase II trial for prostate cancer.

Never smoker NSCLC has historically comprised 10%-15% of lung cancer cases, with a higher proportion in women and those of Asian descent. This subpopulation also presents more frequently with adenocarcinoma compared to smoking-related lung cancer.[2] Smoking rates have declined since this data was generated suggesting that the current proportion of non-smoker NSCLC could be higher. More recent statistics find that 15% of the lung cancer population have never smoked.[3] Based on our review of the data, we see between 14,000 and 15,000 never smoker adenocarcinoma NSCLC cases annually in the US and in Europe (28,000 to 30,000 for both regions). Globally, we estimate 120,000 new cases of never smoker NSCLC adenocarcinoma annually.

Key reasons to own Lantern Pharma Inc. shares:

- **Proprietary RADR AI-driven algorithm for detecting genetic/biomarker signatures**
- **Opportunities to salvage failed drugs, for which safety has already been clinically validated**
- **Declining returns and smaller end markets can benefit from improved drug development approaches that leverage AI**
  - **Build from existing preclinical and clinical work**
  - **Pursue orphan indications and personalized medicine**
  - **Generate pivotal data with less expensive, targeted trials**
  - **Use modeling and complex algorithms to reduce failure risk**
- **Two years of financial runway**

Lantern has recognized the opportunity that AI and ML afford us and is leveraging its RADR platform to identify promising candidates in oncology. RADR can identify genomic biomarkers that identify a responsive population by using data generated from genetic sequencing, drug sensitivity, trial data and patient data among other information sets. By pursuing candidates that have already generated substantial pre-clinical and clinical data, much of the work to demonstrate safety and characterize mechanism of action has been completed. With the ability to target a small population based on parsed data, Lantern can identify patients that will respond to the drug therapy. This allows for smaller, targeted and less expensive trials to obtain approval for underserved indications.

[2] Wakelee, H.A., *et al.* Lung Cancer Incidence in Never Smokers. J Clin Oncol. 2007 Feb 10; 25(5): 472–478.
[3] Lung Cancer Europe. https://www.lungcancereurope.eu/lung-cancer/

Background

Drug Development with Artificial Intelligence

Lantern Pharma is embracing an artificial intelligence (AI) platform to identify new and refined targets for failed drugs. The AI platform Lantern uses is called Response Algorithm for Drug Positioning and Rescue (RADR), which predicts patient therapeutic response and drug efficacy through genomic and biological pathways. The system can efficiently analyze disparate sets of data to find populations that are likely to be highly responsive to selected therapeutics with the potential to reduce cost, accelerate the advancement and increase the probability of drug approval and ultimate commercialization. Throughout history, cancer drug development has been incredibly costly and the success rate of clinical candidates is low. It can cost from several hundred million to over a billion dollars to develop a drug all the way from inception to approval. The pathway forward is even more difficult for oncology drugs which have historically seen lower levels of approval compared to other diseases. Only a small proportion of oncology drugs that enter the clinic are eventually commercialized and many fall by the wayside.

The sunk cost of these failed drugs is an economic burden; however, there is valuable safety and efficacy data embedded in the studies that have been completed. Even though a drug may not have demonstrated efficacy in a certain population does not mean it cannot be useful elsewhere. Two prominent examples of initial failures that went on to be blockbusters include azidothymidine for HIV and Viagra for erectile dysfunction. What if we could use AI to substantially increase the number of serendipitous discoveries?

In some clinical trials, a subset of enrolled patients respond well to the therapy despite overall results failing to be statistically significant. While there may appear to be a signal, identifying the characteristics of responding patients can be difficult for several reasons. The necessary biomarkers to identify responders may not have been discovered, the computational burden required to correlate patients that respond with biomarkers may exceed available resources and the necessary curated data to identify the signal may not be available. In this large pool of failed candidates, there are some undiscovered gems that can be effective in the right population. Since these compounds have already been investigated in preclinical and clinical studies, they have a well understood safety profile, which is half the battle to obtain regulatory approval. Although failure to meet endpoints may prevent a drug from going before the FDA, this does not tell the whole story. The RADR platform can sort through the detail and identify compounds that demonstrate efficacy in a specific subpopulation. Lantern differentiates itself with its ability to identify useful therapeutics and the targeted populations that will benefit from them.

The normal pathway for drug development is a 10 to 15 year journey that begins with 10,000 candidates in basic research to enter a process that only yields one FDA approved medicine on average. Preclinical efforts focus on basic research, drug discovery and pre-clinical *in vivo* and *in vitro* studies that determine the qualities of the compound. Pharmacokinetic and pharmacodynamic studies are conducted in preparation for an investigational new drug (IND) application. If the IND submitted to regulatory authorities is cleared, then clinical trials in humans may begin. When a drug enters the clinic, costs increase. Human trials are notoriously expensive and only increase as a drug progresses through more advanced trial phases.

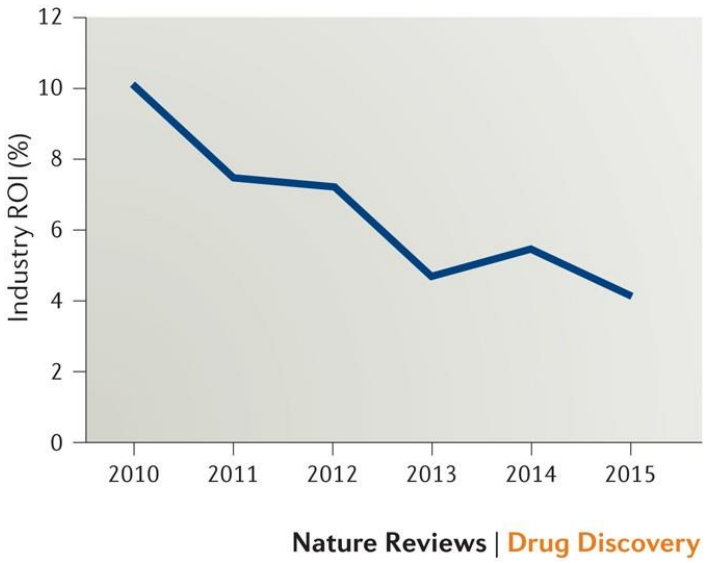
Countless studies have been conducted to determine the cost of advancing a drug to the finish line. Numbers can range from a few hundred million for a relatively simple indication with a strong signal, to billions for trials that have large populations such as the FOURIER trial.[4] With fewer opportunities for blockbusters and costs for trials increasing dramatically, new methods must be found to successfully identify safe and effective medicines.

Personalized Medicine

While drug development has generally succeeded in capturing the low hanging fruit by identifying monotherapies that apply to the broadest segments of disease, the effort becomes more difficult and expensive as remaining afflicted populations are smaller and diseases more complex. Despite this shrinking addressable market, drug development costs have not trended in the same direction, nor have other factors that affect returns such as development time and success rate.

[4] The Phase III FOURIER trial enrolled 27,564 patients to test Evolocumab against placebo for cardiovascular disease. At an estimated cost of $70,000 per patient, just this one Phase III trial could have cost as much as $2 billion for the sponsor Amgen.

Exhibit I – Pharmaceutical industry R&D returns over time[5]



Every patient's genetic makeup is different. These differences affect a patient's response to a medication and can influence whether or not a drug works. For example, in glioblastoma multiforme, a rare but deadly form of brain cancer, the methylation status of the promoter of a DNA repair enzyme (methylguanine methyltransferase) greatly affects a patient's response to the chemotherapy temozolomide, the current standard of care. Stratifying a population by a biomarker can extend median survival by tailoring therapies to the appropriate population. Given the complexity of human physiology, it stands to reason that improved understanding of metabolic variations and how combinations of medicines can impact a unique physiology should provide better matching of drugs with disease. With the advent of sophisticated computational tools, it is now possible to analyze vast quantities of data to identify drug candidates and their companion indications that can advance faster, at lower cost and with a higher degree of confidence in their ultimate success than what has come before.

The Advancement of Artificial Intelligence

The growth in personalized, high-resolution medical data is a function of both the decreasing cost of genetic sequencing and the decreasing cost of data storage and analysis. Increases in computational power and the continued development of ML algorithms allow us to capitalize on this new wealth of medical information. The decline in cost to sequence a genome has exceeded expectations suggested by Moore's Law.[6] In 2001, the cost to sequence one person's genome was approximately $100 million. Almost two decades later, the cost had shrunk to about $1,000 per genome.[7] The average human genome has approximately 30,000 genes made up of over three billion bases. With over seven billion people on the planet, there could be well over 2×10^{19} bases of information that will have varying levels of relevance. The challenge is making sense of the data and AI can help.

Often AI and ML are used interchangeably, but ML is a subset of AI. ML pioneer Tom Mitchell defines it as "the study of computer algorithms that improve automatically through experience."[8] In general, these terms refer to computer programs that are designed to find trends and relationships across vast amounts of many types of data, and are equipped to do so in an automated, iterative fashion. The system employs the algorithm it has developed to make predictions from novel, real-world inputs. In this way, AI/ML goes beyond a conventional computer program or conventional statistics to be arbitrarily and near-infinitely tunable. The technology can adapt to learn highly complex systems and the power is in using the tuned algorithm to then solve real-world problems. In notoriously complex marketing systems, hand-built, interpretable models that had been used in the beginnings of mathematics and physics have been abandoned. Instead, they have been replaced by highly customizable and complex AI/ML algorithms. Medicine is rapidly evolving in this direction.

ML can be classified into two categories: supervised and unsupervised. Supervised learning uses a labeled dataset that allows the program to evaluate its own accuracy while unsupervised learning requires the algorithm to identify differentiating characteristics itself. Common examples of supervised learning models include neural networks,

[5] Mullard, A. Industry R&D returns slip. *Nat Rev Drug Discov* **15,** 7 (2016). https://doi.org/10.1038/nrd.2015.41
[6] Moore's Law states that the number of transistors on a microchips doubles every two years while the cost of computers is halved.
[7] https://www.genome.gov/about-genomics/fact-sheets/Sequencing-Human-Genome-cost
[8] http://www.cs.cmu.edu/~tom/mlbook.html

support vector machines, nearest neighbors and decision trees. Unsupervised models may include k-means clustering or association rules. Other approaches include random forest and logistic regression.

Artificial neural networks are computing systems modelled after human neural networks. The approach uses a group of connected units, or artificial neurons, that process signals and send a result to another unit. Output depends on the pathway the signal takes through the network. The human brain contains approximately 100 billion neurons and provides a useful model for the design of a mechanism of artificial intelligence. To simulate neurons, neural networks contain activation functions that mimic the action potential of nerve cells. Neural nets can have millions of processing nodes densely interconnected that cluster and classify data. Support-vector machine is a learning model that uses associated algorithms to analyze data to perform regression analysis. A training phase is started which teaches the algorithm through labeling to classify an observation into one category or another. The approach is a binary linear classifier. Random forest employs a variety of decision trees that operate together. Many uncorrelated models or trees will independently classify data thus reducing an error by a small subset of trees. This can be a successful approach if the individual models are uncorrelated. K-nearest-neighbors is a non-parametric approach used to classify and/or perform regressions. The output of the model is the class to which an input belongs and is weighted by the sample's proximity to its nearest neighbors. Logistic regression can be used to classify what category an object belongs to using a binary dependent variable. It can describe data and explain the relationship between one dependent binary variable and one or more nominal, ordinal, interval or ratio-level independent variables. This explains only a subset of the approaches that are available to classify data and help make sense of large volumes of information.

As modern medicine matures, the approach to patient care becomes more personalized. As higher resolution medical data becomes more available, personalizing care becomes more feasible. Through AI and ML, this flood of data is organized to support the development and targeting of therapies.

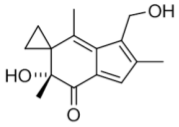
Lantern's RADR uses a variety of statistical and machine learning algorithms, largely centered on neural network techniques and methodologies. Through the RADR platform, Lantern hopes to salvage failed drugs, find the biomarker/genetic signature of patients that are most likely to respond, and revive the drug through clinical trials in the proper patient population. We expect additional features and functionality to emerge as RADR evolves.

The Portfolio

Lantern has three candidates in its portfolio. The most advanced is LP-100, or Irofulven, which is being developed by partner Allarity Therapeutics, previously known as Oncology Venture, for an indication in prostate cancer. It is in a Phase II trial and expected to read out in 1H:21. LP-300 will begin a Phase II trial seeking an indication in never smoker non-small cell lung cancer (NSCLC) adenocarcinoma. We anticipate the trial will begin next year. The third candidate is LP-184 and is in the preclinical stage. The agent will be developed for indications in solid tumors with a defined genomic signature such as ovarian, breast, liver, kidney and thyroid cancers and in glioblastoma.

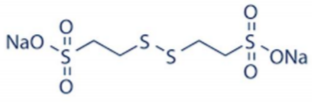
Exhibit II – Lantern Portfolio[9]

LP-100, Irofulven



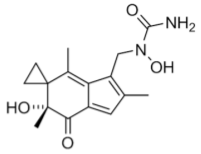
- DNA Damaging Agent
- Mediates cytotoxicity through multiple mechanisms such as DNA adduct formation, RNA polymerase stalling and redox protein modification
- Actively enrolling in a precision medicine, genomic-signature guided Phase II trial (NCT03643107) for metastatic, castration-resistant prostate cancer (mCRPC)

LP-300



- Disulfide bond disrupting agent with cysteine modifying activity on select proteins (ALK) and modulator of protein function (EGFR, MET, ROS1)
- Chemosensitizer for combination therapies by inactivating proteins modulating cell redox status and drug resistance (TRX, GRX, PRX)
- Chemoprotectant activity that reduces toxicities associated with taxane/ platin-based chemotherapies

LP-184



- Novel DNA Damaging Agent - member of the acylfulvene prodrug class
- Favorable *in vitro* and *in vivo* efficacy across multiple tumor types
- Broad anti-tumor agent that counteracts multi-drug resistance
- Nanomolar potency
- A.I. generated, validated and published gene signature for solid tumors

[9] Source: Lantern Corporate Presentation, August 2020.

RADR®

At the intersection of increasing availability of genetic and transcriptomic data, machine learning (ML) and clinical trials is Response Algorithm for Drug Positioning and Rescue (RADR®). This is Lantern's proprietary algorithm and platform that seeks to predict therapeutic response based on personal and physiological features. The platform allows Lantern to salvage clinically-failed drugs by selecting for responsive patients and running new clinical trials on responsive subpopulations. The platform can estimate drug sensitivity, classify a patient as a responder or non-responder and identify predictive biomarkers for each drug-tumor combination.

The data required to draw conclusions about patient-drug response is highly specialized. RADR's training dataset includes information on the patients' tumor transcriptome, drug sensitivity (IC50), DNA copy number and mutations, tumor stage, type/sub-type and histology, age, sex and race/ethnicity and prior treatment history. Lantern hopes to have a combined one billion data points by 2021. Given this dataset, RADR is able to identify statistical relationships between the patients' parameters and tumor-drug response. After training, the RADR algorithm can then be applied to real world patients to identify those most likely to respond in order to include them in clinical trials. Past clinical trials are a rich source of this highly specialized data that RADR can retroactively analyze based on a portfolio of data points and identify patient sub-populations that best respond to treatment. The algorithm output can guide future trials by screening patients based on RADR-defined characteristics and achieve statistically significant efficacy for patients using drugs that were previously abandoned. In cases where only a subset of a trial population responds to a drug, often a metabolic difference is implied; RADR can also be used to clarify novel genomic, epigenomic, enzymatic and proteomic molecular pathways. The same can be applied to combinations of therapies, where more than one drug is used. RADR allows Lantern to salvage abandoned drugs that were well tolerated but did not meet clinical endpoints and further confirm mechanism of action, identify potential combination drug use and select the patient population most likely to respond. With the map of the way forward, Lantern is then able to match the drug and the patient in the clinic for validation.

Exhibit III – RADR Workflow[10]

Prior to Lantern's Initial Public Offering (IPO), RADR had been trained on over 140 drug-cancer interactions, 7,900 patient records, totaling over 275 million pre-clinical and clinical data points. The most recent count is over 500 million data points and this number is expected to grow to over one billion by early 2021 allowing the system to evolve. RADR sources its inputs from publicly available datasets, data from commercial clinical studies and trials, Lantern-proprietary data generated from *ex vivo* 3D tumor models of drug-tumor interactions, preclinical studies and data generated through research collaborations.

[10] Lantern Pharma Precision Oncology Whitepaper

Exhibit IV – Public datasets utilized by RADR[11]

Source	Description
1. Publicly Available Datasets	Datasets collected and organized by sites and organizations such as CellMiner, cBioPortal, R2, GTEX, CCLE, GEO, etc. These are typically genomic, transcriptomic and gene expression datasets compiled and made publicly available by research institutions globally.
2. Publications, Journals and Conference Proceedings	Data selected from publications and published posters, studies, and conference proceedings that are both clinical and preclinical from drug classes of interest and also from studies of specific patient types or from specific cancer sub-types.
3. Proprietary Collaborations & Sponsored Research with Top Academic & Cancer Centers	Data that is proprietary and generated through specific, unique collaborations and joint research initiatives with academic institutions and cancer centers such as: Georgetown Univ., Fox Chase Cancer Center, MSKCC, C-TRIC (UK), Johns Hopkins, and others. This data is usually comprised of both drug sensitivity and tumor response data along with sequencing and genomic data on the tumor(s) being studied.
4. Internally Generated, Proprietary Data on Lantern's Drugs, Compounds of Interest and Specific Drug Classes and Combinations	Data that is generated by Lantern Pharma based on internal development efforts and work with CROs on specific tumors and drugs. This data is largely transcriptome and drug sensitivity data along with proteomic or cellular function data that is unique to the tumor being studied. The sequencing studies are orchestrated as campaigns done with pre-specified sequencing partners under pre-approved protocols.
5. Published & unpublished historical data from the Drug or Compounds & related studied compounds, acquired or in-licensed by Lantern	The drugs and compounds that have been in-licensed by Lantern often have preclinical and clinical data from trials and studies that can be used to establish a baseline of biomarker data, response data, and mechanistic data. They can also often include data from related analogs or compounds that were studied and are typically targeted genomic and biomarker data along with drug sensitivity and drug response data.

As data is fed to the system, RADR operates in three phases: cleaning, processing and prediction. First, RADR prepares the data, by cleaning, transforming and normalizing the raw input. This is followed by feature selection where several hundred of the ~20,000 possible genes are filtered out for further analysis. From this set, RADR uses AI and ML to identify up to 50 most important predictive biomarkers.

After cleaning and normalizing the dataset, the process of gene selection begins with Pearson correlation function with a 5% significance level cutoff. These genes are then further filtered based on their metabolic signaling pathways. Using the Pathcards database covering almost 4,000 pathways and the Pathway commons database covering over 1.5 million interactions, the genes with high degrees of interaction with the drug's target pathway and a high number of connections with other genes are selected. Finally, a relief algorithm ranks and assigns weights to the gene subset based on drug sensitivity (IC50). The highest ranked genes are then used in subsequent RADR predictive analysis.

RADR's predictive algorithm is based on an artificial neural network (ANN). It can also predict using support vector machine, random forest, k-nearest-neighbors, logistic regression and penalized multivariate regression models. Each algorithm is evaluated using accuracy, receiver operating characteristic (ROC) curve area, sensitivity, specificity, precision, root mean square error (RMSE), and mean absolute error. The RADR feature reduction algorithm further reduces the almost 500 predictive genes to 10-30 that best predict both drug sensitivity and can classify responders and non-responders.

ANN was chosen as the preferred algorithm as it was shown to be most accurate in a detailed comparative study performed by the company using the Cancer Cell Line Encyclopedia database. It offers 35 distinct preclinical drug-tumor datasets, 20 approved cancer drugs and 1000 cell lines covering almost 17 million data points and demonstrated that the ANN was faster and more accurate when compared to other machine learning algorithms, such as random forest, support vector machine, and k-nearest-neighbors.

The processing of and training on one billion data points requires substantial computational power. Lantern has appropriately leveraged cloud and parallel computing to allow RADR to be as scalable as possible.

Historically, RADR has been able to classify responders with over 80% accuracy, a testament to the future opportunity and potential machine learning has in precision oncology. Equipped with unprecedented amounts of oncology-relevant data, advances in machine learning combined with a pool of partially developed oncology drugs, Lantern can apply precision oncology to rescue candidates that yielded a positive signal in a subset of the patient population.

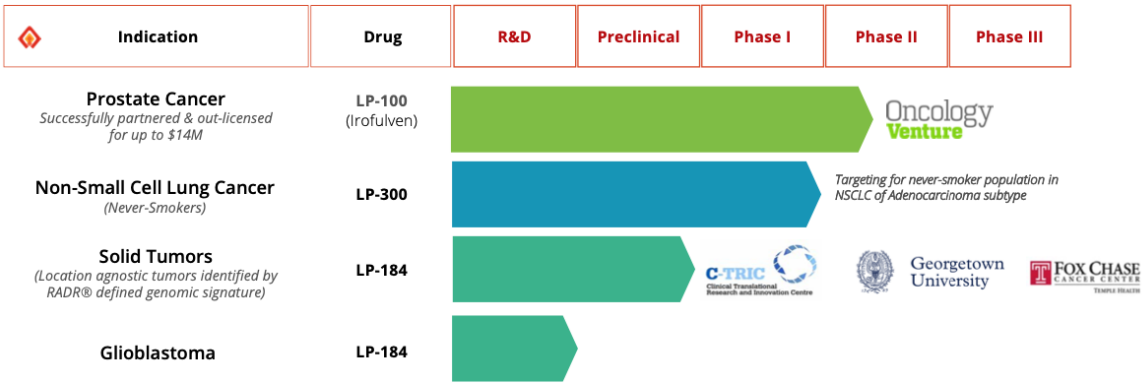
[11] Lantern Pharma Precision Oncology Whitepaper and management-provided data

Candidates

Pipeline

Lantern's pipeline consists of multiple candidates including LP-100 for prostate cancer, LP-300 for never smoker non-small cell lung cancer (NSCLC) and LP-184 in genomically defined solid tumors and glioblastoma multiforme. LP-100 has been licensed to Allarity Therapeutics in Denmark to develop the drug. LP-300 was acquired from BioNumerik Pharmaceuticals in January 2018 and is expected to begin a Phase II trial in 2021. LP-184 is expected to commence IND-enabling studies in 2021 and enter into a Phase I trial in 2022.

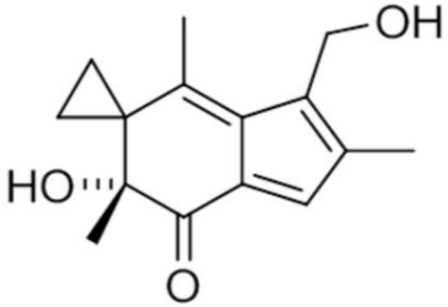
Exhibit V – Clinical Development Pipeline[12]



LP-100

Lantern's partner, Allarity Therapeutics is currently conducting a Phase II trial for LP-100 also known generically as irofulven or chemically as 6-hydroxymethylacylfulvene, in metastatic castration resistant prostate cancer (mCRPC). The drug was initially invented and patented at the University of California San Diego (UCSD) and transited through ownership by MGI Pharma, Eisai, back to UCSD then licensed to Lantern which subsequently sub-licensed it to Allarity Therapeutics. The drug had previously been investigated in near 40 Phase I, II or III clinical trials involving over 1,300 patients. Responses were observed in a broad variety of cancers; however, they were insufficient to meet required endpoints for clinical trial success. A Phase IIb clinical trial in Europe in mCRPC demonstrated increased survival vs. standard of care. However, in another Phase II study, adverse events related to retinal toxicity were observed, associated with dose and administration of LP-100. Efforts were made to identify patients that will respond to LP-100 based on gene expression profiles.

Exhibit VI – Chemical Structure of LP-100[13]



Mechanism of Action

LP-100 inhibits DNA synthesis and replication, affects cell cycle and induces apoptosis. The drug induces damage to DNA that can only be repaired via the transcription-coupled nucleotide excision repair (TC-NER) pathway. LP-100 displaces enzymes that would normally repair the DNA damage and tumor cells undergo S-phase arrest, then apoptosis. When used in combination with other chemotherapy agents, alternative repair routes are also disrupted, increasing the effectiveness of the alkylation agent.

[12] LTRN Investor Presentation July 2020
[13] Source: Lantern S-1 Filing.

Incidence & Prevalence

The estimated global incidence of prostate cancer was 1.3 million new cases in 2018.[14] According to the American Cancer Society estimates, there will be about 191,930 new cases of prostate cancer in the United States in 2020.[15] One in nine American men will be diagnosed with prostate cancer in his lifetime. Older and African-American men are at greater risk with 60% of cases diagnosed in men 65 years and older. Metastatic CRPC is a form of prostate cancer which has spread to other parts of the body and no longer responds to hormone (testosterone-lowering) treatment.[16] About half of all patients who die of prostate cancer have metastases at diagnosis. Hormonal therapy is administered to prostate cancer patients; however, after a period of time, the treatment can become refractory and tumor growth may return. From 10% to 20% of prostate cancer patients fall into this category after five years of treatment on average.

Pathophysiology

Prostate cancer, like all cancers, begins at a specific site. Through the development and advancement of the tumor, the cancer begins to metastasize as the properties of the cancer cells change. Prostate cancer can also develop into non-metastatic CRPC, where the tumor continues to grow, but has not invaded other tissues, despite hormone treatment. Finally, through further mutation in the cancer and changes in cell properties, metastasis occurs, resulting in mCRPC.

Symptoms & Diagnosis

The symptoms of prostate cancer and mCRPC may include trouble urinating, pain or blood in urine, fatigue and weakness, weight loss, shortness of breath and bone pain. Prostate cancer may be screened using the biomarker PSA or a digital rectal exam. Further diagnosis is confirmed through ultrasound, biopsy, and MRI fusion.[17]

Current Standard of Care

Standard of care is largely symptom management and progression control. The castration resistant component of CRPC implies that androgen deprivation therapy (ADT) or hormone therapy no longer works, but many patients will continue this therapy without alternative. Chemotherapy is often employed, with docetaxel and cabazitaxel the most common agents. Immunotherapy is available as well. Sipuleucel-T is an autologous immunotherapy where the body's immune cells are activated using a highly targeted antigen vaccine, directly injected into the patient that directs the immune cells toward the prostate cancer cells.[18] In addition to ADT, second-line hormone therapies can be used such as abiraterone and enzalutamide. Radiotherapy is common in cancer management. Xofigo (radium-223 dichloride) can be used if the mCRPC has spread to the bones.

Mechanism of Action

LP-100 belongs to the acylfulvene class. Acylfulvene members are cytotoxic semi-synthetic derivatives of illudin, a naturally occurring compound in jack o'lantern mushrooms (*o. illudens*).[19]

LP-100 alkylates DNA exploiting cancer cell deficiency in DNA repair mechanisms. LP-100 acts through multiple mechanisms such as DNA adduct formation, RNA polymerase stalling and redox protein modification, greatly inhibiting DNA replication that is necessary for cancer to grow and spread and inducing apoptosis. The LP-100 induced lesions are mediated by components of transcription-coupled nucleotide excision repair (TC-NER) pathway. LP-100 has shown enhanced efficacy in cancer cells that are excision repair cross-complementation Group 3 (ERCC3) mutant or deficient *in vitro* and *in vivo*.

[14] Bray F, Ferlay J, Soerjomataram I, Siegel RL, Torre LA, Jemal A. Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin. 2018;68(6):394–424. doi: 10.3322/caac.21492.
[15] https://www.cancer.org/cancer/prostate-cancer/about/key-statistics.html
[16] Urology Care Foundation mCRPC What You Should Know Fact Sheet
[17] https://www.mayoclinic.org/diseases-conditions/prostate-cancer/diagnosis-treatment/drc-20353093
[18] http://chemocare.com/chemotherapy/drug-info/SipuleucelT.aspx
[19] https://www.caymanchem.com/product/22062/

Previous Trials

LP-100 has an extended history of clinical trials. Approximately 40 trials have been attempted in 13 solid tumors across ~1,500 patients which have demonstrated favorable tolerability and safety. The drug was originally developed by MGI pharma which partnered with Eisai in clinical trials. In these trials, LP-100 demonstrated anti-tumor activity in 10-12% of patients that were multidrug resistant.

Clinical Trials & Partners

The first patient for the trial (NCT03643107) of LP-100 in mCRPC was enrolled in December of 2018. Itl is being conducted in Denmark and Germany and continues to enroll patients up to the 27-participant goal. The patients enrolled have been diagnosed with mCRPC, have progressed on androgen receptor (AR)-targeted therapy and have been treated with docetaxel. These patients were also screened using RADR guided signatures. The patients are administered intravenous (IV) Irofulven at 0.45 mg/kg for 30 minutes on day one and eight of a three-week cycle. The patients are also co-administered 10 mg oral prednisolone daily. Topline data is expected to be reported in the first half of 2021. Allarity Therapeutics, the sponsor of the trial, licenses the patent to use the drug in combination with the tumor biomarker signature. Though the trial is still in progress, a retrospective analysis of past trials shows that median overall survival after 12 months was 86% greater than in mitoxantrone, the current standard of care, setting high expectations for this trial.

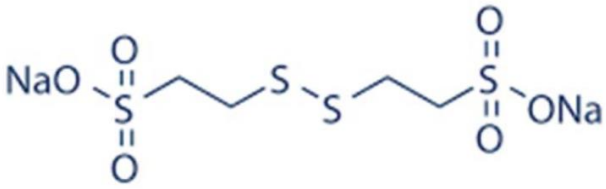
Lantern Interest in LP-100

Lantern has out-licensed the development of LP-100 to Allarity Therapeutics, which is responsible for advancing the drug. Allarity has agreed to make milestone payments to Lantern in connection with LP-100 development in the maximum aggregate amount of approximately $14.0 million. In addition to the milestone payments, it has agreed to pay Lantern royalties in an amount equal to a low single digit percentage of annual sales of LP-100. As an alternative to the development milestone payments and in place of the $14.0 million payment, Lantern may select an alternate payment structure in the event Allarity enters into an agreement for LP-100 with a third party who assumes control over the LP-100 program. If Lantern selects the alternate payment structure, it would be entitled to receive a specified percentage of all amounts, other than royalty payments, received by Allarity from the third party program acquirer. Selection of the alternate payment structure would not change Lantern's right to receive royalty payments from Allarity with respect to LP-100. Lantern is also eligible for a low seven figure milestone to be paid upon the approval of the first successful indication in connection with an acquisition by another entity. Allarity Therapeutics will be responsible for fulfilling Lantern's milestones and royalty payments owed to AF Chemicals to be either paid directly or as a pass through. AF Chemicals is the licensor for LP-100.

LP-300

LP-300 (disodium 2,2'-dithio-bis-ethane sulfonate) is a small molecule capable of modifying the amino acid cysteine in select proteins (ALK) and modulates protein function in others (EGFR, Met and ROS1)[20]. The molecule was in-licensed from BioNumerik Pharmaceuticals, Inc. in May 2016, and then was fully acquired in January 2018.

Exhibit VII – LP-300 molecular structure



LP-300 can modulate multiple cellular pathways simultaneously, and can act as a chemo-sensitizer for combination therapies by counteracting the protein-basis for drug resistance. LP-300 can also serve as a chemoprotectant, reducing toxicities associated with taxane and platinum-based chemotherapies. Lantern is currently designing Phase II trials of LP-300 in never-smokers with adenocarcinoma of the lung, an indication for which there is no approved therapy. The IND is still current for LP-300, and the safety data will allow Lantern to resume advanced trials once trial designs and protocols are cleared by regulatory authorities.

[20] EGFR: epidermal growth factor receptor; MET is also known as hepatocyte growth factor receptor (HGFR); ROS1 gene that encodes for an enzyme that drives uncontrolled cellular growth.

Non or Never Smoker NSCLC Incidence & Prevalence

Lung cancer is a leading cause of cancer death worldwide. In the US, lung cancer ranks second only after prostate and breast cancer in incidence, and leads all other cancers in mortality.[21] NSCLC is the most common type of lung cancer, accounting for nine out of every 10 cases.[22] Of the total NSCLC cases, adenocarcinoma is the most common type, accounting for 40% of NSCLC occurrences. Though prevalence of lung cancer has declined with the decrease in smoking, there exists a subset of the lung cancer population that has never smoked, and NSCLC in never-smokers is metabolically distinct compared to smoking-related NSCLC. Met/ALK and EGFR alterations are more common in non-smokers and LP-300 has demonstrated in the lab that it targets both EGFR WT/mut+ and Met/ALK. Additionally, a large proportion of adenocarcinoma patients are EGFR mutants or Met/ALK positive making this population particularly receptive to LP-300 therapy. The proportion of never-smokers with lung cancer has risen sharply. Approximately 10-15% of all lung cancer cases in the US are in never-smokers.[23] As tobacco smoking has been ruled out, several etiologic factors are under consideration for the increased risk of lung cancer in never smokers (LCINS) including radon, cooking fumes, asbestos, heavy metals, human papillomavirus and genetics.

While Lantern had initially targeted LCINS in female populations, it will pivot to pursue all never-smokers, resulting in a slightly larger population. Adenocarcinoma is the predominant subtype of LCINS, comprising 53% to 70% of cases.[24] When applied to the 229,000 US cases provided by the American Cancer Society and the 146,000 Western European cases and 313,000 in the EU as provided by GLOBOCAN, this suggests almost 14,000 cases in the US and 19,000 in Europe. We estimate almost 90,000 cases in other regions around the globe. With a relatively low incidence and well below the 200,000 threshold for rare disease, the indication will seek orphan status.

Symptoms & Diagnosis

NSCLC typically presents in advanced stages; asymptomatic diagnosis can occur via routine chest x-ray. Advanced NSCLC may cause symptoms such as cough, shortness of breath, joint or bone pain, wheezing, hemoptysis, chest pain, weight loss, hoarseness and fatigue.[25] If the tumor metastasizes, other symptoms will result based on the location. Paraneoplastic syndrome[26] can also occur, resulting in hypercalcemia, confusion, excessive thirst or urination, fatigue, seizures, coma and abnormal antidiuretic hormone secretion.

Diagnosis of NSCLC includes bone scan, imaging tests such as magnetic resonance imaging (MRI), computed tomography (CT) scan and positron emission tomography (PET) scan, analysis of sputum for cancer cell content, and biopsy of the lung.[27]

Current Standard of Care

Treatment of NSCLC depends on cancer stage and degree of metastasis. If the tumor remains localized, surgery with (neo) adjuvant chemo- or radiation-therapy is recommended. If the tumor has metastasized, chemotherapy, targeted therapy or immunotherapy is used to control the condition. Pembrolizumab can be used as a first line treatment in cancer cells with 50% or greater programmed cell death ligand 1 (PD-L1) expression. Patients that do not express sufficient levels of checkpoints are prescribed cisplatin or carboplatin in combination with pemetrexed or a taxane, such as paclitaxel or docetaxel. Bevacizumab can also be used, although it is contraindicated in patients with a concern of thrombolysis, hemoptysis, or brain metastasis.[28]

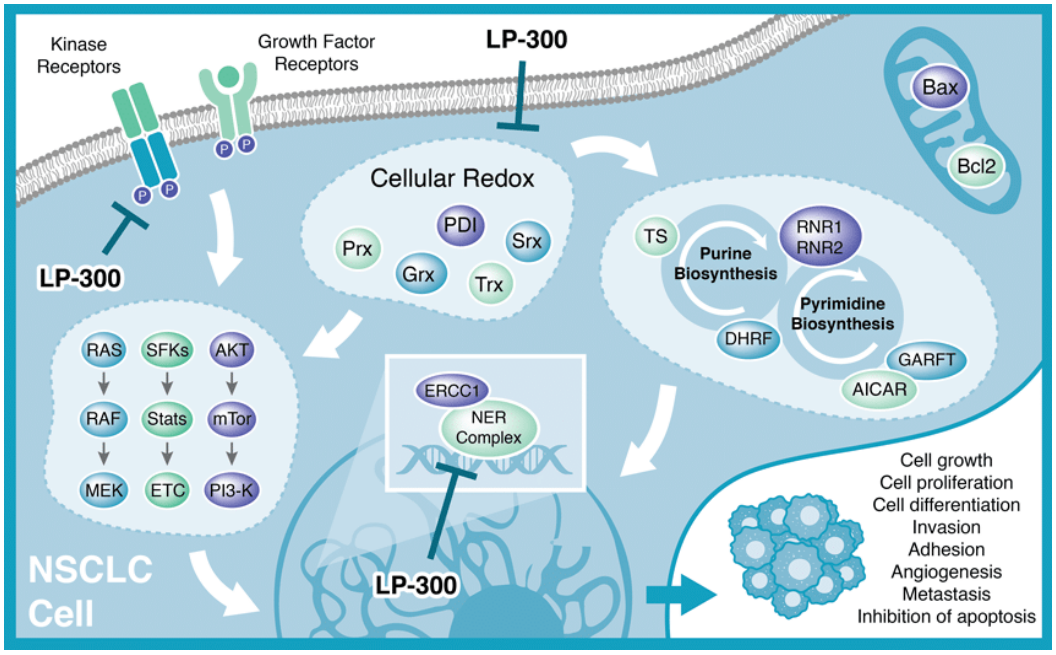
LP-300 Mechanism of Action

LP-300 is a small molecule with the ability to modify cysteine on anaplastic lymphoma kinase, a receptor tyrosine kinase. Inhibition of this receptor has downstream effects on RAS, SFK, and AKT pathways. LP-300 also affects

[21] ACS Cancer Facts and Figures 2020
[22] https://www.cancercenter.com/cancer-types/lung-cancer/types
[23] *Pelosof L, Ahn C, Gao A, Horn L, Madrigales A, Cox J, McGavic D, Minna JD, Gazdar AF, Schiller J.* Proportion of Never-Smoker Non-Small Cell Lung Cancer Patients at Three Diverse Institutions. *J Natl Cancer Inst. 2017 Jan; 109(7):.*
[24] Wakelee, H., *et al.* Lung cancer incidence in never-smokers. J Clin Oncol. 2007 Feb 10; 25(5): 472–478.
[25] https://www.myamericannurse.com/wp-content/uploads/2016/12/ant2-CE-Lung-Cancer-116a.pdf
[26] Paraneoplastic syndromes are a group of rare disorders that are triggered by an abnormal immune system response to a cancerous tumor known as a "neoplasm." Paraneoplastic syndromes are thought to happen when cancer-fighting antibodies or white blood cells (known as T cells) mistakenly attack normal cells in the nervous system. These disorders typically affect middle-aged to older people and are most common in individuals with lung, ovarian, lymphatic, or breast cancer. Source: NIH, National Institute of Neurological Disorders and Stroke.
[27] https://www.healthline.com/health/lung-cancer-non-small-cell#diagnosis
[28] https://www.myamericannurse.com/wp-content/uploads/2016/12/ant2-CE-Lung-Cancer-116a.pdf

the cell's redox balance, which, in turn modulates the RAS, SFK and AKT pathways. Proteins involved in cellular redox also can confer drug resistance, namely thioredoxin (TRX), peroxiredoxin (PRX), glutaredoxin (GRX) and protein disulfide isomerase (PDI), which are inhibited by LP-300 and act as chemo-sensitizers in combination therapy. LP-300 can also act as a chemoprotectant and reduce toxicities associated with taxane and platinum-based therapies. Through the multiple mechanisms of action, LP-300 is potentially a first-in-class combination agent in NSCLC.

Exhibit VIII – LP-300 Pathway Modulation[29]



Previous Trials

LP-300 has been investigated in multiple clinical trials in the past, both as a monotherapy and in combination with other agents. Over 1,000 patients have been administered LP-300 where it has largely been well tolerated. However, these trials failed to meet their endpoints, likely due to the lack of patient stratification based on biomarkers or smoking status.

In combination therapy trials, LP-300 was evaluated with paclitaxel and cisplatin or docetaxel and cisplatin, platinum-based therapies. Retrospective analysis of these past studies revealed subgroups that demonstrated substantial improvement in overall survival, particularly among female non-smokers. The subpopulation showed a 13.6 month improvement in overall survival (OS). Based on this observation and LP-300's multiple effects on cell metabolism, Lantern intends to position LP-300 as a combination therapy in never smokers with adenocarcinoma NSCLC.

Clinical Trials & Partners

LP-300 was in-licensed from BioNumerik Pharma in May 2016 and acquired from them in January 2018. Lantern is currently planning a Phase II trial for LP-300 in combination with chemotherapy in never-smoker adenocarcinoma NSCLC, and is in conversations with the FDA to obtain Orphan Drug status. The Phase II is intended as the continuation of a Phase III trial that demonstrated benefit in a subgroup, despite failing to meet its endpoint overall and will be able to advance under an existing IND. LP-300 in combination with cisplatin and paclitaxel was able to produce a 125% increase in 2-year survival in never-smokers.

The trial is currently expected to span over a two year period and enroll from 60 to 200 patients based on statistical analyses. It will enroll patients diagnosed with adenocarcinoma NSCLC with little or no history of smoking and no prior chemotherapy treatment. The trial will include LP-300 in combination with chemotherapy. It will be structured as a non-randomized, open label study with a primary endpoint of overall survival. Secondary endpoints will be objective response rate, clinical benefit rate, progression-free survival and quality of life.

[29] Lantern S-1 dated April 2020

Preclinical

LP-184

Lantern is also investigating LP-184 in pre-clinical studies with partners. LP-184, like LP-100, is also an acylfulvene (prodrug) that has shown superior efficacy and reduced toxicity as compared to previous generation acylfulvenes. LP-184 is likely activated by the activity of the prostaglandin reductase1 (PTGR1) enzyme. The lesions are exclusively processed by transcription coupled nucleotide excision repair (TC-NER) pathway involving CHK1 and PARP. Results show favorable *in vitro* and *in vivo* efficacy against multiple tumor types including pancreatic, prostate, liver and glioblastoma multiforme (GBM) cell lines. Furthermore, early work has shown that LP-184 is effective in combination with already-approved drug classes and addresses tumor multi-drug resistance, independent of p53 and KEAP1 mutations. Lantern currently has two pending patent applications regarding the synthesis of the molecule, and patents identifying the stratification of patients based on their response.

As an acylfulvene, LP-184 is a DNA-damaging (alkylating) agent. In solid tumors, LP-184 has demonstrated a high degree of potency over approved chemotherapies including cisplatin and pemetrexed, *in vitro*. The cell lines evaluated include liver, multiple NSCLC and multiple ovary lines. For these solid tumors, Lantern has discovered and published the predictive gene signature using RADR. In GBM, LP-184 has shown very high potency, *in vitro,* compared to current standard of care, temozolomide. The methylation status of the promoter for methylguanine methyltransferase (MGMT) largely determines patient response to temozolomide, and unmethylated patients expressing the enzyme develop rapid resistance to the drug. LP-184 is anticipated to be MGMT-methylation agnostic and may improve overall survival for unmethylated patients. Coupled with LP-184's favorable blood-brain barrier permeability, LP-184 is a promising pre-clinical candidate in an indication that is in desperate need of new treatments. The overall survival in GBM patients is less than one year.

IND studies are planned in 2021 and a Phase I trial is anticipated in 2022.[30] The study will use RADR to identify patients with a predictive signature, such as PTGR1. Through a collaboration with NCI, based on their CellMiner platform, 16 independent gene signatures were identified and validated. In partnership with C-TRIC, LP-184 was evaluated in an *ex vivo* model of prostate cancer trial (PRAISE). The trial initiated in 1Q:19 with partial funding from the Invest Northern Ireland economic development agency. LP-184 is also being studied in prostate and pancreatic cancers in partnership with Georgetown University which began in 2Q:20. When clinical testing is started, Lantern expects to employ a precision biomarker approach to stratify responders and non-responders in a small Phase I trial.

On September 27, Lantern announced a collaboration and research agreement with Fox Chase Cancer Center in Philadelphia, Pennsylvania. The cooperation will advance efforts with Lantern's LP-184 in pancreatic cancer to develop a more biologically relevant and robust gene signature for future clinical trials and improve the precision of cancer treatment. The work on LP-184 at Fox Chase, led by Igor Astsaturov, MD, Ph.D., will identify the opportunities for the candidate in pancreatic cancers. The effort will employ 3D organoids and patient derived xenograft (PDx) models to identify the biomarker signatures necessary to characterize the mechanisms behind LP-184. Lantern had previously announced that it was engaged in discussions with Fox Chase to advance LP-184 related to evaluating the correlation of sensitivity of PTGR1 status using cell lines and PDx models in various cancer types.

Georgetown University and Lantern announced a continuation in their agreement on October 5th related to advancing LP-184 in genomically defined solid tumors, including prostate and pancreatic cancers. Lantern has been collaborating with Georgetown since 2019 to determine the efficacy of LP-184 in a panel of prostate cancer organoid models and engineered pancreatic cancer cell lines. The studies will gather data on LP-184 responses and drug sensitivity in prostate and pancreatic cancers. This first stage of work demonstrated that LP-184 had nanomolar potency across a wide variety of prostate cancer cell lines, had the ability to kill PTGR1 expressing cancer cells and exhibited dose dependent cancer cell death in 3D organoid cultures. The efforts are generating genomic, transcriptomic and drug sensitivity data that will refine the response signature and identify the DNA repair deficiencies that are most likely to respond to LP-184. So far the studies have suggested that LP-184's mechanism of action damages and blocks a critical pathway for cancer cell proliferation and is particularly amenable to combination therapies in a number of tumor types. The next stage of the Georgetown collaboration will focus on a larger set of PDx models and attempt to confirm the role of PTGR1 and the genetic mutations driving the DNA damage repair pathways that make the drug potent in the identified cancers. In preparation for clinical trials, these efforts will develop a more biologically relevant and robust gene signature that is more personalized and effective for specific patients with prostate cancer.

[30] Provided on the 2Q:20 inaugural earnings conference call.

Intellectual Property

Lantern has a broad portfolio of 108 issued patents, and seven pending applications across 14 patent families. The patents relate to the drug candidates, usage, manufacturing processes and other items and some have been in-licensed or acquired from other companies. The intellectual property portfolio also covers the RADR system.

The LP-100 portfolio consists of two patent families, with rights secured in the United States, Japan and the EU. This patent family has rights that will expire in August 2026, not accounting for adjustments or extensions.

BioNumerik Pharma has assigned patent rights to Lantern to develop LP-300 in January 2018. SEC filings show 29 patents related to this agreement ranging from *Increasing Cancer Patient Survival Time by Administration of Dithio-Containing Compounds* to *Formulations and Methods of Reducing the Toxicity of Antineoplastic Agents*. The patents span over six families in the United States, Europe, Japan, China and other jurisdictions. The expiration for non-small cell lung cancer (NSCLC) related patents and patent applications directed to LP-300 ranges from 2028 to as late as 2040 and does not account for any applicable patent term adjustments or extensions.

Intellectual property held for the RADR precision medicine platform in drug sensitivity and response signatures using biomarkers and methods of use. It encompasses biomarker signatures, patient selection and stratification approaches and development of novel, combination approaches using existing therapeutics. There is a patent application filed for RADR identifying specific genes that map key biological signaling pathways filed in March 2020. Lantern relies on trade secrets and confidential procedures to protect its AI and machine learning process, curation of data from public and private sources and developing insights that can be modeled to represent biological processes within the RADR algorithms.

Lantern's portfolio of products includes multiple target populations below the 200,000 incidence per year threshold that is applicable to orphan drugs. If the company's candidates are granted orphan status and approved, they will receive seven years of exclusivity. The company's patents may be eligible for patent term extension, which restores time to the patent consumed during the FDA regulatory review process.

Additional patent applications have been filed, including three directed toward LP-184 as well as other novel, synthetic illudin analogs and two applications for LP-300. The claims are directed towards the use of biomarkers or sensitivity parameters to identify patients and predict response. As the company advances, it expects to continue to develop intellectual property related to its drug portfolio and precision, patient stratified targeted therapies and genomic or biomarker signatures.

Risks

All investments contain an element of risk which reflects the uncertainty of a business and what it will ultimately achieve. Some investments exhibit higher predictability, with current cash flows and established sales. These enterprises will have a lower level of perceived risk while other companies that are developing an undefined, new technology have a much higher level of perceived risk.

The biotechnology space includes companies at both ends of the spectrum, from mega-cap pharmaceutical powerhouses that have multiple products currently generating revenues, to small operations with a handful of employees conducting pre-clinical studies. Many of the risks faced by the large pharmaceutical companies and smaller biotechnology-focused firms are similar; however, there are some hazards that are particular to smaller companies that have not yet established themselves or their products. The typical risks faced by companies operating in the biotechnology space include risks related to liquidity, financing & trading, clinical trials, regulatory, personnel, intellectual property, marketing the therapy, and geopolitics.

Liquidity, Financing & Trading

Any company may find that securing funding may be difficult depending on where we are in the economic cycle. During periods of improving confidence, capital may be easy to obtain; however, during a liquidity crisis or a period of heightened risk perception, even companies with bright prospects may be in trouble if they are dependent on the financial markets to fund their work. Pre-revenue biotech firms rely primarily on equity issuance to fund their operations. The duration of drug development is considerable, and can and can last over a decade before a product is sold. Funds can be sourced through debt or grants and tax credits; however, these sources may reduce the flexibility of the company and can create difficulties if debt is unable to be repaid.

If capital is required to sustain operations and it is not readily available, a company may be forced to suspend research and development, sell equity at a substantial discount to previous valuations and dilute earlier shareholders. A lack of funding may leave potentially promising therapies without a viable route forward or force a company to accept onerous terms. The recent pandemic has disrupted capital markets, and any economic effects may last well into the future.

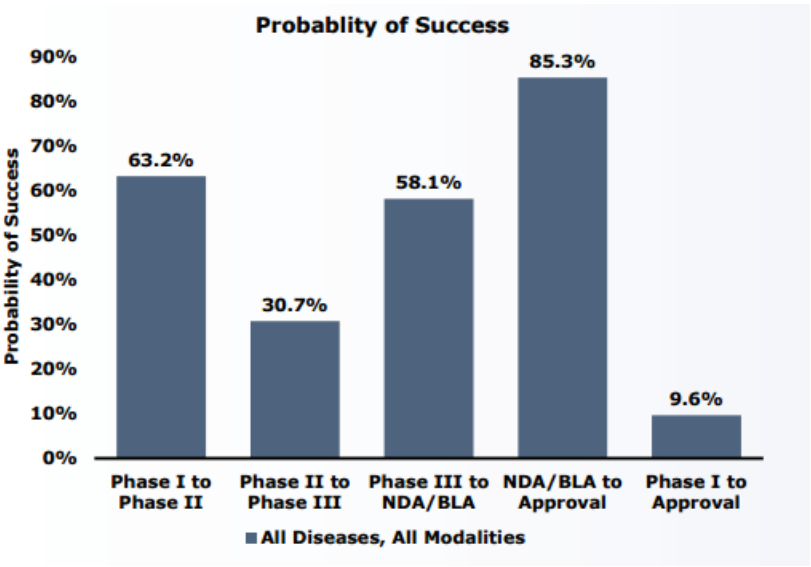
Trading volumes are lower for smaller biotech firms, creating liquidity risk for the investor and large transactions may have a material impact on share price. In periods of crisis or heightened risk perception, share price may be volatile. Companies with smaller capitalizations are typically considered riskier and changes in sentiment may adversely affect their trading prices and volumes. Smaller firms may also have less visibility, compete for investor dollars in a shallow market and be excluded from market indices.

Lantern has endured operational losses since inception and expects to continue to do so into the future. Lantern may fail to monetize its development programs and may never become profitable. Lantern recently raised $26.25 million in its initial public offering providing a runway of about two years. The funds will support advancement of planned studies including a Phase II trial for LP-300 in never-smoker adenocarcinoma NSCLC and IND enabling work for LP-184. While the effects on the capital markets related to COVID-19 were short lived in the first half of 2020, there may be longer term impacts to the economy and availability of capital. The global pandemic may also have a detrimental impact on clinical trials which may require sponsors to increase spending to provide additional safety protocols or result in the closure of clinical trial sites as the associated hospital addresses the health crisis. While Lantern has approximately two years of capital on the balance sheet, there is no guarantee that capital markets will support further raises after the current balance is consumed. Lantern carries no debt on its balance sheet other than a small paycheck protection program (PPP) loan.

Clinical Trials

For smaller early-stage companies, investing in drug development is a lengthy process. The timeframe for conducting pre-clinical research to eventually commercializing a drug can take from 12 to 15 years or even longer given market and company-specific conditions. And with, on average, only one in one thousand compounds eventually making it to the market from the preclinical stage, the risks are substantial.

Exhibit IX – Success of Phased Trials and Regulatory Approval[31]



The future of Lantern Pharmaceuticals is dependent on the data produced from expensive clinical trials. Due to the cost, magnitude and complexity typical of Phase III trials, partners are often sought to help finance and manage them. Partners may have competing demands which can adversely affect the work they are managing on behalf of the firm. CROs and subcontractors must abide by strict execution and trial parameters that if violated can jeopardize trial execution or data validity. Patient recruitment may be difficult. Subcontractors supervise and execute research, biometric and pharmacovigilance, which are complex tasks. Clinical investigational centers need sufficient capacity and the candidate drug needs to be manufactured in compliance with current Good Manufacturing Practices (cGMP) and be available to administer. Finally, the data itself needs to achieve statistical significance to justify regulatory approval.

Lantern's proprietary platform RADR seeks to decrease the risk associated with clinical trials. By identifying biomarkers that predict patient response, Lantern has developed a mechanism to increase the likelihood of therapy success in clinical trials. Despite all of the valuable work performed *in silico*, real world outcomes may differ. Furthermore, patient populations with the desired characteristics may be difficult to identify and enroll in clinical trials.

Lantern is in collaboration with Allarity Therapeutics, previously known as Oncology Venture, a European biotechnology company headquartered in Denmark. While the majority of risk is borne by Allarity Therapeutics for developing LP-100, the sponsor must succeed in its clinical programs in order to provide a return to Lantern. The company also relies on partners for preclinical wet-lab work. LP-300 is currently undergoing pre-clinical work in partnership with Fox Chase Cancer Center that is reliant on others for success.

Regulatory

Regulatory risk centers on clinical trial requirements, marketing approval of the candidate, expedited pathways and associated oversight. Regulations extend to post-marketing surveillance and pricing dynamics. Furthermore, biotechnology firms typically have a presence globally and must navigate the regulatory approval process, clinical trial requirements and marketing regulations in the jurisdiction where they seek to commercialize. Substantial expense is undertaken to bring a molecule or compound through clinical trials and address all of the regulatory agencies' concerns. Companies that have a long history of research success in drug development, with opinion leaders and experts advocating for the product in the field will have an advantage. Previous success with the FDA or other regulatory agencies is another attractive attribute for a sponsor.

Some accelerated pathways to approval are available such as those outlined in the Orphan Drug Act and the Breakthrough Therapy designation; however, changes in sentiment or perceived safety could change the regulatory environment to demand a more thorough process and these pathways may be extended or additional requirements may be put in place. Depending on the regulatory environment, government mandates can influence marketing dynamics as well. The US has experienced legislative disruption recently with the Patient Protection and Affordable

[31]Clinical Development Success Rates 2006-2015. David Thomas, Justin Burns, John Audette, Adam Carroll, Corey Dow-Hygelund, Michael Hay.

Care Act (PPACA) of 2010, amended by the Health Care and Education Reconciliation Act that imposes non-deductible excise tax on pharmaceutical manufacturers or importers that sell branded prescription drugs to government programs. Under the PPACA, some firms are required to provide a discount on branded prescription drugs. The PPACA increases the level of Medicaid rebates payable by manufacturers of brand-name drugs and requires collection of rebates for drugs paid by Medicaid managed care organizations.

Personnel

Biotechnology startups rely on the expertise and leadership of management to make decisions and investments on their behalf. Competition for talented and experienced management is intense and matching the optimal skill set with the right company is difficult. Change in management can be disruptive if leaders or scientists are lured away by other firms. Early stage biotech companies are often virtual and have a small team. This can put them at a disadvantage when compared to larger firms, with full-time specialized personnel. A smaller company with much of the upside tied to stock price may deter certain talent from joining the firm.

Lantern currently relies on partners to conduct preclinical research, and focuses its team on the management of the RADR platform. Following the capital raise from the IPO, Lantern is adding new personnel and larger teams will be required to advance the technology faster than the competition.

Intellectual Property

Despite the existence of patents and trade secrets, the loss of intellectual property is a risk. RADR is based on open source machine learning algorithms which are run on widely available cloud-based solutions, raising the risk that the platform could be imitated or replicated, especially by a larger firm with more resources. While this does not affect Lantern's current portfolio, competition for salvageable candidates may increase. Despite a patent application relating to the RADR technology, Lantern does not own patents on the system and largely relies on trade secrets to protect this intellectual property.

Market Risk

Successful marketing of approved drug candidates relies on the adoption by patients and providers. An approved drug must have convincing clinical trial data and maintain a favorable reputation amongst prescribers. Marketing is expensive and requires an experienced sales force and a presence in the marketing area. Marketed products remain under surveillance and any unexpected adverse effects may lead to regulatory authorities revoking marketing authorization. Insurance coverage is also important. Rapidly obtaining a preferred position on health plan and payor formularies is critical to achieving target penetration rates. If health plans and payors cannot agree on appropriate pricing for the drug and the compound fails to offer a significant benefit above standard of care, sales may be limited.

Geopolitical

Recent trade tensions between the US and China threaten the world economy, and have been exacerbated by the recent pandemic. There has been a cross-pollination of capital and drug development between China and the United States in recent years which may slow as a result of the trade and political dispute between the countries. This conflict may reduce the availability of capital, partnerships and future development deals between companies in the two nations. The UK withdrew from the European Union on January 31, 2020. Previously, a drug approved under the centralized procedure in the European Union would be approved in all member states. However, with the withdrawal of the UK additional efforts and expense may be required to obtain marketing approval in this top five European market.

Peers and Competitors

Lantern is both an oncology company and a technology company, competing against and collaborating with other firms at the intersection of life sciences and artificial intelligence. The company's most advanced candidates are pursuing indications in metastatic castration resistant prostate cancer (mCRPC) and never-smoker non-small cell lung cancer (NSCLC).

There are over 400 companies developing drug candidates either directly or indirectly using artificial intelligence (AI) and machine learning (ML), many of which are small, private startups. There are many ways to apply AI and ML in the field of medicine including drug discovery, metabolic pathway modeling, target identification, ADMET[32], biomarker identification, drug repurposing and patient screening. Often, companies apply a mix of the above, using various public and proprietary datasets. Some focus specifically on the AI platform, seeking to partner with drug development companies while others, such as Lantern, primarily use AI to identify candidates to develop internally. Falling outside the realm of ML, some companies such as Schrödinger or Nimbus Therapeutics use computer simulation of molecular physics to discover, optimize or predict drug efficacy. Lantern's RADR ML platform identifies biomarkers and genetic signatures of patient sub-populations that respond to therapies, allowing Lantern to rescue failed drug candidates and expedite the clinical process.

Large biopharma firms have also taken steps toward implementing AI in the clinic. In October 2019, Novartis and Microsoft announced a partnership applying AI to medical datasets, especially for personalized medicine and the production of cell and gene therapies. In 2016, Pfizer and IBM Watson announced a partnership to accelerate drug discovery in immuno-oncology. In 2017, Sanofi and Exscientia partnered to use AI to help identify and design drugs for metabolic diseases. Exscientia also partnered with GSK, finding its first candidate molecule in April 2019. Even Amazon's Comprehend Medical tool is being tried by Roche to match patients to available clinical trials. Google has collaborated with DeepMind to build AlphaFold, a model that can predict protein folding and structure to guide drug development.

AI/ML applications in medicine and healthcare are still early phase, yet have exploded in number and diversity. While there is an abundance of data, the key will be to clean, curate and create relationships among datasets. This is a formidable and time-consuming endeavor, as data structure varies greatly between sources, and relationships formed between sets are practically limitless. Some firms may have access to proprietary datasets that may give them an edge.

[32] Adsorption, distribution, metabolism and excretion, toxicity in pharmacokinetics.

Exhibit X – Public Companies[33,34]

Ticker	Company	Price	MktCap (MM)	EV (MM)	Therapeutic Area
ABBV	Pharmacyclics	$87.70	$154,776	$230,797	Bruton's tyrosine kinase inhibitor for cancer
AGEN	Agenus	$4.35	$798	$738	Immuno-oncology
AGIO	Agios Pharma	$35.61	$2,461	$1,671	Small molecule targeting growth factor pathway in cancer
BAYRY	Bayer	$13.77	$51,365	$82,459	Regorafenib for GBM
BTAI	BioXcel Tx.	$48.02	$1,073	$1,008	Repurpose existing drugs using AI
BDTX	Black Diamond	$33.78	$1,213	$1,009	Uses MAP platform to target oncogenic mutations.
CLDX	Celldex Tx	$17.13	$670	$463	Antibody and protein based therapy for cancer/Rindopepimut
CLVS	Clovis Oncology	$5.68	$501	$817	Cancer treatments with focus on precision medicine
EPZM	Epizyme	$12.45	$1,263	$1,046	Epigenetic medicines for cancer
ETX	e-Therapeutics	15.25	$64	$60	Analyze complex networks of molecular interactions in cells.
GRTS	Gritstone Onc.	$3.00	$113	$21	Predict immune targets for cancer immunotherapy.
IMGN	ImmunoGen	$4.82	$841	$624	Antibody-drug conjugates for treatment of cancer
IMUCD	ImmunoCellular Tx	$0.35	$1	-$2	Stem-cell derived T-cells/ICT-107
INCY	Incyte	$95.74	$20,938	$19,381	Oral JAK1/JAK2 inhibitors for rheumatoid arthritis
INFI	Infinity Pharma	$1.17	$69	$26	Oral P3K-gamma inhibitor for cancers
INO	Inovio	$12.31	$2,062	$1,770	INO-5401 in Ph2 for GBM with Regeneron
KTRA	Kintara Therap	$1.66	$39	$42	Developing VAL083 for GBM
KPTI	Karyopharm Tx	$14.83	$1,090	$905	Nuclear export inhibition for cancer
MACK	Merrimack Pharma	$3.97	$53	$37	Liposomal irinotecan for pancreatic adenocarcinoma
MGNX	MacroGenics	$25.46	$1,378	$1,145	DART,TRIDENT & FC optimization platforms for Ab engineering
MREO	OncoMed Pharma	$2.22	$158	$136	Anti-TIGIT monoclonal antibody for pancreatic cancer
MRK	Merck	$80.36	$203,250	$218,303	Temodar (GBM)
NBIO	Nascent Biotech	$0.06	$4	$4	Ecto-domain vimentin targeting antibodies
NVS	Endocyte	$88.39	$202,298	$219,960	Small molecule drug conjugates
NWBO	Northwest BioTx	$0.83	$646	$640	Dendritic cell-based immunotherapy for cancer/CDVax-L
PBYI	Puma Bio	$10.01	$397	$378	Antibodies for cancer
PFE	BIND Tx	$36.79	$204,438	$232,173	Accurins targeting hematological and solid tumors
PNEXF	Pharnext	$3.65	$62	$71	Screen and reposition known drugs in unrelated indications.
RHHBY	Genentech	$44.03	$299,030	$308,610	Avastin (GBM)
RLAY	Relay Tx.	$42.15	$3,792	$3,500	Understand how protein shape influences health and disease.
SDGR	Schrödinger	$56.72	$3,591	$3,306	Ideate, optimize, and analyze drug candidates.
SENS	Sensyne Health	$0.40	$97	$136	Novel target and patient screening using AI.
SGEN	Seattle Genetics	$200.78	$34,935	$34,039	Monoclonal-antibody-drug conjugates for treatment of cancer
TKPHF	ARIAD Pharma	$35.65	$53,910	$96,120	Iclusig for Ph+ CML or ALL
ZIOP	Ziopharm Oncology	$2.81	$602	$448	Engineered T Cells targeting patient-unique neoantigens
LTRN	Lantern Pharma	$20.11	$125.0	$101.3	Rescuing failed drugs using AI to identify responsive populations

[33] https://blog.benchsci.com/startups-using-artificial-intelligence-in-drug-discovery
[34] Price as of October 9, 2020

Exhibit XI – Private Companies[35]

Company	Therapeutic Area
3BIGS	Discover relationships between diseases, targets, and drugs
AI Therapeutics	Next-gen sequencing for patient selection
Ariana Pharma	AI driven patient screening
Atomwise	Computer aided drug design
Auransa	Novel target and patient subgroup identification
Beactica	Small-molecule allosteric LSD1 modulators
BenevolentAI	Drug discovery using AI & computational medicine
Berg	Data analysis for novel biomarkers and targets
BioSymetrics	Process raw phenotypic, imaging, drug, and genomic data sets
Biovista	MOA analysis between compounds, targets, and diseases
Boston Biomedical	Cancer stemness pathways and tumor antigens
BullFrog AI	Predict which patients will respond to therapies in development
Cambridge Cancer Genomics	Precision oncology and biomarker discovery
Cellarity	Uncover metabolic behaviors modeling biology and drug actions
Coral Genomics	Predict patient response to drugs from genomic data
Deep Genomics	Genetic and biomarker driven drug development
Delta 5	Conduct in silico screening prior to experimental screening
Empirica Tx	CD133-targeting CAR-T cell therapy
Empirico	Analyze data from thousands of studies and millions of people
Engine Biosciences	Gene interactions and biological networks for drug discovery
Envisagenics	Analyze RNA data to identify new biomarkers and drug targets
Erasca	Elucidate novel tumor biology that shut down cancer pathways
Exscientia	Learn best-practices from drug discovery data
Genialis	Multi-omics next-generation sequencing data for precision medicine
Healx	Match existing drugs with rare diseases
Innoplexus	Insights from billions of data points from thousands of sources
Insiliance	Analyze data from consolidated health databases
Molecular Health	Predict clinical trial success and guide precision medicine
NetraMark	Understand how patient subpopulations respond to treatments
NuMedii	AIDD for drug, target and biomarker elucidation
Oncocross	Analyze gene expression patterns
OneThree Biotech	Analyze chemical, biological, and clinical data
Owkin	Federated learning for patient screening and clinical prediction
Precisionlife	Precision medicine for complex diseases
Recursion	Machine learning for drug discovery

[35] https://blog.benchsci.com/startups-using-artificial-intelligence-in-drug-discovery

Management Profiles

Panna Sharma, Chief Executive Officer, President and Director

Mr. Sharma began serving as CEO and President of Lantern in July 2018. He has served as a director since August 2018. Mr. Sharma brings a wealth of leadership experience, especially in both the oncology and data science space. From May 2010 to February 2018, he served as President, CEO and director of NASDAQ-listed Cancer Genetics, a company specializing in DNA-based cancer diagnostics and services. In 2001, Mr. Sharma founded TSG Partners, focused on corporate strategy and finance advising to companies in life science, biotech and environmental science. Before founding TSG, Mr. Sharma served as Senior Vice President of E-Business Solutions and Chief Strategy Officer at iXL Inc. For the six years prior, Mr. Sharma helped found, manage and exit two consulting and professional services firms. From 1996 to 1998, he was a partner at Interactive Solutions, Inc. after serving as a consultant to Putnam Investment Management, LLC and Bank of America. Mr. Sharma holds a Bachelor of Science with a concentration in neural networks and artificial intelligence from Boston University.

David R. Margrave, Chief Financial Officer and Secretary

Mr. Margrave has served as CFO since November 2019 and as Secretary since June 2018. Mr. Margrave brings decades of legal, life science, and executive experience to Lantern. Before joining Lantern, Mr. Margrave served as a life science consultant, starting in January 2016, supporting life science companies in strategic and legal matters. In over two decades spanning 1995 to 2015, Mr. Margrave served as an executive officer at BioNumerik Pharmaceuticals, Inc., a life science company working in the oncology space before continuing on as a consultant to BioNumerik in 2016. Margrave has also served as Senior Legal Advisor to MedCare Investment Corporation. Before joining BioNumerik, Mr. Margrave was a partner at Andrews & Kurth LLP. He currently serves as Chairman on the board of the Texas Healthcare and Bioscience Institute, and also serves as Chairman and member of the board of the State of Texas Product Development & Small Business Incubator Board. In the past, he has served on the board of Texas Technology Transfer Association. Mr. Margrave holds his bachelor's in economics and petroleum engineering from Stanford University and a Juris Doctor from the University of Texas School of Law.

Kishor G. Bhatia, Ph.D., Chief Scientific Officer

Dr. Bhatia joined Lantern in December 2019 as CSO and has served as scientific consultant since January 2019. He also serves as a scientific consultant to Reprocell since December 2016, and Cancer Genetics, Inc. from December 2016 to November 2019. As of 2006, Dr. Bhatia has served as Adjunct Investigator with the National Cancer Institute (NCI) - Division of Cancer Epidemiology and Genetics. From 2007 until 2016, Dr. Bhatia also served as director of the AIDS Malignancy Program at the NCI, Office of HIV and AIDS Malignancy. From 2004 to 2007, he served as Program Director and Director of HIV and Cancer at NCI, Division of Cancer Treatment and Diagnosis. Dr. Bhatia received a Bachelor of Science in microbiology from the University of Pune and a Ph.D. in biochemistry from the University of Mumbai. He is a Fellow of the Royal College of Pathology, and was a Post-Doctoral Fellow at Johns Hopkins University and a Research Assistant Professor at Georgetown University.

Financial & Operational Results

Corporate Milestones

Lantern will be conducting multiple clinical trials for guided chemotherapy in various indications. Below we list key recent and future milestones.

- First patient dosed with LP-100 - 4Q:18
- Announced collaboration with NCI to identify response-predictive gene signatures - October 4Q:19
- IPO and initiation of trading on the NASDAQ – June 10, 2020
- Regulatory interaction for Phase II trial design, LP-300 – 2H:20
- Phase II of LP-100 in mCRPC readout – 1H:21
- Phase II launch of LP-300 – mid-2021
- Phase I launch of LP-184 – 4Q:21 to 1Q:22
- Amass > 1 billion data points for RADR – 2H:21

On June 10, 2020, Lantern Pharma announced the pricing of its IPO which was set at $15 per share. 1.75 million shares were issued yielding $26.25 million in gross proceeds. ThinkEquity, a division of Fordham Financial Management, acted as sole book-running manager for the offering. Colliers Securities LLC and Paulson Investment Company acted as co-managers for the offerings. Later in the month, Lantern announced that it would present two posters at the upcoming American Association for Cancer Research (AACR) 2020 Virtual Annual Meeting, taking place June 22-24, 2020. The first poster, "LP-184, a molecule with nanomolar potency, exhibits strong activity in lung cancers with KEAP1 and KRAS mutations," emphasized LP-184's nanomolar potency and activity in tumors resistant to multiple drugs. The second poster entitled "Machine learning-derived gene signature predicts strong sensitivity of several solid tumors to the alkylating agent LP-184," highlighted Lantern's use of ML, specifically artificial neural networks (ANN), to identify a genomic signature with high predictive ability of LP-184 across varied solid tumors and central nervous system (CNS) cancers, used to guide therapy. At the end of June, Lantern announced it had surpassed 450 million curated data points for its RADR platform used to train the company's proprietary AI and machine-learning platform.

In its first quarterly filing since going public, Lantern reported second quarter earnings on July 30. The company held its inaugural conference call sharing its strategy, objectives and recent accomplishments highlighting the close of the IPO, surpassing the hurdle of 500 million data points and advancing its manufacturing capabilities. Lantern initiated multiple preclinical studies for LP-184 in genomically defined solid tumors and glioblastoma multiforme.

At the end of the second quarter, Lantern held $23.8 million in cash on its balance sheet. No revenues were generated for this clinical stage company and operating expenses totaled $833,000 during the three month period ending June 30. General and administrative expenses were $676,000, up 152% year-over-year, on account of higher labor expense ($86,000), increases in NASDAQ and filing fees ($44,000), professional fee increases ($79,000), insurance expense increases ($139,000) and stock option increases ($99,000). These amounts were partially offset by a decrease in travel and relocation expense ($48,000). Research and development expenses were $157,000, falling from prior year levels of $361,000. The decrease was due to reductions in product candidate manufacturing costs, reduction in preclinical and clinical expenses that were offset by a rise in non-manufacturing related consulting expenses. The firm produced a net loss in 2Q:20 of ($833,000) or ($0.31) per share.

Cash burn for the first six months of the year was ($1.2) million offset by cash from financing of $23.8 million.

Valuation

Lantern Pharma is an oncology research and development company that uses artificial intelligence (AI) and machine learning (ML) to salvage drugs by identifying responsive subpopulations from failed clinical trials. The company has three compounds in its pipeline; however, the majority of the company's value is derived from its LP-300 program in non- or never smoker non-small cell lung cancer (NSCLC). As the number of smokers has declined, so has the number of smoking related lung cancer deaths. However, the overlooked non- or never smoker component of this group which makes up 10% to 15% of total NSCLC deaths has a distinguishable genetic profile which has been ignored as sponsors pursue therapies that address the larger market. Through the use of its RADR platform, Lantern has identified LP-300's efficacy in the non- and never smoker population based on data generated in a broader population. As LP-300 had previously been cleared for clinical trials by the FDA and there is substantial safety data available, Lantern has a tremendous head start for the development of this previously abandoned compound. The company is now preparing LP-300 for a Phase II clinical trial that is expected to stratify patients based on biomarkers.

Lantern has partnered LP-100, which is currently being developed by Allarity Therapeutics. The agreement with Allarity provides the option to either receive $14 million in milestones or an alternate payment structure in the case that Allarity or the LP-100 program is acquired.[36] Lantern will also receive royalties in the single digit range on sales of LP-100. To estimate this value, we assume penetration of 50% in 2025 to peak penetration of 110% in 2030 then to 10% in 2036 of average global drug revenues of $435 million.[37] We assume that Lantern receives a 5% royalty from net revenues of LP-100. While the alternate payment structure may yield a greater benefit, until additional details are available we assume Lantern will select the upfront $14 million in milestones. As with the milestones, Lantern may elect to receive a low seven figure dollar amount which is to be paid on acquisition of the program by another entity. Based on the royalty and milestones identified, and the development stage of LP-100, we apply a 25% probability of success for the drug and discount the cash flows to present at a 15% rate.

Although there are more deaths from lung cancer than from any other type, the non- or never smoker NSCLC population comprises only about 10% to 15% of the total. This suggests about 14,000 cases in the US and 19,000 in Europe. Due to the focus of most therapies on the broad NSCLC population, they are not tailored to maximize efficacy in the non- or never smoker population which features a different set of mutations as compared to smoking-related lung cancer. As the incidence of smoking has declined, the non-smoking subpopulation has become more visible and is in need of targeted therapies. We forecast target population growth of 0.6% in the US and 0.4% in the EU and 1.0% in the rest of the world.

LP-300 is expected to enter a Phase II study in mid-2021 and hold an end of Phase II meeting with the FDA allowing a Phase III study to be launched in 2023. We see the Phase III as a two year endeavor producing study analysis by 2025, after which an NDA will be filed. Assuming approval is granted, commercialization will begin in 2026 in the United States, 2027 in Europe due to pricing negotiations and in 2028 in other global markets.

In our discounted cash flow (DCF) model, we forecast an addressable market for NSCLC adenocarcinoma for never smokers of about 14,000 in the US, 19,000 in Europe and just under 90,000 in the rest of the world. Since the majority of patent protection will have expired, we expect that new chemical entity exclusivity will provide the primary intellectual property protection. This is expected to be five years in the US and 11 years in the EU.

In the US, we project the year one penetration of LP-300 to be 33% rising to 45% by the fourth year and remaining there until exclusivity ends. We estimate pricing for LP-300 will be more in line with novel chemotherapies rather than immunotherapies and forecast a $96,000 cost per treatment by the first year of sales in 2026. Drug price inflation is estimated to be 3% per annum.

In the EU, we forecast a similar trajectory of market penetration as we do in the US, but with sales starting in 2027 due to an anticipated delay to negotiate pricing country by country. In the first year, 25% penetration is expected, rising to 45% by the fourth year. Sales will continue at this level until year 11. Pricing is expected to be half the level in the US and at approximately $46,000 per treatment in 2027 growing at a 3% pace per annum.

Individuals of Asian heritage are particularly susceptible to lung cancer in never-smokers (LCINS) and also comprise the largest market for a successful LP-300. We anticipate a 2028 launch of LP-300 in Asian and other

[36] If Allarity were acquired, Lantern has the option to receive an undisclosed percentage of the transaction value.
[37] Tay-Teo, K. et al. Comparison of Sales Income and Research and Development Costs for FDA-Approved Cancer Drugs Sold by Originator Drug Companies. JAMA Netw Open . 2019 Jan; 2(1): e186875.

global regions outside of the US and Europe. We conservatively assume an addressable market of ~90,000 in 2020, growing at 1% per annum. Pricing is also expected to be below levels in the US and the EU and we forecast prices at on average one-third of the level in the United States.

Our model expects Lantern to sell commercialization rights to a partner with a sales force already in place for an all-in 35% of net revenues royalty. This amount includes any upfront or milestone amounts that may be part of the agreement. Lantern owes a variable low double digit royalty to BioNumerik that we estimate at a fixed 15%. Following an estimated recovery of $40 million in development costs for LP-300, we assume a net royalty of about 20% overall. Following commercialization of LP-300 we only estimate minimal operating costs; however, when follow-on compounds enter the clinic we will layer on associated operating costs and update our valuation.

We use a DCF model to value Lantern's cash flows using a 15% discount rate and a 25% probability of ultimate commercialization. Cash taxes are estimated at 26%, which consists of 21% federal and 5% state and local which will be recognized when net operating losses are exhausted. We assume outstanding options and warrants are exercised, and add resulting cash to the balance sheet.

The result of our forecasts and estimates generates a valuation and present value of Lantern Pharma of $28.00 per share.

Conclusion

Lantern Pharma is a company building the intersection of artificial intelligence (AI) and medicine using its proprietary Response Algorithm for Drug Positioning and Rescue (RADR) AI platform. The company now has over 500 million curated, oncology-focused data points that it can leverage to identify new indications for partially developed drugs. Lantern's strategy is to rescue failed drugs through the use of its AI, machine learning (ML) and genomic data platform.

The company's portfolio consists of LP-100, LP-300 and LP-184. LP-100 (Irofulven) is an acylfulvene class chemotherapy targeting metastatic castration-resistant prostate cancer (mCRPC) which is the primary cause of prostate cancer deaths. Prostate cancer is one of the most common cancers in men and many patients progress despite existing treatments. LP-100 has been outlicensed to Allarity Therapeutics with Lantern eligible for milestone payments and royalties. LP-300 is a cysteine-modifying compound with a multi-pronged mechanism of action targeting never-smoker adenocarcinoma non-small cell lung cancer (NSCLC). Lung cancer in never-smokers (LCINS) affects women more than men and has a higher incidence in those of Asian descent. The addressable population is conservatively 120,000 around the globe and lacks a targeted therapy. Lantern will launch a Phase II trial of LP-300 in tandem with current standard of care next year and is pursuing orphan status for the indication. Lantern is also developing LP-184, another acylfulvene compound, demonstrating *in vitro* nanomolar potency, targeting glioblastoma and multiple solid tumors which share a common signature. Lantern will conduct IND-enabling studies in 2021 and is expected to submit an IND and launch a Phase I by 1H:22. With the recent IPO that raised approximately $26 million, Lantern now has the funds to advance LP-300.

Because never-smoker NSCLC is distinct from smoking NSCLC, treatments that focus on the broad lung cancer population may not fully address the disease. We think penetration into this market can be relatively high given the small population and what we expect will be a differentiated impact on overall survival. LP-300 may be commercialized by a partner and we see penetration into the US, EU and rest of world with this precision agent.

Beyond LP-300, the company has another candidate in reserve, LP-184, which has shown early promise in a number of cancers. This and other yet to be acquired candidates will continue to feed the pipeline taking advantage of AI's ability to identify biomarkers and subpopulations that can benefit from previously failed drugs.

Lantern recently raised approximately $26 million through an IPO, supplying funds to advance LP-300 into a Phase II and LP-184 into the clinic, and sustain the firm for the next two years. Lantern has several catalysts over the next few years which should increase valuations including increasing the number of data points for its platform, entering the clinic with LP-300 and LP-184 and adding new candidates to the pipeline. Drug development is expensive, takes a long time to get to approval and has a low success rate. By adding AI to the mix, Lantern may be able to reverse some of these pressures on the industry and find new treatments to help patients.

Key reasons to own Lantern Pharma Inc. shares:

- **Proprietary RADR AI-driven algorithm for detecting genetic/biomarker signatures**
- **Opportunities to salvage failed drugs, for which safety has already been clinically validated**
- **Declining returns and smaller end markets can benefit from improved drug development approaches that leverage AI**
    - **Build from existing preclinical and clinical work**
    - **Pursue orphan indications and personalized medicine**
    - **Generate pivotal data with less expensive, targeted trials**
    - **Use modeling and complex algorithms to reduce failure risk**
- **Two years of financial runway**

Based on our analysis of Lantern's portfolio interest in LP-100 and commercialization of LP-300 around the globe, we see a pathway forward for commercialization in the US, EU and Asia. The company holds other assets in its portfolio that may ultimately provide more value. We will adjust the model to reflect this change and the related catalysts that take place. We initiate on Lantern Pharma with a valuation of $28.00 per share.

PROJECTED FINANCIALS

Lantern Pharma, Inc. - Income Statement

Lantern Pharma Inc.	2019 A	Q1 A	Q2 A	Q3 E	Q4 E	2020 E	2021 E	2022 E
Total Revenues ($US)	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
General & Administrative	$1,475	$340	$676	$900	$1,000	$2,917	$3,300	$3,383
Research & Development	$953	$137	$157	$900	$1,300	$2,494	$6,500	$6,100
Income from operations	($2,428)	($477)	($833)	($1,800)	($2,300)	($5,411)	($9,800)	($9,483)
Pre-Tax Income	($2,428)	($477)	($833)	($1,800)	($2,300)	($5,411)	($9,800)	($9,483)
Provision for Income Tax		$0	$0	$0	$0	$0	$0	$0
Tax Rate	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*
Net Income	**($2,428)**	**($477)**	**($833)**	**($1,800)**	**($2,300)**	**($5,411)**	**($9,800)**	**($9,483)**
Reported EPS	**($1.23)**	**($0.24)**	**($0.31)**	**($0.29)**	**($0.36)**	**($1.25)**	**($1.52)**	**($1.41)**
Basic Shares Outstanding	1,978	2,021	2,719	6,250	6,350	4,335	6,460	6,725

Source: Company Filing // Zacks Investment Research, Inc. Estimates

HISTORICAL STOCK PRICE

Lantern Pharma, Inc. – Share Price Chart[38]

[38] Source: Zacks Research System

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