Lightwave Logic, Inc.
Form 424B3
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Registration No 333-229433

PROSPECTUS

9,500,000 Shares of Common Stock

This prospectus relates to the resale of up to 9,500,000 shares of the common stock, par value $0.001 per share (Common Stock) of Lightwave Logic, Inc. (Company , us or we) which may be offered by the selling securityho identified in this prospectus from time to time. 9,500,000 shares (including 1,162,500 commitment shares) have been or may be issued pursuant to a purchase agreement between Lincoln Park and the Company, dated as of January 21, 2019 (the Purchase Agreement . See The Lincoln Park Transaction for a description of the Purchase Agreement, and Selling Securityholder for additional information regarding Lincoln Park.

We previously filed a registration statement on Form S-3 (File No. 333-224614) (the Prior Registration Statement) filed with the Securities and Exchange Commission on January 30, 2018 and declared effective on May 11, 2018. The Prior Registration Statement registered 21,705,326 shares of Common Stock including 5,563,343 shares that have been or may be issued pursuant to a purchase agreement between Lincoln Park and the Company, dated as of January 29, 2016 (the 2016 Purchase Agreement). As of January 22, 2019, 1,396,995 shares (including 246,995 commitment shares) registered under the Prior Registration Statement remain available for sale (or issuance) to Lincoln Park under the 2016 Purchase Agreement, which will terminate pursuant to its terms on April 30, 2019, after which time no further shares can be sold to Lincoln Park thereunder.

The registration of the shares hereunder does not mean that Lincoln Park will actually offer or sell the full number of the shares being registered pursuant to this prospectus. We will not receive any proceeds from the sales of shares of our Common Stock by Lincoln Park; however we may receive proceeds upon the sale of up to 8,337,500 purchase shares to Lincoln Park under the Purchase Agreement, which have not yet been sold.

Lincoln Park is an underwriter within the meaning of Section 2(a)(11) of the Securities Act. Lincoln Park may offer the securities registered hereunder directly or through agents or to or through underwriters or dealers. The securities may be offered and sold through public or private transactions at market prices prevailing at the time of sale, at a fixed price or fixed prices, at negotiated prices, at various prices determined at the time of sale or at prices related to prevailing market prices. See "Plan of Distribution" for more information about how Lincoln Park may sell the shares of Common Stock being registered pursuant to this prospectus.

Our Common Stock is currently quoted on the OTC Markets (OTCQB) under the symbol "LWLG". On January 22, 2019, the Company had 79,934,809 shares issued and outstanding, and the last reported sale price of our Common Stock was $0.74 per share.

We will pay the expenses incurred in registering the shares, including legal and accounting fees. See Plan of Distribution .

Investing in our securities involves a high degree of risk. See Risk Factors beginning on page 4 of this prospectus for a discussion of information that should be considered in connection with an investment in our securities.

Neither the Securities and Exchange Commission nor any state securities regulators have approved or disapproved of these securities or determined if this prospectus is truthful or complete. Any representation to the contrary is a criminal offense.

The date of this prospectus is February 13, 2019.

TABLE OF CONTENTS

You should rely only on the information contained in this prospectus. We have not, and the selling securityholder has not, authorized any person to provide you with different information. If anyone provides you with different or inconsistent information, you should not rely on it. This prospectus is not an offer to sell, nor is the selling securityholder seeking an offer to buy, securities in any state where the offer or solicitation is not permitted. The information contained in this prospectus is complete and accurate as of the date on the front cover of this prospectus, but information may have changed since that date. We are responsible for updating this prospectus to ensure that all material information is included and will update this prospectus to the extent required by law.

This prospectus includes statistical and other industry and market data that we obtained from industry publications and research, surveys and studies conducted by third parties. Industry publications and third-party research, surveys and studies generally indicate that their information has been obtained from sources believed to be reliable, although they

do not guarantee the accuracy or completeness of such information. While we believe that these industry publications and third-party research, surveys and studies are reliable, we have not independently verified such data and we do not make any representation as to the accuracy of the information.

PROSPECTUS SUMMARY

Our Company

We were incorporated under the laws of the State of Nevada on June 24, 1997 and in 2004 we acquired PSI-TEC Corp., and in 2006 we merged with PSI-TEC Corp. PSI-TEC Corp. was incorporated under the laws of the State of Delaware on September 12, 1995. In 2008 we changed our name to Lightwave Logic, Inc. Unless the context otherwise requires, all references to Lightwave the Company, we, our or us and other similar terms means Ligh Logic, Inc., a Nevada corporation.

Our principal executive office is located at 369 Inverness Parkway, Suite 350, Englewood, CO 80112, and our telephone number is (720) 340-4949. Our website address is www.lightwavelogic.com. No information found on our website is part of this prospectus.

Overview

Lightwave Logic, Inc. is a development stage company whose P^2IC^{TM} technology addresses advanced telecommunication, data communications, and data center markets utilizing its advanced organic electro-optic polymer systems. The Company currently has development activities in both polymer materials as well as device design.

Materials Development

The Company designs and synthesizes organic chromophores for use in its own proprietary electro-optic *polymer systems* and photonic device designs. A polymer system is not solely a material, but also encompasses various technical enhancements necessary for its implementation. These include host polymers, poling methodologies, and molecular spacer systems that are customized to achieve specific optical properties. Our organic electro-optic polymer systems compounds are mixed into solution form that allows for thin film application. Our proprietary electro-optic polymers are designed at the molecular level for potentially superior performance, stability and cost-efficiency. We believe they have the potential to replace more expensive, higher power consuming, slower-performance materials and devices used in fiber-optic communication networks.

Our patented and patent pending molecular architectures are based on a well-understood chemical and quantum mechanical occurrence known as *aromaticity*. Aromaticity provides a high degree of molecular stability that enables our core molecular structures to maintain stability under a broad range of operating conditions.

We expect our patented and patent-pending optical materials along with trade secrets and licensed materials, to be the core of and the enabling technology for future generations of optical devices, modules, sub-systems and systems that we will develop or potentially out-license to electro-optic device manufacturers. The Company contemplates future applications that may address the needs of semiconductor companies, optical network companies, Web 2.0 media companies, high performance computing companies, telecommunications companies, aerospace companies, and government agencies.

Device Design and Development

Electro-optic Modulators

The Company designs its own proprietary electro-optical modulation devices. Electro-optical modulators convert data from electric signals into optical signals that can then be transmitted over high-speed fiber-optic cables. Our modulators are electro-optic, meaning they work because the optical properties of the polymers are affected by electric fields applied by means of electrodes. Modulators are key components that are used in fiber optic telecommunications, data communications, and data centers networks etc., to convey the high data flows that have been driven by applications such as pictures, video streaming, movies etc., that are being transmitted through the internet. Electro-optical modulators are expected to continue to be an essential element as the appetite and hunger for data increases every year.

Polymer Photonic Integrated Circuits (P^2IC^{TM})

The Company also designs its own proprietary polymer photonic integrated circuits (otherwise termed a polymer PIC). A polymer PIC is a photonic device that integrates several photonic functions on a single chip. We believe that our technology can enable the ultra-miniaturization needed to increase the number of photonic functions residing on a semiconductor chip to create a progression like what was seen in the computer integrated circuits, commonly referred to as Moore s Law. One type of integration is to combine several instances of the same photonic functions such as a plurality of modulators to create a 4 channel polymer PIC. In this case, the number of photonic components would increase by a factor of 4. Another type is to combine different types of devices including from different technology bases such as the combination of a semiconductor laser with a polymer modulator. Our P^2IC platform encompasses both these types of architecture.

Current photonic technology today is struggling to reach faster device speeds. Our modulator devices, enabled by our electro-optic polymer material systems, work at extremely high frequencies (wide bandwidths) and possess inherent advantages over current crystalline electro-optic material contained in most modulator devices such as lithium niobate (LiNbO3), indium phosphide (InP), silicon (Si), and gallium arsenide GaAs). Our advanced electro-optic polymer platform is creating a new class of modulators and associated PIC platforms that can address higher data rates in a lower cost, lower power consuming manner, with much simpler modulation techniques.

Our electro-optic polymers can be integrated with other materials platforms because they can be applied as a thin film coating in a fabrication clean room such as may be found in semiconductor foundries. Our polymers are unique in that they are stable enough to seamlessly integrate into existing CMOS, Indium Phosphide (InP), Gallium Arsenide (GaAs), and other semiconductor manufacturing lines.

The Offering

Common stock outstanding prior to this offering (1)	79,934,809, including 350,000 commitment shares issued to Lincoln Park under the Purchase Agreement prior to the effectiveness of the registration statement of which this prospectus is a part (the Registration Statement).
Common Stock offered by the selling securityholder	Up to 9,500,000 shares of Common Stock, consisting of (i) 8,337,500 shares of Common Stock that may be issued to Lincoln Park as purchase shares under the Purchase Agreement, (ii) 350,000 commitment shares issued to Lincoln Park as initial commitment shares under the Purchase Agreement and (iii) 812,500 shares of Common Stock that may be issued to Lincoln Park as commitment shares under the Purchase Agreement following the effectiveness of the Registration Statement of which this prospectus is a part.

Common stock to be outstanding after this offering	89,084,809 shares
Use of proceeds	We will receive no proceeds from the sale of shares of Common Stock by Lincoln Park in this offering. We may receive up to $25,000,000 aggregate gross proceeds under the Purchase Agreement from any sales we make to Lincoln Park pursuant to the Purchase Agreement. Any proceeds that we receive from sales to Lincoln Park under the Purchase Agreement will be used for working capital and general corporate purposes. See "Use of Proceeds".
OTC Markets (OTCQB) symbol	LWLG
Risk factors	This investment involves a high degree of risk. See Risk Factors for a discussion of factors you should consider carefully before making an investment decision.

(1)

The number of shares of our Common Stock set forth above is based on 79,934,809 shares of Common Stock outstanding as of January 22, 2019, and excludes options and warrants to purchase an aggregate of 19,334,867 shares of our Common Stock at exercise prices ranging from $0.57 - $1.69 per share with a weighted average exercise price of $0.90 per share.

The Lincoln Park Transactions

On January 21, 2019, the Company entered into the Purchase Agreement with Lincoln Park, pursuant to which Lincoln Park agreed to purchase from us up to $25,000,000 of our Common Stock (subject to certain limitations) from time to time over a 36-month period. In connection with the Purchase Agreement, the Company also entered into a registration rights agreement with Lincoln Park whereby the Company agreed to file registration statements, with the SEC covering the shares of the Company s Common Stock that may be issued to Lincoln Park under the Purchase Agreement. After the Registration Statement of which this prospectus is a part is declared effective, the Company may, from time to time and at its sole discretion, direct Lincoln Park to purchase up to 125,000 shares of our Common Stock on any such business day, which may be increased to up to 200,000 shares depending on certain conditions as set forth in the Purchase Agreement (and subject to adjustment for any reorganization, recapitalization, non-cash dividend, stock split, reverse stock split or other similar transaction as provided in the Purchase Agreement); provided that in no event shall Lincoln Park purchase more than $500,000 worth of our Common Stock on any single business day (each, a Regular Purchase). Under certain circumstances, we may also, in our sole discretion, direct Lincoln Park on each purchase date to make accelerated purchases on the following business day up to the lesser of (i) two (2) times the number of shares purchased pursuant to a Regular Purchase or (ii) 30% of the trading volume on the accelerated purchase date at a purchase price equal to the lesser of (i) the closing sale price on the accelerated purchase date and (ii) 95% of the accelerated purchase date s volume weighted average price. Except as described in this prospectus, there are no trading volume requirements or restrictions under the Purchase Agreement, and we control the timing and amount of any sales of our Common Stock to Lincoln Park. The purchase price of the up to 200,000 shares that may be sold to Lincoln Park under the Purchase Agreement on any business day will be based on the market price of our Common Stock immediately preceding the time of sale as computed under the Purchase Agreement without any fixed discount.

The purchase price per share will be equitably adjusted for any reorganization, recapitalization, non-cash dividend, forward or reverse stock split, or other similar transaction occurring during the business days used to compute such price. We may at any time in our sole discretion terminate the Purchase Agreement without fee, penalty or cost upon one business day s prior notice.

The Purchase Agreement contains customary representations, warranties, covenants, closing conditions and indemnification and termination provisions by, among and for the benefit of the parties. Lincoln Park has covenanted not to cause or engage in any manner whatsoever, any direct or indirect short selling or hedging of the Company s Common Stock. Lincoln Park may not assign or transfer its rights and obligations under the Purchase Agreement, and the Purchase Agreement may be terminated by the Company at any time at its discretion without any cost to the Company.

In consideration for entering into the Purchase Agreement, the Company issued to Lincoln Park 350,000 shares of Common Stock as a commitment fee and is obliged to issue up to an additional 812,500 commitment shares, pro rata for no consideration, when and if Lincoln Park purchases (at the Company s discretion) the $25,000,000 aggregate commitment. For example, if we elect, at our sole discretion, to require Lincoln Park to purchase $50,000 of our stock then we would issue 1,625 additional commitment shares, which is the product of $50,000 (the amount we have elected to sell) divided by $25,000,000 (remaining total amount we can sell Lincoln Park pursuant to the Purchase Agreement) multiplied by 812,500 (the total number of additional commitment shares). The additional commitment shares will only be issued pursuant to this formula if and when we elect at our discretion to sell stock to Lincoln Park.

Until the earlier of (i) April 30, 2019 (ii) such time as we terminate the 2016 Purchase Agreement, (iii) such time as all of the 1,396,995 purchase shares remaining available for purchase under the 2016 Purchase Agreement that are registered under the Prior Registration Statement have been sold to Lincoln Park, or (iv) the Prior Registration Statement is no longer effective, we may continue to direct Lincoln Park to purchase shares of Common Stock under the 2016 Purchase Agreement. After the occurrence of any of the above, and the Registration Statement of which this prospectus is a part has been declared effective, we will only sell shares of our Common Stock to Lincoln Park under the Purchase Agreement. See The Lincoln Park Transaction for additional description of the Purchase Agreement.

RISK FACTORS

Before you make a decision to invest in our securities, you should consider carefully the risks described below, together with other information in this prospectus. If any of the following events actually occur, our business, operating results, prospects or financial condition could be materially and adversely affected. This could cause the trading price of our Common Stock to decline and you may lose all or part of your investment. The risks described below are not the only ones that we face. Additional risks not presently known to us or that we currently deem immaterial may also significantly impair our business operations and could result in a complete loss of your investment.

Risks Related to our Business

We have incurred substantial operating losses since our inception and will continue to incur substantial operating losses for the foreseeable future.

Since our inception, we have been engaged primarily in the research and development of our electro-optic polymer materials technologies and potential products. As a result of these activities, we incurred significant losses and experienced negative cash flow since our inception. We incurred a net loss of $5,749,382 for the year ended December 31, 2017 and $4,509,172 for the nine months ended September 30, 2018. We anticipate that we will continue to incur operating losses through at least 2019.

We may not be able to generate significant revenue either through customer contracts for our potential products or technologies or through development contracts from the U.S. government or government subcontractors. We expect to continue to make significant operating and capital expenditures for research and development and to improve and expand production, sales, marketing and administrative systems and processes. As a result, we will need to generate significant revenue to achieve profitability. We cannot assure you that we will ever achieve profitability.

We are subject to the risks frequently experienced by early stage companies.

The likelihood of our success must be considered in light of the risks frequently encountered by early stage companies, especially those formed to develop and market new technologies. These risks include our potential inability to:

- Establish product sales and marketing capabilities;
- Establish and maintain markets for our potential products;
- Identify, attract, retain and motivate qualified personnel;
- Continue to develop and upgrade our technologies to keep pace with changes in technology and the growth of markets using polymer based materials;
- Develop expanded product production facilities and outside contractor relationships;
- Maintain our reputation and build trust with customers;
- Scale up from small pilot or prototype quantities to large quantities of product on a consistent basis;
- Contract for or develop the internal skills needed to master large volume production of our products; and
- Fund the capital expenditures required to develop volume production due to the limits of our available financial resources.

If we fail to effectively manage our growth, and effectively transition from our focus on research and development activities to commercially successful products, our business could suffer.

Failure to manage growth of operations could harm our business. To date, a large number of our activities and resources have been directed at the research and development of our technologies and development of potential related products. The transition from a focus on research and development to being a vendor of products requires effective planning and management. Additionally, growth arising from the expected synergies from future acquisitions will require effective planning and management. Future expansion will be expensive and will likely strain management and other resources.

In order to effectively manage growth, we must:

- Continue to develop an effective planning and management process to implement our business strategy;
- Hire, train and integrate new personnel in all areas of our business; and
- Expand our facilities and increase capital investments.

We cannot assure you that we will be able to accomplish these tasks effectively or otherwise effectively manage our growth.

We will require additional capital to continue to fund our operations and if we do not obtain additional capital, we may be required to substantially limit our operations.

Our business does not presently generate the cash needed to finance our current and anticipated operations. Based on our current operating plan and budgeted cash requirements, we believe that we have sufficient funds to finance our operations through May 2019. Although we expect that funds from the sale of purchase shares under the Purchase agreement will fund the Company in the near future, we may need to obtain additional future financing to finance our operations until such time that we can conduct profitable revenue-generating activities. We expect that we will need to seek additional funding through public or private financings, including additional equity financings, and through other arrangements, including collaborative arrangements. Poor financial results, unanticipated expenses or unanticipated opportunities could require us to obtain additional financing sooner than we expect. Other than with respect to the Purchase Agreements we entered into with Lincoln Park, we have no plans or arrangements with respect to the possible acquisition of additional financing, and such financing may be unavailable when we need it or may not be available on acceptable terms.

Our forecast of the period of time through which our financial resources will be adequate to support our operations is a forward-looking statement and involves risks and uncertainties, and actual results could vary as a result of a number of factors, including the factors discussed elsewhere in this Registration Statement. We have based this estimate on assumptions that may prove to be wrong, and we could use our available capital resources sooner than we currently expect.

Additional financing may not be available to us, due to, among other things, our Company not having a sufficient credit history, income stream, profit level, asset base eligible to be collateralized, or market for its securities. If we raise additional funds by issuing equity or convertible debt securities, the percentage ownership of our existing shareholders may be reduced, and these securities may have rights superior to those of our common stock. If adequate funds are not available to satisfy our long-term capital requirements, or if planned revenues are not generated, we may be required to substantially limit our operations.

We are entering new markets, and if we fail to accurately predict growth in these new markets, we may suffer substantial losses.

We are devoting significant resources to engineer next-generation organic nonlinear optical materials and devices for future applications to be utilized by electro-optic device manufacturers, such as telecommunications component and systems manufacturers, networking and switching suppliers, semiconductor companies, aerospace companies and government agencies as well as our proprietary photonic devices, such as our Polymer Photonic Integrated Circuits P^2IC^{TM}. We expect to continue to develop products for these markets and to seek to identify new markets. These markets change rapidly, and we cannot assure you that they will grow or that we will be able to accurately forecast market demand, or lack thereof, in time to respond appropriately. Our investment of resources to develop products for these markets may either be insufficient to meet actual demand or result in expenses that are excessive in light of actual sales volumes. Failure to predict growth and demand accurately in new markets may cause us to suffer substantial losses. In addition, as we enter new markets, there is a significant risk that:

- The market may not accept the price and/or performance of our products;
- There may be issued patents we are not aware of that could block our entry into the market or could result in excessive litigation; and
- The time required for us to achieve market acceptance of our products may exceed our capital resources that would require additional investment.

Our plan to develop relationships with strategic partners may not be successful.

Part of our business strategy is to maintain and develop strategic relationships with private firms, and to a lesser extent, government agencies and academic institutions, to conduct research and development of products and technologies. For these efforts to be successful, we must identify partners whose competencies complement ours. We must also successfully enter into agreements with them on terms attractive to us, and integrate and coordinate their resources and capabilities with our own. We may be unsuccessful in entering into agreements with acceptable partners or negotiating favorable terms in these agreements. Also, we may be unsuccessful in integrating the resources or capabilities of these partners. In addition, our strategic partners may prove difficult to work with or less skilled than we originally expected. If we are unsuccessful in our collaborative efforts, our ability to develop and market products could be severely limited.

The failure to establish and maintain collaborative relationships may have a materially adverse affect on our business.

We plan to sell many of our products directly to commercial customers or through potential industry partners. For example, we expect to sell our proprietary electro-optic polymer systems to electro-optic device manufacturers, such as telecommunications component and systems manufacturers, networking and switching suppliers, semiconductor companies, aerospace companies and government agencies. Our ability to generate revenues depends significantly on the extent to which potential customers and other potential industry partners develop, promote and sell systems that incorporate our products, which, of course, we cannot control. Any failure by potential customers and other potential industry partners to successfully develop and market systems that incorporate our products could adversely affect our sales. The extent to which potential customers and other industry partners develop, promote and sell systems incorporating our products is based on a number of factors that are largely beyond our ability to control.

We may participate in joint ventures that expose us to operational and financial risk.

We may participate in one or more joint ventures for the purpose of assisting us in carrying out our business expansion, especially with respect to new product and/or market development. We may experience with our joint venture partner(s) issues relating to disparate communication, culture, strategy, and resources. Further, our joint venture partner(s) may have economic or business interests or goals that are inconsistent with ours, exercise their rights in a way that prohibits us from acting in a manner which we would like, or they may be unable or unwilling to fulfill their obligations under the joint venture or other agreements. We cannot assure you that the actions or decisions of our joint venture partners will not affect our operations in a way that hinders our corporate objectives or reduces any anticipated cost savings or revenue enhancement resulting from these ventures.

If we fail to develop and introduce new or enhanced products on a timely basis, our ability to attract and retain customers could be impaired and our competitive position could be harmed.

We plan to operate in a dynamic environment characterized by rapidly changing technologies and industry standards and technological obsolescence. To compete successfully, we must design, develop, market and sell products that provide increasingly higher levels of performance and reliability and meet the cost expectations of our customers. The introduction of new products by our competitors, the market acceptance of products based on new or alternative technologies, or the emergence of new industry standards could render our anticipated products obsolete. Our failure to anticipate or timely develop products or technologies in response to technological shifts could adversely affect our operations. In particular, we may experience difficulties with product design, manufacturing, marketing or certification that could delay or prevent our development, introduction or marketing of products. If we fail to introduce products that meet the needs of our customers or penetrate new markets in a timely fashion our Company will be adversely affected.

Our future growth will suffer if we do not achieve sufficient market acceptance of our organic nonlinear optical material products or our proprietary photonic devices.

We are developing our proprietary electro-optic polymer systems to be utilized by electro-optic device manufacturers, such as telecommunications component and systems manufacturers, networking and switching suppliers, semiconductor companies, aerospace companies and government agencies, as well as our proprietary photonic devices, such as our Polymer Photonic Integrated Circuits P^2IC^{TM}. All of our potential products are still in the development stage, and we do not know when a market for these products will develop, if at all. Our success depends, in part, upon our ability to gain market acceptance of our products. To be accepted, our products must meet the technical and performance requirements of our potential customers. OEMs, suppliers or government agencies may not accept polymer-based products. In addition, even if we achieve some degree of market acceptance for our potential products in one industry, we may not achieve market acceptance in other industries for which we are developing products.

Achieving market acceptance for our products will require marketing efforts and the expenditure of financial and other resources to create product awareness and demand by customers. We may be unable to offer products that compete effectively due to our limited resources and operating history. Also, certain large corporations may be predisposed against doing business with a company of our limited size and operating history. Failure to achieve broad acceptance of our products by customers and to compete effectively would harm our operating results.

Our potential customers require our products to undergo a lengthy and expensive qualification process, which does not assure product sales.

Prior to purchasing our products, our potential customers will require that our products undergo extensive qualification processes. These qualification processes may continue for several months or more. However, qualification of a product by a customer does not assure any sales of the product to that customer. Even after successful qualification and sales of a product to a customer, a subsequent revision to the product, changes in our customer s manufacturing process or our selection of a new supplier may require a new qualification process, which may result in additional delays. Also, once one of our products is qualified, it could take several additional months or more before a customer commences volume production of components or devices that incorporate our products. Despite these uncertainties, we are devoting substantial resources, including design, engineering, sales, marketing and management efforts, to qualifying our products with customers in anticipation of sales. If we are unsuccessful or delayed in qualifying any of our products with a customer, sales of our products to a customer may be precluded or delayed, which may impede our growth and cause our business to suffer.

Obtaining a sales contract with a potential customer does not guarantee that a potential customer will not decide to cancel or change its product plans, which could cause us to generate no revenue from a product and adversely affect our results of operations.

Even after we secure a sales contract with a potential customer, we may experience delays in generating revenue from our products as a result of a lengthy development cycle that may be required. Potential customers will likely take a considerable amount of time to evaluate our products; it could take 12 to 24 months from early engagement by our sales team to actual product sales. The delays inherent in these lengthy sales cycles increase the risk that a customer will decide to cancel, curtail, reduce or delay its product plans, causing us to lose anticipated sales. In addition, any delay or cancellation of a customer s plans could materially and adversely affect our financial results, as we may have incurred significant expense and generated no revenue. Finally, our customers failure to successfully market and sell their products could reduce demand for our products and materially and adversely affect our business, financial condition and results of operations. If we were unable to generate revenue after incurring substantial expenses to develop any of our products, our business would suffer.

Many of our products will have long sales cycles, which may cause us to expend resources without an acceptable financial return and which makes it difficult to plan our expenses and forecast our revenue.

Many of our products will have long sales cycles that involve numerous steps, including initial customer contacts, specification writing, engineering design, prototype fabrication, pilot testing, regulatory approvals (if needed), sales and marketing and commercial manufacture. During this time, we may expend substantial financial resources and management time and effort without any assurance that product sales will result. The anticipated long sales cycle for

some of our products makes it difficult to predict the quarter in which sales may occur. Delays in sales may cause us to expend resources without an acceptable financial return and make it difficult to plan expenses and forecast revenues.

Successful commercialization of our current and future products will require us to maintain a high level of technical expertise.

Technology in our target markets is undergoing rapid change. To succeed in our target markets, we will have to establish and maintain a leadership position in the technology supporting those markets. Accordingly, our success will depend on our ability to:

- Accurately predict the needs of our target customers and develop, in a timely manner, the technology required to support those needs;
- Provide products that are not only technologically sophisticated but are also available at a price acceptable to customers and competitive with comparable products;
- Establish and effectively defend our intellectual property; and
- Enter into relationships with other companies that have developed complementary technology into which our products may be integrated.

We cannot assure you that we will be able to achieve any of these objectives.

One of our significant target markets is the telecommunications market, which historically has not accepted polymer modulators.

One of our significant target markets is the telecommunications market, which demands high reliability optical components. Historically, polymer modulators have not been accepted into this market even though polymer modulators have achieved Telcordia based specifications. It is clear that the telecommunications market is demanding higher and higher data rates for its optical components, and may again decide that polymer based modulators are not suitable even if higher data rates, high reliability, and low power consumption are demonstrated

Another of our significant target markets is the data communications (datacenter and/or high performance computing) market, which may be subject to heavy competition from other PIC based technologies such as silicon photonics and Indium Phosphide.

Another of our significant target markets is the data communications (datacenter and/or high performance computing) market, which may be subject to heavy competition from other PIC based technologies such as silicon photonics and Indium Phosphide. As the demands for high performance, low cost ($/Gbps) is implemented into next generation architectures, polymer modulators and polymer based PIC products may be subject to significant competition. Furthermore, there is a potential that technologies such as silicon photonics and Indium Phosphide might reach the might reach the metric of $1/Gbps at 400Gbps before ours. Customers may then be less willing to purchase new technology such as ours or invest in new technology development such as ours for next generation systems.

Our inability to successfully acquire and integrate other businesses, assets, products or technologies could harm our business and cause us to fail at achieving our anticipated growth.

We may grow our business through strategic acquisitions and investments, such as our acquistion of BrPhotonics polymer business, and we are actively evaluating acquisitions and strategic investments in businesses, products or technologies that we believe could complement or expand our product offering, create and/or expand a client base, enhance our technical capabilities or otherwise offer growth or cost-saving opportunities. From time to time, we may enter into letters of intent with companies with which we are negotiating potential acquisitions or investments or as to which we are conducting due diligence. Although we are currently not a party to any binding definitive agreement with respect to potential investments in, or acquisitions of, complementary businesses, products or technologies, we may enter into these types of arrangements in the future, which could materially decrease the amount of our available cash or require us to seek additional equity or debt financing. We have limited experience in successfully acquiring and integrating businesses, products and technologies. We may not be successful in negotiating the terms of any potential acquisition, conducting thorough due diligence, financing the acquisition or effectively integrating the acquired business, product or technology into our existing business and operations. Our due diligence may fail to identify all of the problems, liabilities or other shortcomings or challenges of an acquired business, product or

technology, including issues related to intellectual property, product quality or product architecture, regulatory compliance practices, revenue recognition or other accounting practices, or employee or customer issues.

Additionally, in connection with any acquisitions we complete, we may not achieve the synergies or other benefits we expected to achieve, and we may incur write-downs, impairment charges or unforeseen liabilities that could negatively affect our operating results or financial position or could otherwise harm our business. If we finance acquisitions using existing cash, the reduction of our available cash could cause us to face liquidity issues or cause other unanticipated problems in the future. If we finance acquisitions by issuing convertible debt or equity securities, the ownership interest of our existing stockholders may be diluted, which could adversely affect the market price of our stock. Further, contemplating or completing an acquisition and integrating an acquired business, product or technology could divert management and employee time and resources from other matters, which could harm our business, financial condition and operating results.

We may incur debt in the future that might be secured with our intellectual property as collateral, which could subject our Company to the risk of loss of all of our intellectual property.

If we incur debt in the future, we may be required to secure the debt with our intellectual property, including all of our patents and patents pending. In the event we default on the debt, we could incur the loss of all of our intellectual property, which would materially and adversely affect our Company and cause you to lose your entire investment in our Company.

Our quarter-to-quarter performance may vary substantially, and this variance, as well as general market conditions, may cause our stock price to fluctuate greatly and even potentially expose us to litigation.

We have generated no significant sales to date and we cannot accurately estimate future quarterly revenue and operating expenses based on historical performance. Our quarterly operating results may vary significantly based on many factors, including:

- Fluctuating demand for our potential products and technologies;
- Announcements or implementation by our competitors of technological innovations or new products;
- Amount and timing of our costs related to our marketing efforts or other initiatives;
- The status of particular development programs and the timing of performance under specific development agreements;
- Timing and amounts relating to the expansion of our operations;
- Product shortages requiring suppliers to allocate minimum quantities;
- Announcements or implementation by our competitors of technological innovations or new products;
- The status of particular development programs and the timing of performance under specific development agreements;
- Our ability to enter into, renegotiate or renew key agreements;
- Timing and amounts relating to the expansion of our operations;
- Costs related to possible future acquisitions of technologies or businesses; or
- Economic conditions specific to our industry, as well as general economic conditions.

Our current and future expense estimates are based, in large part, on estimates of future revenue, which is difficult to predict. We expect to continue to make significant operating and capital expenditures in the area of research and development and to invest in and expand production, sales, marketing and administrative systems and processes. We may be unable to, or may elect not to, adjust spending quickly enough to offset any unexpected revenue shortfall. If our increased expenses were not accompanied by increased revenue in the same quarter, our quarterly operating results would be harmed.

Our failure to compete successfully could harm our business.

The markets that we are targeting for our proprietary electro-optic polymer systems and photonic devices are intensely competitive. Most of our present and potential competitors have or may have substantially greater research and product development capabilities, financial, scientific, marketing, manufacturing and human resources, name recognition and experience than we have. As a result, these competitors may:

- Succeed in developing products that are equal to or superior to our potential products or that will achieve greater market acceptance than our potential products;
- Devote greater resources to developing, marketing or selling their products;
- Respond more quickly to new or emerging technologies or scientific advances and changes in customer requirements, which could render our technologies or potential products obsolete;
- Introduce products that make the continued development of our potential products uneconomical;
- Obtain patents that block or otherwise inhibit our ability to develop and commercialize our potential products;
- Withstand price competition more successfully than we can;
- Establish cooperative relationships among themselves or with third parties that enhance their ability to address the needs of our prospective customers.

The failure to compete successfully against these existing or future competitors could harm our business.

We may be unable to obtain effective intellectual property protection for our potential products and technology.

Our intellectual property, or any intellectual property that we have or may acquire, license or develop in the future, may not provide meaningful competitive advantages. Our patents and patent applications, including those we license, may be challenged by competitors, and the rights granted under such patents or patent applications may not provide meaningful proprietary protection. For example, numerous patents held by third parties relate to polymer materials and electro-optic devices. These patents could be used as a basis to challenge the validity or limit the scope of our patents or patent applications. A successful challenge to the validity or limitation of the scope of our patents or patent applications could limit our ability to commercialize our polymer materials technology and, consequently, reduce our revenues.

Moreover, competitors may infringe our patents or those that we license, or successfully avoid these patents through design innovation. To combat infringement or unauthorized use, we may need to resort to litigation, which can be expensive and time-consuming and may not succeed in protecting our proprietary rights. In addition, in an infringement proceeding a court may decide that our patents or other intellectual property rights are not valid or are unenforceable, or may refuse to stop the other party from using the intellectual property at issue on the ground that it is non-infringing. Policing unauthorized use of our intellectual property is difficult and expensive, and we may not be able to, or have the resources to, prevent misappropriation of our proprietary rights, particularly in countries where the laws may not protect these rights as fully as the laws of the United States.

We also rely on the law of trade secrets to protect unpatented technology and know-how. We try to protect this technology and know-how by limiting access to those employees, contractors and strategic partners with a need to know this information and by entering into confidentiality agreements with these parties. Any of these parties could breach the agreements and disclose our trade secrets or confidential information to our competitors, or these competitors might learn of the information in other ways. Disclosure of any trade secret not protected by a patent could materially harm our business.

We may be subject to patent infringement claims, which could result in substantial costs and liability and prevent us from commercializing our potential products.

Third parties may claim that our potential products or related technologies infringe their patents. Any patent infringement claims brought against us may cause us to incur significant expenses, divert the attention of our management and key personnel from other business concerns and, if successfully asserted against us, require us to pay substantial damages. In addition, as a result of a patent infringement suit, we may be forced to stop or delay developing, manufacturing or selling potential products that are claimed to infringe a patent covering a third party's intellectual property unless that party grants us rights to use its intellectual property. We may be unable to obtain these rights on terms acceptable to us, if at all. Even if we are able to obtain rights to a third party's patented intellectual property, these rights may be non-exclusive, and therefore our competitors may obtain access to the same intellectual property. Ultimately, we may be unable to commercialize our potential products or may have to cease some of our business operations as a result of patent infringement claims, which could severely harm our business.

If our potential products infringe the intellectual property rights of others, we may be required to indemnify customers for any damages they suffer. Third parties may assert infringement claims against our current or potential customers. These claims may require us to initiate or defend protracted and costly litigation on behalf of customers, regardless of the merits of these claims. If any of these claims succeed, we may be forced to pay damages on behalf of these customers or may be required to obtain licenses for the products they use. If we cannot obtain all necessary licenses on commercially reasonable terms, we may be unable to continue selling such products.

Our technology may be subject to government rights.

We may have obligations to government agencies in connection with the technology that we have developed, including the right to require that a compulsory license be granted to one or more third parties selected by certain government agencies. It may be difficult to monitor whether these third parties will limit their use of our technology to these licensed uses, and we could incur substantial expenses to enforce our rights to our licensed technology in the event of misuse.

The loss of certain of our key personnel, or any inability to attract and retain additional personnel, could impair our ability to attain our business objectives.

Our future success depends to a significant extent on the continued service of our key management personnel, particularly Dr. Michael Lebby, our Chief Executive Officer and James S. Marcelli our President, Chief Operating Officer, Secretary and Principal Financial Officer. Accordingly, the loss of the services of either of these persons would adversely affect our business and our ability to timely commercialize our products, and impede the attainment of our business objectives.

Our future success will also depend on our ability to attract, retain and motivate highly skilled personnel to assist us with product development and commercialization. Competition for highly educated qualified personnel in the polymer industry is intense. If we fail to hire and retain a sufficient number of qualified management, engineering, sales and technical personnel, we will not be able to attain our business objectives.

If we fail to develop and maintain the quality of our manufacturing processes, our operating results would be harmed.

The manufacture of our potential products is a multi-stage process that requires the use of high-quality materials and advanced manufacturing technologies. Also, polymer-related device development and manufacturing must occur in a highly controlled, clean environment to minimize particles and other yield and quality-limiting contaminants. In spite of stringent quality controls, weaknesses in process control or minute impurities in materials may cause a substantial percentage of a product in a lot to be defective. If we are not able to develop and continue to improve on our manufacturing processes or to maintain stringent quality controls, or if contamination problems arise, our operating results would be harmed.

The complexity of our anticipated products may lead to errors, defects and bugs, which could result in the necessity to redesign products and could negatively, impact our reputation with customers.

Products as complex as those we intend to market might contain errors, defects and bugs when first introduced or as new versions are released. Delivery of products with production defects or reliability, quality or compatibility problems could significantly delay or hinder market acceptance of our products or result in a costly recall and could damage our reputation and adversely affect our ability to sell our products. If our products experience defects, we may need to undertake a redesign of the product, a process that may result in significant additional expenses.

We may also be required to make significant expenditures of capital and resources to resolve such problems. There is no assurance that problems will not be found in new products after commencement of commercial production, despite testing by our suppliers, our customers and us.

If we decide to make commercial quantities of products at our facilities, we will be required to make significant capital expenditures to increase capacity.

We lack the internal ability to manufacture products at a level beyond the stage of early commercial introduction. To the extent we do not have an outside vendor to manufacture our products, we will have to increase our internal production capacity and we will be required to expand our existing facilities or to lease new facilities or to acquire entities with additional production capacities. These activities would require us to make significant capital investments and may require us to seek additional equity or debt financing. We cannot assure you that such financing would be available to us when needed on acceptable terms, or at all. Further, we cannot assure you that any increased demand for our potential products would continue for a sufficient period of time to recoup our capital investments associated with increasing our internal production capacity.

In addition, we do not have experience manufacturing our potential products in large quantities. In the event of significant demand for our potential products, large-scale production might prove more difficult or costly than we anticipate and lead to quality control issues and production delays.

We may not be able to manufacture products at competitive prices.

To date, we have produced limited quantities of products for research, development, demonstration and prototype purposes. The cost per unit for these products currently exceeds the price at which we could expect to profitably sell them. If we cannot substantially lower our cost of production as we move into sales of products in commercial quantities, our financial results will be harmed.

We conduct significantly all of our research and development activities at our Englewood, CO facility, and circumstances beyond our control may result in considerable interruptions.

We conduct significantly all of our research and development activities at our Englewood, CO facility. And although we have an agreement with have an agreement with CU Boulder to use their facilities in case of any contingency, a disaster such as a fire, flood or severe storm at or near one of our facilities could prevent us from further developing our technologies or manufacturing our potential products, which would harm our business.

We are subject to regulatory compliance related to our operations.

We are subject to various U.S. governmental regulations related to occupational safety and health, labor and business practices. Failure to comply with current or future regulations could result in the imposition of substantial fines, suspension of production, alterations of our production processes, cessation of operations, or other actions, which could harm our business.

We may be unable to export our potential products or technology to other countries, convey information about our technology to citizens of other countries or sell certain products commercially, if the products or technology are subject to United States export or other regulations.

We are developing certain polymer-based products that we believe the United States government and other governments may be interested in using for military and information gathering or antiterrorism activities. United States government export regulations may restrict us from selling or exporting these potential products into other countries, exporting our technology to those countries, conveying information about our technology to citizens of other countries or selling these potential products to commercial customers. We may be unable to obtain export licenses for products or technology, if they become necessary. We currently cannot assess whether national security concerns would affect our potential products and, if so, what procedures and policies we would have to adopt to comply with applicable existing or future regulations.

We may incur liability arising from the use of hazardous materials.

Our business and our facilities are subject to a number of federal, state and local laws and regulations relating to the generation, handling, treatment, storage and disposal of certain toxic or hazardous materials and waste products that we use or generate in our operations. Many of these environmental laws and regulations subject current or previous owners or occupiers of land to liability for the costs of investigation, removal or remediation of hazardous materials. In addition, these laws and regulations typically impose liability regardless of whether the owner or occupier knew of, or was responsible for, the presence of any hazardous materials and regardless of whether the actions that led to the presence were taken in compliance with the law. In our business, we use hazardous materials that are stored on site. We use various chemicals in our manufacturing process that may be toxic and covered by various environmental controls. An unaffiliated waste hauler transports the waste created by use of these materials off-site. Many environmental laws and regulations require generators of waste to take remedial actions at an off-site disposal location even if the disposal was conducted lawfully. The requirements of these laws and regulations are complex, change frequently and could become more stringent in the future. Failure to comply with current or future environmental laws and regulations could result in the imposition of substantial fines, suspension of production, alteration of our production processes, cessation of operations or other actions, which could severely harm our business.

Our data and information systems and network infrastructure may be subject to hacking or other cyber security threats. If our security measures are breached and an unauthorized party obtains access to our proprietary business information, our information systems may be perceived as being unsecure, which could harm our business and reputation, and our proprietary business information could be misappropriated which could have an adverse effect on our business and results of operations.

Our Company stores and transmits its proprietary information on its computer systems. Despite our security measures, our information systems and network infrastructure may be vulnerable to cyber-attacks or could be breached due to an employee error or other disruption that could result in unauthorized disclosure of sensitive information that has the potential to significantly interfere with our business operations. Breaches of our security measures could expose us to a risk of loss or misuse of this information, litigation and potential liability. Since techniques used to obtain unauthorized access or to sabotage information systems change frequently and generally are not recognized until launched against a target, we may be unable to anticipate these techniques or to implement adequate preventive measures in advance of such an attack on our systems. In addition, we use a vendor that uses cyber or Cloud storage of information as part of their service or product offerings, and despite our attempts to validate the security of such services, our proprietary information may be misappropriated by third parties. In the event of an actual or perceived breach of our security, or the security of one of our vendors, the market perception of the effectiveness of our security measures could be harmed and we could suffer damage to our reputation or our business. Additionally, misappropriation of our proprietary business information could prove competitively harmful to our business.

If we are unable to maintain effective internal controls, our business, financial position and results of operations could be adversely affected.

If we are unable to maintain effective internal controls, our business, financial position and results of operations could be adversely affected. We are subject to the reporting and other obligations under the Securities Exchange Act of 1934 (Exchange Act), including the requirements of Section 404 of the Sarbanes-Oxley Act of 2002, which require annual management assessments of the effectiveness of our internal control over financial reporting. Our management is responsible for establishing and maintaining adequate internal control over financial reporting, as such term is defined in Exchange Act Rules 13a-15(f) and 15d-15(f). Our internal control over financial reporting is a process designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with accounting principles generally accepted in the United States. Any failure to achieve and maintain effective internal controls could have an adverse effect on our business, financial position and results of operations. In addition, our independent registered public accounting firm is required to attest to the effectiveness of our internal control over financial reporting annually. If our independent registered public accounting firm is unable to attest to the effectiveness of our internal control over financial reporting, investor confidence in our reported results will be harmed and the price of our securities may fall. These reporting and other obligations place significant demands on our management and administrative and operational resources, including accounting resources.

Risks Related to Our Common Stock

Sales of shares to Lincoln Park under the Purchase Agreements may affect the price of our Common Stock and make it more difficult to raise additional equity capital.

All 9,500,000 shares registered hereunder which may be sold to Lincoln Park pursuant to the Purchase Agreements are expected to be freely tradable. Currently, 350,000 of such shares have been issued to Lincoln Park as commitment shares, and 9,150,000 of such shares are issuable from time to time under the Purchase Agreement. It is anticipated that such shares registered hereunder will be sold, if at all, before February of 2022 commencing on the date that the Registration Statement of which this prospectus is a part becomes effective. The sale by Lincoln Park of a significant amount of shares registered hereunder at any given time could cause the market price of our Common Stock to decline and to be highly volatile. We may ultimately sell (or issue as commitment shares) all, some or none of the shares of Common Stock issuable under the Purchase Agreement and registered in this offering Lincoln Park. If we sell (or issue as commitment shares) such shares to Lincoln Park, Lincoln Park may sell all, some or none of such shares. Therefore, sales to Lincoln Park by us under the Purchase Agreement may result in substantial dilution to the interests of other holders of our Common Stock. In addition, if we sell a substantial number of shares to Lincoln Park under the Purchase Agreement, or if investors expect that we will do so, the actual sales of shares or the mere existence of our arrangements with Lincoln Park may make it more difficult for us to sell equity or equity-related securities in the future at a time and at a price that we might otherwise wish to effect such sales. However, we have the right to control the timing and amount of any sales of our shares to Lincoln Park and the Purchase Agreement may be terminated by

us at any time at our discretion without any cost to us.

There is a limited market for our common stock, which may make it more difficult for you to sell your stock.

Our Company s Common Stock is quoted on the OTCMarkets (OTCQB) under the symbol "LWLG." The trading market for our Common Stock is limited, accordingly, there can be no assurance as to the liquidity of any markets that may develop for our common stock, your ability to sell our common stock, or the prices at which you may be able to sell our common stock.

Shares eligible for future sale may adversely affect the market.

From time to time, certain of the Company s shareholders may be eligible to sell all or some of their shares of Common Stock by means of ordinary brokerage transactions in the open market pursuant to Rule 144, promulgated under the Securities Act of 1933, as amended (the Securities Act), subject to certain limitations. In general, a non-affiliate stockholder who has satisfied a six-month holding period may, under certain circumstances, sell its shares, without limitation. Any substantial sale of the Company s Common Stock pursuant to Rule 144 or pursuant to any resale prospectus may have a material adverse effect on the market price of our common stock.

Our board of directors has the authority, without stockholder approval, to issue preferred stock with terms that may not be beneficial to existing common stockholders and with the ability to affect adversely stockholder voting power and perpetuate their control over us.

Our amended articles of incorporation allow us to issue shares of preferred stock without any vote or further action by our stockholders. Our board of directors has the authority to fix and determine the relative rights and preferences of preferred stock. Our board of directors also has the authority to issue preferred stock without further stockholder approval, including large blocks of preferred stock. As a result, our board of directors could authorize the issuance of a series of preferred stock that would grant to holders thereof the preferred right to our assets upon liquidation, the right to receive dividend payments before dividends are distributed to the holders of Common Stock or other preferred stockholders and the right to the redemption of the shares, together with a premium, prior to the redemption of our Common Stock or existing preferred stock, if any.

Preferred stock could be used to dilute a potential hostile acquirer. Accordingly, any future issuance of preferred stock or any rights to purchase preferred stock may have the effect of making it more difficult for a third party to acquire control of us. This may delay, defer or prevent a change of control or an unsolicited acquisition proposal. The issuance of preferred stock also could decrease the amount of earnings attributable to, and assets available for distribution to, the holders of our Common Stock and could adversely affect the rights and powers, including voting rights, of the holders of our Common Stock and preferred stock.

Our articles of incorporation and bylaws, and certain provisions of Nevada corporate law, as well as certain of our contracts, contain provisions that could delay or prevent a change in control even if the change in control would be beneficial to our stockholders.

Nevada law, as well as our amended articles of incorporation and bylaws, contain anti-takeover provisions that could delay or prevent a change in control of our Company, even if the change in control would be beneficial to our stockholders. These provisions could lower the price that future investors might be willing to pay for shares of our common stock. These anti-takeover provisions:

- authorize our board of directors to create and issue, without stockholder approval, preferred stock, thereby increasing the number of outstanding shares, which can deter or prevent a takeover attempt;
- prohibit cumulative voting in the election of directors, which would otherwise allow less than a majority of stockholders to elect director candidates;
- empower our board of directors to fill any vacancy on our board of directors, whether such vacancy occurs as a result of an increase in the number of directors or otherwise;
- provide that our board of directors be divided into three classes, with approximately one-third of the directors to be elected each year;

- provide that our board of directors is expressly authorized to adopt, amend or repeal our bylaws; and
- provide that our directors will be elected by a plurality of the votes cast in the election of directors.

Nevada Revised Statutes, the terms of our employee stock option agreements and other contractual provisions may also discourage, delay or prevent a change in control of our Company. Nevada Revised Statutes sections 78.378 to 78.3793 provide state regulation over the acquisition of a controlling interest in certain Nevada corporations unless the articles of incorporation or bylaws of the corporation provide that the provisions of these sections do not apply. Our articles of incorporation and bylaws do not state that these provisions do not apply. The statute creates a number of restrictions on the ability of a person or entity to acquire control of a Nevada company by setting down certain rules of conduct and voting restrictions in any acquisition attempt, among other things. The statute contains certain limitations and it may not apply to our Company. Our 2016 Equity Incentive Plan includes change-in-control provisions that allow us to grant options that may become vested immediately upon a change in control. Our board of directors also has the power to adopt a stockholder rights plan that could delay or prevent a change in control of our Company even if the change in control is generally beneficial to our stockholders. These plans, sometimes called poison pills, are oftentimes criticized by institutional investors or their advisors and could affect our rating by such investors or advisors. If our board of directors adopts such a plan, it might have the effect of reducing the price that new investors are willing to pay for shares of our common stock.

Together, these charter, statutory and contractual provisions could make the removal of our management and directors more difficult and may discourage transactions that otherwise could involve payment of a premium over prevailing market prices for our common stock. Furthermore, the existence of the foregoing provisions, as well as the significant Common Stock beneficially owned by our founders, executive officers, and members of our board of directors, could limit the price that investors might be willing to pay in the future for shares of our common stock. They could also deter potential acquirers of our Company, thereby reducing the likelihood that you could receive a premium for your Common Stock in an acquisition.

The risks and uncertainties we have described are not the only risks that we face. Additional risks and uncertainties not presently known to us or that we currently deem immaterial may also affect our operations. The occurrence of these known or unknown risks might cause you to lose all or part of your investment.

See also the statements contained under the heading Forward Looking Statements.

FORWARD-LOOKING STATEMENTS

This prospectus contains forward-looking statements that involve substantial risks and uncertainties. The forward-looking statements are contained principally in the sections entitled Prospectus Summary , Risk Factors , Management s Discussion and Analysis of Financial Condition and Results of Operations and Business but are also contained elsewhere in this prospectus. In some cases, you can identify forward-looking statements by the words may , might , will , could , would , should , expect , intend , plan , objective , anticipate , believe , e potential , continue and ongoing, or the negative of these terms, or other comparable terminology intended to identify statements about the future. These statements involve known and unknown risks, uncertainties and other factors that may cause our actual results, levels of activity, performance or achievements to be materially different from the information expressed or implied by these forward-looking statements. Although we believe that we have a reasonable basis for each forward-looking statement contained in this prospectus, we caution you that these statements are based on a combination of facts and factors currently known by us and our expectations of the future, about which we cannot be certain. Forward-looking statements include, but are not limited to, statements about:

- inability to generate revenue or to manage growth;
- lack of available funding;
- lack of a market for or market acceptance of our products;
- competition from third parties;
- general economic and business conditions;
- competition from third parties;
- intellectual property rights of third parties;
- changes in the price of our stock and dilution;
- regulatory constraints and potential legal liability;
- ability to maintain effective internal controls;
- security breaches, cybersecurity attacks and other significant disruptions in our information technology systems;
- changes in technology and methods of marketing;
- delays in completing various engineering and manufacturing programs;
- changes in customer order patterns and qualification of new customers;
- changes in product mix;
- success in technological advances and delivering technological innovations;
- shortages in components;
- production delays due to performance quality issues with outsourced components;
- those events and factors described by us in the section entitled “Risk Factors”;
- other risks to which our Company is subject; and
- other factors beyond the Company's control.

In addition, you should refer to the “Risk Factors” section of this prospectus for a discussion of other important factors that may cause our actual results to differ materially from those expressed or implied by our forward-looking statements. As a result of these factors, we cannot assure you that the forward-looking statements in this prospectus will prove to be accurate or that we will achieve the plans, intentions or expectations expressed or implied in our

forward-looking statements. Furthermore, if our forward-looking statements prove to be inaccurate, the inaccuracy may be material. In light of the significant uncertainties in these forward-looking statements, you should not regard these statements as a representation or warranty by us or any other person that we will achieve our objectives and plans in any specified time frame, or at all. Any forward-looking statements we make in this prospectus speak only as of its date, and we undertake no obligation to publicly update any forward-looking statements, whether as a result of new information, future events or otherwise, except as required by law.

You should read this prospectus and the documents that we reference in this prospectus and have filed as exhibits to the Registration Statement, of which this prospectus is a part, completely and with the understanding that our actual future results may be materially different from what we expect. We qualify all of our forward-looking statements by these cautionary statements.

USE OF PROCEEDS

This prospectus relates to shares of our Common Stock that may be offered and sold from time to time by the selling securityholder. We will receive no proceeds from the sale of shares of Common Stock by Lincoln Park in this offering. However, we may receive gross proceeds of up to $25,000,000 under the Purchase Agreement, including the sale of up to 8,337,500 shares issued or issuable pursuant to the Purchase Agreement, which are being registered hereunder for resale by Lincoln Park.

We intend to use approximately 65% of any proceeds received under the Purchase Agreement towards our research and development efforts which may include, without limitation, (a) retaining additional management, sales, marketing, technical and other staff to our workforce, (b) expanding our research and development facilities, including the purchase of additional laboratory and production equipment, (c) marketing our future products as they are introduced into the marketplace, (d) developing and maintaining collaborative relationships with strategic partners, (e) developing and improving our manufacturing processes and quality controls, and approximately 35% of any proceeds received may be used for increasing our general and administrative activities related to our operations as a reporting public company and related corporate compliance requirements.

CAPITALIZATION

The following table sets forth our cash and cash equivalents and our capitalization as of September 30, 2018:

		September 30, 2018 (Unaudited)
Cash and cash equivalents	$	2,204,317
Stockholders equity:		
Preferred stock, $0.001 par value, 1,000,000 shares authorized, no shares issued or outstanding		
Common stock, $0.001 par value, 250,000,000 shares authorized, 77,635,666 issued and outstanding		77,636
Additional paid-in-capital		61,006,130
Accumulated deficit		(56,265,183)
Total stockholders equity		4,818,583
Total capitalization	$	5,237,215

The number of shares of Common Stock outstanding in the table above excludes, as of September 30, 2018, options and warrants to purchase an aggregate of 18,974,867 shares of our Common Stock at exercise prices ranging from $0.57 - $1.69 per share with a weighted average exercise price of $0.91 per share.

MARKET FOR COMMON EQUITY AND RELATED SHAREHOLDER MATTERS

Market Information

Our Common Stock is quoted on the OTCQB under the symbol LWLG . The following table set forth below lists the range of high and low bids for our Common Stock for our two most recent fiscal years and the interim period through January 22, 2019. The prices in the table reflect inter-dealer prices, without retail markup, markdown or commission and may not represent actual transactions or a liquid trading market.

		High	Low
2017	1st Quarter	$0.86	$0.63
	2nd Quarter	$1.73	$0.71
	3rd Quarter	$1.53	$1.04
	4th Quarter	$1.47	$1.29
2018	1st Quarter		
	2nd Quarter	$1.30	$1.06
	3rd Quarter	$1.24	$1.02
	4th Quarter	$1.07	$0.64
2019	1st Quarter (through January 22)	$0.87	$0.66

As of January 22, 2019, we have a total of 79,934,809 shares of Common Stock outstanding, held by approximately 107 record shareholders. We do not have any shares of preferred stock outstanding.

Dividends

No cash dividends have been declared or paid on our Common Stock to date. No restrictions limit our ability to pay dividends on our common stock. The payment of cash dividends in the future, if any, will be contingent upon our Company s revenues and earnings, if any, capital requirements and general financial condition. The payment of any dividends is within the discretion of our board of directors. Our board of director s present intention is to retain all earnings, if any, for use in our business operations and, accordingly, the board of directors does not anticipate paying any cash dividends in the foreseeable future.

MANAGEMENT S DISCUSSION AND ANALYSIS OF FINANCIAL CONDITION AND RESULTS OF OPERATIONS

The following management s discussion and analysis of financial condition and results of operations provides information that management believes is relevant to an assessment and understanding of our plans and financial condition. The following selected financial information is derived from our historical financial statements and should be read in conjunction with such financial statements and notes thereto set forth elsewhere herein and the Forward-Looking Statements explanation included herein.

Overview

Lightwave Logic, Inc. is a development stage company whose P^{2}IC^{TM} technology addresses advanced telecommunication, data communications, and data center markets utilizing its advanced organic electro-optic polymer systems. The Company currently has development activities in both polymer materials as well as device design.

Materials Development

The Company designs and synthesizes organic chromophores for use in its own proprietary electro-optic *polymer systems* and photonic device designs. A polymer system is not solely a material, but also encompasses various technical enhancements necessary for its implementation. These include host polymers, poling methodologies, and molecular spacer systems that are customized to achieve specific optical properties. Our organic electro-optic polymer systems compounds are mixed into solution form that allows for thin film application. Our proprietary electro-optic polymers are designed at the molecular level for potentially superior performance, stability and cost-efficiency. We believe they have the potential to replace more expensive, higher power consuming, slower-performance materials and devices used in fiber-optic communication networks.

Our patented and patent pending molecular architectures are based on a well-understood chemical and quantum mechanical occurrence known as *aromaticity*. Aromaticity provides a high degree of molecular stability that enables our core molecular structures to maintain stability under a broad range of operating conditions.

We expect our patented and patent-pending optical materials along with trade secrets and licensed materials, to be the core of and the enabling technology for future generations of optical devices, modules, sub-systems and systems that we will develop or potentially out-license to electro-optic device manufacturers. The Company contemplates future applications that may address the needs of semiconductor companies, optical network companies, Web 2.0 media

companies, high performance computing companies, telecommunications companies, aerospace companies, and government agencies.

Device Design and Development

Electro-optic Modulators

The Company designs its own proprietary electro-optical modulation devices. Electro-optical modulators convert data from electric signals into optical signals that can then be transmitted over high-speed fiber-optic cables. Our modulators are electro-optic, meaning they work because the optical properties of the polymers are affected by electric fields applied by means of electrodes. Modulators are key components that are used in fiber optic telecommunications, data communications, and data centers networks etc., to convey the high data flows that have been driven by applications such as pictures, video streaming, movies etc., that are being transmitted through the internet. Electro-optical modulators are expected to continue to be an essential element as the appetite and hunger for data increases every year.

Polymer Photonic Integrated Circuits (P^2IC^{TM})

The Company also designs its own proprietary polymer photonic integrated circuits (otherwise termed a polymer PIC). A polymer PIC is a photonic device that integrates several photonic functions on a single chip. We believe that our technology can enable the ultra-miniaturization needed to increase the number of photonic functions residing on a semiconductor chip to create a progression like what was seen in the computer integrated circuits, commonly referred to as Moore s Law. One type of integration is to combine several instances of the same photonic functions such as a plurality of modulators to create a 4 channel polymer PIC. In this case, the number of photonic components would increase by a factor of 4. Another type is to combine different types of devices including from different technology bases such as the combination of a semiconductor laser with a polymer modulator. Our P^2IC platform encompasses both these types of architecture.

Current photonic technology today is struggling to reach faster device speeds. Our modulator devices, enabled by our electro-optic polymer material systems, work at extremely high frequencies (wide bandwidths) and possess inherent advantages over current crystalline electro-optic material contained in most modulator devices such as lithium niobate (LiNbO3), indium phosphide (InP), silicon (Si), and gallium arsenide GaAs). Our advanced electro-optic polymer platform is creating a new class of modulators and associated PIC platforms that can address higher data rates in a lower cost, lower power consuming manner, with much simpler modulation techniques.

Our electro-optic polymers can be integrated with other materials platforms because they can be applied as a thin film coating in a fabrication clean room such as may be found in semiconductor foundries. Our polymers are unique in that they are stable enough to seamlessly integrate into existing CMOS, Indium Phosphide (InP), Gallium Arsenide (GaAs), and other semiconductor manufacturing lines.

Business Strategy

Our business strategy anticipates that our revenue stream will be derived from one or some combination of the following: (i) technology licensing for specific product application; (ii) joint venture relationships with significant industry leaders; or (iii) the production and direct sale of our own electro-optic device components. Our objective is to be a leading provider of proprietary technology and know-how in the electro-optic device market. In order to meet this objective, we intend to:

- Further the development of proprietary organic electro-optic polymer material systems
- Develop photonic devices based on our P^2IC^{TM} technology
- Continue to develop proprietary intellectual property
- Grow our commercial device development capabilities
- Grow our product reliability and quality assurance capabilities
- Grow our optoelectronic packaging and testing capabilities
- Grow our commercial material manufacturing capabilities
- Maintain/develop strategic relationships with major telecommunications and data communications companies to further the awareness and commercialization of our technology platform
- Continue to add high-level personnel with industrial and manufacturing experience in key areas of our materials and device development programs.

Create Organic Polymer-Enabled Electro-Optic Modulators

We intend to utilize our proprietary optical polymer technology to create an initial portfolio of commercial electro-optic polymer product devices with applications for various markets, including telecommunications, data

communications and data centers. These product devices will be part of our proprietary photonics integrated circuit (PIC) technology platform.

We expect our initial modulator products will operate at data rates at least 50 Gbaud (capable of 50 Gbps with standard data encoding of NRZ and 100 Gbps with more complex PAM-4 encoding). Our devices are highly linear, enabling the performance required to take advantage of the more advance complex encoding schemes. We are currently developing our polymer technology to operate at the next industry node of 100Gbaud.

Our Proprietary Products in Development

As part of a two-pronged marketing strategy, our Company is developing several optical devices, which are in various stages of development and that utilize our polymer optical materials. They include:

Ridge Waveguide Modulator

Our ridge electro-optic waveguide modulator was designed and fabricated in our in-house laboratory. The fabrication of our first in-house device is significant to our entire device program and is an important starting point for modulators that are being developed for target markets. We have multiple generations of new materials that we will soon be optimizing for this specific design. In September 2017 we announced that our initial alpha prototype ridge waveguide modulator, enabled by our P^2IC polymer system, demonstrated bandwidth performance levels that will enable 50 Gbaud modulation in fiber-optic communications. This device demonstrated true amplitude (intensity) modulation in a Mach-Zehnder modulator structure incorporating our polymer waveguides. This important achievement will allow users to utilize arrays of 4 x 50 Gbaud (4x 100 Gbps) polymer modulators using PAM-4 encoding to access 400 Gbps data rate systems. These ridge waveguide modulators are currently being packaged with our partner into prototype packages. We showed an example packaged modulator at our Annual Shareholders Meeting in May 2018.

These prototype packages will enable potential customers to evaluate the performance at 50 Gbaud. Once a potential customer generates technical feedback on our prototype, we expect to be asked to optimize the performance to their specifications. Assuming this is successful, we expect to enter a qualification phase where our prototypes will be evaluated more fully.

In parallel, we are developing modulators for scalability to higher data rates above 50 Gbaud. In September 2018, we showed in conference presentations the potential of our polymer modulator platform to operate at over 100 GHz bandwidth. This preliminary result corresponds to 100 Gbaud data rates using a simple NRZ data encoding scheme or 200 Gbps with PAM-4 encoding. With 4 channel arrays in our P^2IC platform, the Company thus has the potential to address both 400 Gbps and 800 Gbps markets. While customers may start the engagement at 50 Gbaud, we believe potential customers recognize that scalability to higher speeds is an important differentiator of the polymer technology.

We believe the ridge waveguide modulator represents our first commercially viable device and targets the fiber optics communications market. We have completed internal market analysis and are initially targeting interconnect reach distances of greater than 10km. In these markets, the system network companies are looking to implement modulator-based transceivers that can handle aggregated data rates 100 Gbps and above. The market opportunity for greater than 10km is worth over $1B over the next decade.

Advanced Modulator Structures

As part of supporting further improvement and scalability of our platform, we continue to explore more advanced device structures. Our functional polymer photonics slot waveguide modulator utilizes an existing modulator structure with one of our proprietary electro-optic polymer material systems as the enabling material layer and is functional as an operating prototype device.

Preliminary testing and initial data on our polymer photonics slot waveguide modulators demonstrated several promising characteristics. The tested polymer photonic chip had a 1-millimeter square footprint, enabling the possibility of sophisticated integrated optical circuits on a single silicon substrate. In addition, the waveguide structure was approximately 1/20 the length of a typical inorganic-based silicon photonics modulator waveguide.

With the combination of our proprietary electro-optic polymer material and the extremely high optical field concentration in the slot waveguide modulator, the test modulators demonstrated less than 2.2 volts to operate. Initial speeds exceeded 30-35 GHz in the telecom, 1550 nanometer frequency band. This is equivalent to 4 x 10Gbps, inorganic, lithium niobate modulators that would require approximately 12-16 volts to move the same amount of

information.

We continued with our collaborative development of our polymer photonic slot waveguide modulator in 2014 and continued our collaboration with an associated third-party research group in 2017 and 2018. We are now designing slot modulators to operate at data rates greater than 50 Gbaud.

Our Long-Term Device Development Goal - Multichannel Polymer Photonic Integrated Circuit (P^2IC)

Our P^2IC platform is positioned to address markets with aggregated data rates of 100 Gbaud, 400 Gbaud, 800 Gbaud and beyond. Our P^2IC platform will contain a number of photonic devices that may include, over and above polymer-based modulators, photonic devices such as lasers, multiplexers, demultiplexers, detectors, fiber couplers.

While our polymer-based ridge waveguide and slot modulators are currently under development to be commercially viable products, our long-term device development goal is to produce a platform for the 400 Gbps and beyond transceiver market. This has been stated in our photonics product roadmap that is publicly available on our website. The roadmap shows a progression from: 10 Gbaud ridge waveguide modulators; to 25 Gbaud based ridge waveguide modulators; to 50 Gbaud based ridge waveguide modulators, and potentially 100 Gbaud based ridge waveguide modulators. These modulators are then arrayed to create a multichannel P^2IC platform for the 100 Gbps, 400 Gbps, 800 Gbps, and potentially 1.6 Tbps aggregated data-rate markets. As the performance of the modulator is capable of up to 100 Gbaud, the next major milestone on our roadmap will be to create a multichannel polymer-based P^2IC platform for the 400 Gbps market. This will be composed of either 4 channels each carrying 100 Gbps, implemented either with NRZ modulation on 100 Gbaud modulators or PAM-4 modulation on 50 Gbaud modulators.

For our device goals, we are developing polymer materials that perform even faster at a serial single channel 100Gbps using a NRZ modulation format. We showed bandwidths of polymer-based modulator devices at a major international conference (ECOC European Conference on Optical Communications) this year with bandwidths that exceeded 100GHz. We noted that to achieve 100Gbaud, the polymer-based modulator only has to achieve 80GHz bandwidth. We were pleased with the polymer modulator performance, and we are now optimizing the device parameters for very low voltage operation.

Our Target Markets

Cloud computing and data centers

Big data is a general term used to describe the voluminous amount of unstructured and semi-structured data a Company creates -- data that would take too much time and cost too much money to load into a relational database for analysis. Companies are looking to cloud computing in their data centers to access all the data. Inherent speed and bandwidth limits of traditional solutions and the potential of organic polymer devices offer an opportunity to increase the bandwidth, reduce costs and improve speed of access.

Datacenters have grown to enormous sizes with hundreds of thousands and even millions of servers in a single datacenter. The number of so-called hyperscale datacenters are expected to continue to increase in number. Due to their size, a single datacenter may consist of multiple large warehouse-size buildings on a campus or even several locations distributed around a metropolitan area. Data centers are confronted with the problem of moving vast amounts of data not only around a single data center building, but also between buildings in distributed data center architecture. Links within a single datacenter building may be shorter than 500 meters, though some will require optics capable of 2 km. Between datacenter buildings, there is an increasing need for high performance interconnects over 10km in reach.

Our modulators are suitable for single-mode fiber optic links. We believe that our single mode modulator solutions will be competitive at 500m to 10km link distances, but it will be ideally suited at greater than 10km link distances.

Telecommunications/Data Communications

The telecommunications industry has evolved from transporting traditional analogue voice data over copper wire into the movement of digital voice and data. Telecommunication companies are faced with the enormous increasing

challenges to keep up with the resulting tremendous explosion in demand for bandwidth. The metropolitan network is especially under stress now and into the near future. Telecommunications companies provide services to some data center customers for the inter-data center connections discussed above. 5G mobile upgrade, autonomous driving and IoT are expected to increase the need for data stored and processed close to the end user in edge data centers. This application similarly requires optics capable of very high speeds and greater than 10 km reach.

Recent Significant Events and Milestones Achieved

In December 2016 we achieved high-speed modulation in our first all-organic polymer ridge waveguide intensity modulator prototype, which constituted one of the most significant moments in the history of our Company. Our initial "alpha" prototype device, enabled by our P^2IC polymer system, demonstrated bandwidth suitable for data rates up to about 10 Gbps. This performance exceeds the telecom OC-48 standard (2.5 Gbps). This device demonstrated true amplitude (intensity) modulation in a Mach-Zehnder modulator structure incorporating our polymer waveguides.

In April 2017 we achieved bandwidth suitable for 25Gbps data rates in an all-organic polymer ridge waveguide intensity modulator prototype, a significant improvement over our initial 10Gbps device modulator prototype. This breakthrough was significant because a 25Gbps data rate is important to the optical networking industry because this data rate is a major node to achieve 100 Gbps (using 4 channels of 25 Gbps). In July 2017 we advanced our high-speed modulation performance to satisfy 28Gbps data rates for QSFP28 standards and 100Gbps data center applications.

In September 2017 we achieved outstanding performance of our ridge waveguide Mach-Zehnder modulators ahead of schedule, with bandwidth performance levels that will enable 50Gbps modulation in fiber-optic communications. This important achievement will allow users to utilize arrays of 4 x 50Gbps polymer modulators using PAM-4 encoding to access 400Gbps data rate systems. Pulse-Amplitude Modulation (PAM-4) is an encoding scheme that can double the amount of data that can be transmitted.

During February and March 2018, we moved our Newark, Delaware synthetic laboratory and our Longmont, Colorado optical testing laboratory and corporate headquarters to our new office, laboratory and research and development space located at 369 Inverness Parkway, Suite 350, Englewood, Colorado. The new 13,420 square feet Englewood facility includes fully functional 1,000 square feet of class 1,000 cleanroom, 500 square feet of class 10,000 cleanroom, chemistry laboratories, and analytic laboratories. The new Englewood facility streamlines all of our Company s research and development workflow for greater operational efficiencies.

During March 2018, our Company, together with our packaging partner, successfully demonstrated packaged polymer modulators designed for 50Gbps, which we believe will allow us to scale our P^2IC platform with our Mach-Zehnder ridge waveguide modulator design as well as other photonics devices competitively in the 100Gbps and 400Gbps datacom and telecommunications applications market. We are currently fine-tuning the performance parameters of these prototypes in preparation for customer evaluations.

During June 2018, our Company Acquired the Polymer Technology Intellectual Property Assets of BrPhotonics Productos Optoelectrónicos S.A., a Brazilian corporation, which significantly advanced our patent portfolio of electro-optic polymer technology with 15 polymer chemistry materials, devices, packaging and subsystems patent and further strengthened our design capabilities to solidify our market position as we prepare to enter the 400Gbps integrated photonics marketplace with a highly competitive, scalable alternative to installed legacy systems. Since June 2018, we have made significant progress on integrating this technology into our P^2IC (polymer photonic integrated circuit) platform.

Also, during June 2018, our Company promoted polymer PICs and Solidified Polymer PICs as Part of the Photonics Roadmap at the World Technology Mapping Forum in Enschede, Netherlands, which includes our Company s technology of polymers and polymer PICs that have the potential to drive not only 400Gbps aggregate data rate solutions, but also 800Gbps and beyond.

In August 2018 we announced the completion (ahead of schedule) of our fully equipped on-site fabrication facility, where we are expanding our high-speed test and design capabilities. We also announced the continuation of the building of our internal expertise with the hiring of world-class technical personnel with 100Gbps experience.

As we move forward to diligently to meet our goals, we continue to work closely with our packaging partner for the 50Gbaud prototypes, and we are advancing our reliability and characterization efforts to support our prototyping. We are actively engaged with test equipment manufacturers to deliver the most advanced test equipment for our state-of-the-art polymer results. We continue to engage with multiple industry bodies to promote our roadmap. We continue to fine tune our business model with target markets, customers, and technical specifications. Discussions with prospective customers are validating that our modulators are ideally suited for the datacenter and telecommunications markets that are over 10km in length. Details of what these prospective customers are seeking

from a prototype are delivered to our technical team.

Capital Requirements

As a development stage company, we do not generate revenues. We have incurred substantial net losses since inception. We have satisfied our capital requirements since inception primarily through the issuance and sale of our common stock.

Results of Operations

Comparison of three months ended September 30, 2018 to three months ended September 30, 2017

Revenues

As a development stage company, we had no revenues during the three months ended September 30, 2018 and September 30, 2017. The Company is in various stages of photonic device and material development and evaluation. We expect the next revenue stream to be in product development agreements and prototype devices prior to moving into production.

Operating Expenses

Our operating expenses were $1,443,534 and $1,205,932 for the three months ended September 30, 2018 and 2017, respectively, for an increase of $237,602. This increase in operating expenses was due primarily to increases in salaries and wages, depreciation, laboratory materials and supplies, recruiting fees, travel, research and development moving expenses, accounting fees, patent amortization and patent related expenses, general and administrative office expenses, research and development rent and utility expenses and general and administrative consulting expenses offset by decreases in legal, research and development non-cash stock option amortization and laboratory material testing expense and electro-optic device development.

Included in our operating expenses for the three months ended September 30, 2018 was $984,760 for research and development expenses compared to $821,331 for the three months ended September 30, 2017, for an increase of $163,429. This is primarily due to increases in research and development salaries and wages, depreciation, laboratory materials and supplies, moving expenses, patent amortization and patent related expenses, travel and rent and utility expenses offset by decreases in research and development non-cash stock option amortization and laboratory material testing expense and electro-optic device development.

Research and development expenses currently consist primarily of compensation for employees and consultants engaged in internal research, product development activities; laboratory operations, internal material and device fabrication testing and prototype electro-optic device design, development and prototype device processing; costs; and related operating expenses.

We expect to continue to incur substantial research and development expense to develop and commercialize our photonic devices PIC development and electro-optic materials platform. These expenses will increase as a result of accelerated development effort to support commercialization of our non-linear optical polymer materials technology; to build photonic device prototypes in our in-house laboratories; hiring additional technical and support personnel; engaging a senior technical advisor; pursuing other potential business opportunities and collaborations; customer testing and evaluation; and incurring related operating expenses.

Wages and salaries increased $92,237 from $371,523 for the three months ended September 30, 2017 to $463,760 for the three months ended September 30, 2018. The reason for the variation was primarily due to an increase in full time technical personnel working on device and material development and change in research and development allocation.

Depreciation expenses increased $72,092 from $46,210 for the three months ended September 30, 2017 to $118,302 for the three months ended September 30, 2018. The primary reason for the increase was due to the addition of capital

equipment in the new facility.

Laboratory materials and supplies also increased $33,973 from $65,162 for the three months ended September 30, 2017 to $99,135 for the three months ended September 30, 2018. The primary reason for the increase was fabrication of prototype wafers and devices, and electro-optic polymer material systems.

Moving expenses increased by $16,099 to $17,786 for the three months ended September 30, 2018 from $1,687 for the three months ended September 30, 2017. The primary reason for the increase was the relocation of employees to the new facility.

Patent amortization and patent related expenses increased by $10,683 to $20,059 for the three months ended September 30, 2018 from $9,376 for the three months ended September 30, 2017. The primary reason for the increase was the BrPhotonics patents purchased as part of the asset purchase agreement.

Travel expenses increased $9,373 from $17,932 for the three months ended September 30, 2017 to $27,305 for the three months ended September 30, 2018. The increase was primarily due to employee travel for relocation planning, and conferences.

Rent and utilities increased $9,285 from $31,375 for the three months ended September 30, 2017 to $40,660 for the three months ended September 30, 2018. The primary reason for the increase was due to acquiring a larger facility in order to consolidate all the Company s operations into one facility.

Research and development non-cash stock option amortization decreased $51,398 from $96,827 for the three months ended September 30, 2017 to $45,429 for the three months ended September 30, 2018. The reason for the variation in decreased amortization was the vesting schedules.

Product prototype development and material testing expense decreased $39,089 from $56,566 for the three months ended September 30, 2017 to $17,477 for the three months ended September 30, 2018. The decrease was primarily due to the move to the new facility and transitioning of outside services in-house.

General and administrative expense consists primarily of compensation and support costs for management staff, and for other general and administrative costs, including executive, sales and marketing, investor relations, accounting and finance, legal, consulting and other operating expenses.

General and administrative expenses increased $74,173 to $458,774 for the three months ended September 30, 2018 compared to $384,601 for the three months ended September 30, 2017. The increase is primarily due to increases in general and administrative salary and wages, recruiting fees, accounting fees, travel, office expenses and general and administrative consulting offset by a decrease in legal fees.

Salary and wages increased $44,480 to $160,444 for the three months ended September 30, 2018 compared to $115,964 for the three months ended September 30, 2017. The reason for the increase was hiring of key personnel.

Recruiting fees increased $24,500 to $24,500 for the three months ended September 30, 2018 compared to $0 for the three months ended September 30, 2017. The reason for the increase was hiring of key personnel.

Accounting fees increased $13,500 to $39,000 for the three months ended September 30, 2018 compared to $25,500 for the three months ended September 30, 2017. The primary reason for the increase was due to the additional work being an accelerated filer and general accounting expense.

Travel expenses increased $13,128 to $23,767 for the three months ending September 30, 2018 from $10,639 for the three months ended September 30, 2017. The primary reason for the increase was due to travel expense to the new facility and conferences.

Office expenses increased $9,455 to $18,132 for the three months ending September 30, 2018 from $8,677 for the three months ended September 30, 2017. The reason for the variation was due to relocating into a larger facility.

General and administrative consulting expenses increased $6,042 to $6,042 for the three months ending September 30, 2018 from $0 for the three months ended September 30, 2017. The primary reason for the increase was due to a non-cash consulting expense.

Legal fees decreased $57,509 to $29,448 for the three months ending September 30, 2018 from $86,957 for the three months ended September 30, 2017. The primary reason for the variance was an overall decrease in general legal work.

We expect general and administrative expense to increase in future periods as we increase the level of corporate and administrative activity, including increases associated with our operation as a public company; and significantly increase expenditures related to the future production and sales of our products.

Other Income (Expense)

Other expense decreased $20,406 to $54,167 for the three months ended September 30, 2018 from $74,573 for the three months ended September 30, 2017, relating to the commitment fee associated with the purchase of shares by Lincoln Park under the 2016 Purchase Agreement.

Net Loss

Net loss was $1,497,701 and $1,280,505 for the three months ended September 30, 2018 and 2017, respectively, for an increase of $217,196, due primarily to increases in salaries and wages, depreciation, laboratory materials and supplies, recruiting fees, travel, research and development moving expenses, accounting fees, patent amortization and patent related expenses, general and administrative office expenses, research and development rent and utility expenses and general and administrative consulting expenses offset by decreases in legal, research and development non-cash stock option amortization, laboratory material testing expense and electro-optic device development and commitment fee associated with the purchase of shares by Lincoln Park under the 2016 Purchase Agreement.

Comparison of nine months ended September 30, 2018 to nine months ended September 30, 2017

Revenues

As a development stage company, we had no revenues during the nine months ended September 30, 2018 and September 30, 2017. The Company is in various stages of photonic device and material development and evaluation. We expect the next revenue stream to be in product development agreements and prototype devices prior to moving into production.

Our operating expenses were $4,374,026 and $4,032,323 for the nine months ended September 30, 2018 and 2017, respectively, for an increase of $341,703. This increase in operating expenses was due primarily to increases in research and development salaries and wages, depreciation, rent and utility expenses, laboratory materials and supplies, moving expenses, office expenses, travel expenses, accounting fees, auditing fees, recruiting fees, general and administrative consulting expenses, repair, other tax expenses and director and officer insurance expenses offset by decreases in non-cash stock option and warrant amortization, laboratory material testing expense and electro-optic device development, legal, general and administrative salary and wages, royalty fees and patent amortization and patent related expenses.

Included in our operating expenses for the nine months ended September 30, 2018 was $2,830,785 for research and development expenses compared to $2,388,861 for the nine months ended September 30, 2017, for an increase of $441,924. This is primarily due to increases in research and development salaries and wages, depreciation, laboratory materials and supplies, rent and utility expenses, research and development moving expenses, travel expenses, repair and office expenses offset by decreases in non-cash stock option amortization, laboratory material testing expense and electro-optic device development, royalty fees and patent amortization and patent related expenses.

Research and development expenses currently consist primarily of compensation for employees and consultants engaged in internal research, product development activities; laboratory operations, internal material and device fabrication testing and prototype electro-optic device design, development and prototype device processing; costs; and related operating expenses.

We expect to continue to incur substantial research and development expense to develop and commercialize our photonic devices PIC development and electro-optic materials platform. These expenses will increase as a result of accelerated development effort to support commercialization of our non-linear optical polymer materials technology; to build photonic device prototypes in our in-house laboratories; hiring additional technical and support personnel; engaging a senior technical advisor; pursuing other potential business opportunities and collaborations; customer testing and evaluation; and incurring related operating expenses.

Wages and salaries increased $335,112 from $967,448 for the nine months ended September 30, 2017 to $1,302,560 for the nine months ended September 30, 2018. The reason for the variation was primarily due to an increase in full time technical personnel working on device and material development and change in research and development allocation.

Depreciation expense increased $137,448 from $133,408 for the nine months ended September 30, 2017 to $270,856 for the nine months ended September 30, 2018. The primary reason for the increase was due to the addition of capital equipment in the new facility.

Laboratory materials and supplies increased $116,200 from $141,526 for the nine months ended September 30, 2017 to $257,726 for the nine months ended September 30, 2018. The primary reason for the increase was fabrication of prototype wafers and devices, and electro-optic polymer material systems.

Rent and utility expenses increased $87,400 from $93,827 for the nine months ended September 30, 2017 to $181,227 for the nine months ended September 30, 2018. The primary reason for the increase was due to acquiring a larger facility in order to consolidate all the Company s operations into one facility.

Moving expenses increased by $59,239 to $61,885 for the nine months ended September 30, 2018 from $2,646 for the nine months ended September 30, 2017. The primary reason for the increase was the relocation of employees to the new facility.

Travel expenses increased by $32,706 to $81,742 for the nine months ended September 30, 2018 from $49,036 for the nine months ended September 30, 2017. The increase was primarily due to employee travel for relocation planning, and conferences.

Repair and maintenance expenses increased by $17,705 to $41,461 for the nine months ended September 30, 2018 from $23,756 for the nine months ended September 30, 2017. The primary reason for the increase was due to general maintenance in the new Colorado facility, and repairs to Delaware facility.

Office expenses increased by $14,640 to $19,410 for the nine months ended September 30, 2018 from $4,770 for the nine months ended September 30, 2017. The increase was primarily due furnishing the new Colorado facility.

Research and development non-cash stock option amortization decreased $210,903 from $408,396 for the nine months ended September 30, 2017 to $197,493 for the nine months ended September 30, 2018. The reason for the variation in decreased amortization was the vesting schedules.

Product prototype development and material testing expense decreased $111,668 from $167,209 for the nine months ended September 30, 2017 to $55,541 for the nine months ended September 30, 2018. The decrease was primarily due to the move to the new facility and transitioning of outside services in-house.

Royalty expenses decreased $22,500 to $0 for the nine months ended September 30, 2018 from $22,500 for the nine months ended September 30, 2017. The primary reason for the decrease was the termination of a license agreement.

Patent amortization and patent related expenses decreased by $18,992 to $44,956 for the nine months ended September 30, 2018 from $63,948 for the nine months ended September 30, 2017. The primary reason for the decrease was lower cost in patent application prosecution.

General and administrative expense consists primarily of compensation and support costs for management staff, and for other general and administrative costs, including executive, sales and marketing, investor relations, accounting and finance, legal, consulting and other operating expenses.

General and administrative expenses decreased $100,221 to $1,543,241 for the nine months ended September 30, 2018 compared to $1,643,462 for the nine months ended September 30, 2017. The decrease is primarily due to decreases in general and administrative non-cash stock option and warrant amortization, legal fees and general and administrative salary and wages offset by increases in office expenses, rent and utility expenses, accounting fees, auditing fees, travel, moving expenses, recruiting fees, general and administrative consulting, other tax expenses and director and officer insurance expenses.

General and administrative non-cash stock option and warrant amortization decreased by $257,532 to $204,314 for the nine months ended September 30, 2018 from $461,846 for the nine months ended September 30, 2017. The reason for the variation was due to stock options and warrants vesting schedules.

Legal fees decreased $93,129 to $202,680 for the nine months ended September 30, 2018 from $295,809 September 30, 2017 The primary reason for the variance was an overall decrease in general legal work.

Salary and wages decreased $23,556 to $399,243 for the nine months ending September 30, 2018 from $422,799 for the nine months ending September 30, 2017. The primary reason for the variance is a decrease in management salaries and change in general and administrative allocation.

Office expenses increased $64,412 from $29,763 for the nine months ended September 30, 2017 to $94,175 for the nine months ended September 30, 2018. The reason for the variation was due to relocating into a larger facility.

Rent and utility expenses increased $46,534 from $24,823 for the nine months ended September 30, 2017 to $71,357 for the nine months ended September 30, 2018. The primary reason was due to support of the new larger facility and old operations facilities.

Accounting fees increased $27,166 to $106,750 for the nine months ended September 30, 2018 from to $79,584 for the nine months ended September 30, 2017. The primary reason for the increase was due to the additional work being an accelerated filer and general accounting expense.

Auditing fees increased $25,150 to $78,600 for the nine months ending September 30, 2018 from $53,450 for the nine months ending September 30, 2017. The primary reason for the increase was due to the Company s change in status to an accelerated filer, which requires additional testing by the auditors.

Travel expenses increased $21,177 to $49,605 for the nine months ending September 30, 2018 from $28,428 for the nine months ending September 30, 2017. The primary reason for the increase was due to travel expense to the new facility and conferences.

Moving expenses increased $20,606 to $20,606 for the nine months ending September 30, 2018 from $0 for the nine months ending September 30, 2017. The reason for the variation was due to moving to a new facility.

Recruiting fees increased $20,500 to $40,500 for the nine months ending September 30, 2018 from $20,000 for the nine months ending September 30, 2017. The reason for the increase was hiring of personnel.

General and administrative consulting expenses increased $18,125 to $18,125 for the nine months ended September 30, 2018 from $0 for the nine months ended September 30, 2017. The primary reason for the increase was due to a non-cash consulting expense.

Other tax expenses increased $14,833 to $26,694 for the nine months ended September 30, 2018 from $11,861 for the nine months ended September 30, 2017. The primary reason for the increase was due to sales and use tax on capital equipment for new facility.

Director and officer insurance expenses increased $13,781 to $109,319 for the nine months ended September 30, 2018 from $95,538 for the nine months ended September 30, 2017. The primary reason for the increase was an increase in insurance premiums.

We expect general and administrative expense to increase in future periods as we increase the level of corporate and administrative activity, including increases associated with our operation as a public company; and significantly increase expenditures related to the future production and sales of our products.

Other Income (Expense)

Other expense increased $6,776 to $135,146 for the nine months ended September 30, 2018 from $128,370 for the nine months ended September 30, 2017, relating to the commitment fee associated with the purchase of shares by Lincoln Park under the 2016 Purchase Agreement.

Net Loss

Net loss was $4,509,172 and $4,160,693 for the nine months ended September 30, 2018 and 2017, respectively, for an increase of $348,479, due primarily to increases in research and development, salaries and wages, depreciation, rent and utility expenses, laboratory materials and supplies, moving expenses, office expenses, travel expenses, accounting fees, auditing fees, recruiting fees, general and administrative consulting expenses, repair, other tax expenses and director and officer insurance expenses offset by decreases in non-cash stock option and warrant amortization, laboratory material testing expense and electro-optic device development, legal, general and administrative salary and wages, royalty fees, patent amortization and patent related expenses and commitment fee associated with the purchase of shares by Lincoln Park under the 2016 Purchase Agreement.

Comparison of Fiscal 2017 to Fiscal 2016

Revenues

As a development stage company, we had no revenues during the years ended December 31, 2017 and December 31, 2016. The Company is in various stages of photonic device and material development and evaluation. Our revenue stream will be derived from one or some combination of the following: (i) technology licensing for specific product application; (ii) joint venture relationships with significant industry leaders; or (iii) the production and direct sale of our own electro-optic device components.

Operating Expenses

Our operating expenses were $5,523,538 and $4,135,578 for the years ended December 31, 2017 and 2016, respectively, for an increase of $1,387,960. The increase in operating expenses is primarily due to increases in non-cash stock option and warrant amortization, research and development salaries, legal fees, patent amortization and patent related expenses, product development consulting expenses, product prototype development and material testing expenses, laboratory materials and supplies, recruiting fees, fees for disposal of obsolete materials, rent, license fees, insurance expense, accounting fees, shareholder annual meeting expenses and other tax expenses offset by decreases in general and administrative salaries, general and administrative consulting, investor relations expenses, software expenses, general and administrative travel expenses and internet and web design fees.

Included in our operating expenses for the year ended December 31, 2017 was $3,519,129 for research and development expenses compared to $2,474,689 for the year ended December 31, 2016, for an increase of $1,044,440. The increase in research and development expenses is primarily due to increases in non-cash stock option and warrant amortization, research and development salaries, patent amortization and patent related expenses, product development consulting expenses, product prototype development and material testing expenses, laboratory materials and supplies, fees for disposal of obsolete materials, rent and license fees.

Research and development expenses currently consist primarily of compensation for employees and consultants engaged in internal research, product development activities; laboratory operations, internal material and device fabrication testing and prototype electro-optic device design, development and prototype device processing; costs; and related operating expenses.

We expect to continue to incur substantial research and development expense to develop and commercialize our photonic devices PIC development and electro-optic materials platform. These expenses will increase as a result of accelerated development effort to support commercialization of our non-linear optical polymer materials technology; to build photonic device prototypes in our in-house laboratories; hiring additional technical and support personnel; engaging a senior technical advisor; pursuing other potential business opportunities and collaborations; customer testing and evaluation; and incurring related operating expenses.

Non-cash stock compensation and stock option and warrant amortization increased $351,348 from $362,435 for the year ended December 31, 2016 to $713,783 for the year ended December 31, 2017.

Wages and salaries and benefits increased $261,710 from $1,095,884 for the year ended December 31, 2016 to $1,357,594 for the year ended December 31, 2017.

Patent amortization and write-off of previously capitalized patent costs increased $114,374 from $15,891 for the year ended December 31, 2016 to $130,265 for the year ended December 31, 2017.

Product development consulting expenses increased $80,698 from $292,283 for the year ended December 31, 2016 to $372,981 for the year ended December 31, 2017.

Product prototype development and material testing expense increased $68,939 from $150,711 for the year ended December 31, 2016 to $219,650 for the year ended December 31, 2017.

Laboratory materials and supplies also increased $50,697 from $151,607 for the year ended December 31, 2016 to $202,304 for the year ended December 31, 2017.

Disposal of obsolete materials increased $39,963 from $3,565 for the year ended December 31, 2016 to $43,528 for the year ended December 31, 2017.

Rent expense increased $34,157 from $117,775 for the year ended December 31, 2016 to $151,932 for the year ended December 31, 2017 for the new headquarter facility in Colorado.

License fees increased $30,000 to $30,000 for the year ended December 31, 2017 from $0 for the year ended December 31, 2016.

General and administrative expense consists primarily of compensation and support costs for management staff, and for other general and administrative costs, including executive, sales and marketing, investor relations, accounting and finance, legal, consulting and other operating expenses.

General and administrative expenses increased $343,520 to $2,004,409 for the year ended December 31, 2017 from $1,660,889 for the year ended December 31, 2016. The increase is primarily due to increases in non-cash stock option and warrant amortization, legal fees, recruiting fees, insurance expense, accounting fees, rent and utilities expenses, shareholder annual meeting expenses and other tax expenses offset by decreases in salaries, general and administrative consulting, investor relations expenses, software expenses, general and administrative travel expenses and internet and web design fees.

Non-cash stock compensation and stock option amortization increased $249,737 from $248,152 for the year ended December 31, 2016 to $497,889 for the year ended December 31, 2017.

Legal fees increased $178,712 to $353,437 for the year ended December 31, 2017 from $174,725 for the year ended December 31, 2016.

Recruiting fees increased $50,500 to $50,500 for the year ended December 31, 2017 compared to $0 for the year ended December 31, 2016.

Insurance expense increased $19,002 from $112,785 for the year ended December 31, 2016 to $131,787 for the year ended December 31, 2017.

Accounting fees increased $12,084 from $93,000 for the year ended December 31, 2016 to $105,084 for the year ended December 31, 2017.

Rent and utility expenses increased $10,684 to $43,553 for the year ended December 31, 2017 from $32,869 for the year ended December 31, 2016 primarily for the expenses of the new headquarter facility in Colorado.

Expenses for the annual shareholder meeting increased $6,702 from $44,506 for the year ended December 31, 2016 to $51,208 for the year ended December 31, 2017.

Other tax expenses increased $6,131 from $6,593 for the year ended December 31, 2016 to $12,724 for the year ended December 31, 2017.

General and administrative wages and salaries decreased $102,307 from $635,982 for the year ended December 31, 2016 to $533,675 for the year ended December 31, 2017.

General and administrative consulting expenses decreased $42,958 from $27,000 for the year ending December 31, 2016 to ($15,958) for the year ending December 31, 2017.

Investor relations expenses decreased by $19,674 from $37,454 for the year ended December 31, 2016 to $17,780 for the year ended December 31, 2017.

Software expenses decreased $10,876 from $17,339 for the year ended December 31, 2016 to $6,463 for the year ended December 31, 2017.

Travel expenses decreased $10,003 from $51,300 for the year ended December 31, 2016 to $41,297 for the year ended December 31, 2017.

Internet and web design fees decreased $6,191 to $10,992 for the year ended December 31, 2017 from $17,183 for the year ended December 31, 2016.

We expect general and administrative expense to increase in future periods as we increase the level of corporate and administrative activity, including increases associated with our operation as a public company; and significantly increase expenditures related to the future production and sales of our products.

Other Income (Expense)

Other expense decreased $45,786 to $225,844 for the year ended December 31, 2017 from $271,630 for the year ended December 31, 2016, relating to the commitment fee associated with the purchase of shares by Lincoln Park under the 2016 Purchase Agreement.

In December 2017, the Tax Cuts and Jobs Act was enacted, which reduces the U.S. statutory corporate tax rate from a maximum rate of 35% to 21% for tax years beginning 2018. The Company remeasured certain deferred tax assets and valuation allowance based on the rates at which they are expected to reverse. The remeasurement incorporates assumptions made based upon the best available interpretation of the Act and may change as the Company receives additional clarification and implementation guidance.

Net Loss

Net loss was $5,749,382 and $4,407,208 for the years ended December 31, 2017 and 2016, respectively, for an increase of $1,342,174, due primarily to increases in non-cash stock option and warrant amortization, research and development salaries, legal fees, patent amortization and patent related expenses, product development consulting expenses, product prototype development and material testing expenses, laboratory materials and supplies, recruiting fees, fees for disposal of obsolete materials, rent, license fees, insurance expense, accounting fees, shareholder annual meeting expenses and other tax expenses offset by decreases in general and administrative salaries, commitment fee associated with the purchase of shares by Lincoln Park under the 2016 Purchase Agreement, general and administrative consulting, investor relations expenses, software expenses, general and administrative travel expenses and internet and web design fees.

Significant Accounting Policies

Our discussion and analysis of our financial condition and results of operations are based on our financial statements, which have been prepared in accordance with accounting principles generally accepted in the United States. The preparation of these financial statements requires us to make estimates and judgments that affect the reported amounts of assets, liabilities, revenues and expenses, and related disclosure of contingent assets and liabilities. On an ongoing basis, we evaluate our estimates based upon historical experience and various other assumptions that we believe to be reasonable under the circumstances, the results of which form the basis for making judgments about the carrying values of assets and liabilities that are not readily apparent from other sources. Our actual results may differ materially from these estimates.

We believe our significant accounting policies affect our more significant estimates and judgments used in the preparation of our financial statements. Our Annual Report on Form 10-K for the year ended December 31, 2017 and our Quarterly Report on 10-Q for the nine months ended September 30, 2018 contain a discussion of these significant accounting policies.

Recently Adopted Accounting Pronouncements. In June 2018, the FASB issued ASU No. 2018-07, Compensation Stock Compensation (Topic 718), Improvements to Nonemployee Share-Based Payment Accounting. The amendments in this Update expand the scope of Topic 718 to include share-based payment transactions for acquiring goods and services from nonemployees. Prior to this Update, Topic 718 applied only to share-based transactions to employees. Consistent with the accounting requirement for employee share-based payment awards, nonemployee share-based payment awards within the scope of Topic 718 are measured at grant-date fair value of the equity instruments that an entity is obligated to issue when the good has been delivered or the service has been rendered and any other conditions necessary to earn the right to benefit from the instruments have been satisfied. The amendments in this Update are effective for public business entities for fiscal years beginning after December 15, 2018, including interim periods within that fiscal year. Early adoption is permitted, but no earlier than an entity s adoption date of Topic 606. The adoption of this pronouncement on June 30, 2018 had no material impact on the Company s financial statements.

Reclassifications. Certain reclassifications have been made to the 2017 financial statement in order to conform to the 2018 financial statement presentation.

Liquidity and Capital Resources

For the Nine Months Ended September 30, 2018

During the nine months ended September 30, 2018, net cash used in operating activities was $3,404,846 and net cash used in investing activities was $1,266,594, which was due primarily to the Company s research and development activities, general and administrative expenditures and capital expenditures. Net cash provided by financing activities for the nine months ended September 30, 2018 was $3,393,430. At September 30, 2018, our cash and cash equivalents totaled $2,204,317, our assets totaled $5,237,215, our liabilities totaled $418,632, and we had stockholders equity of $4,818,583.

For the year ended December 31, 2017

During the year ended December 31, 2017, net cash used in operating activities was $4,409,696 and net cash used in investing activities was $265,532, which was due primarily to the Company s research and development activities and general and administrative expenditures. Net cash provided by financing activities for the year ended December 31, 2017 was $6,200,711. At December 31, 2017, our cash and cash equivalents totaled $3,482,327, our assets totaled $5,849,770, our liabilities totaled $833,055 and we had stockholders equity of $5,016,715.

Sources and Uses of Cash

Our future expenditures and capital requirements will depend on numerous factors, including: the progress of our research and development efforts; the rate at which we can, directly or through arrangements with original equipment manufacturers, introduce and sell products incorporating our polymer materials technology; the costs of filing, prosecuting, defending and enforcing any patent claims and other intellectual property rights; market acceptance of our products and competing technological developments; and our ability to establish cooperative development, joint venture and licensing arrangements. We expect that we will incur approximately $526,000 of expenditures per month over the next 12 months. Based upon our current cash position and expenditures of approximately $526,000 per month and no debt service, we believe our Company has sufficient funds to finance its operations through May 2019. Our cash requirements are expected to increase at a rate consistent with the Company s path to revenue growth as we expand our activities and operations with the objective of commercializing our electro-optic polymer technology.

On January 21, 2019, the Company entered into the Purchase Agreement with Lincoln Park, pursuant to which Lincoln Park agreed to purchase from us up to $25,000,000 of our Common Stock (subject to certain limitations) from time to time over a 36-month period. Pursuant to the Purchase Agreement, Lincoln Park is obligated to make purchases as the Company directs in accordance with the Purchase Agreement, which may be terminated by the Company at any time, without cost or penalty. Sales of shares will be made in specified amounts and at prices that are based upon the market prices of our Common Stock immediately preceding the sales to Lincoln Park. We expect this financing to provide us with sufficient funds to maintain our operations for the foreseeable future. With the additional capital, we expect to achieve a level of revenues attractive enough to fulfill our development activities and adequate enough to support our business model for the foreseeable future. We cannot assure you that we will meet the conditions of the Purchase Agreement with Lincoln Park in order to obligate Lincoln Park to purchase our shares of common stock. In the event we fail to do so, and other adequate funds are not available to satisfy long-term capital requirements, or if planned revenues are not generated, we may be required to substantially limit our operations. This limitation of operations may include reductions in capital expenditures and reductions in staff and discretionary costs.

There are no trading volume requirements or restrictions under the Purchase Agreement and we will control the timing and amount of any sales of our Common Stock to Lincoln Park. Lincoln Park has no right to require any sales by us, but is obligated to make purchases from us as we direct in accordance with the Purchase Agreement. We can also accelerate the amount of Common Stock to be purchased under certain circumstances. There are no limitations on use of proceeds, financial or business covenants, restrictions on future funding, rights of first refusal, participation rights, penalties or liquidated damages in the Purchase Agreement. Lincoln Park may not assign or transfer its rights and obligations under the purchase agreement.

We expect that our cash used in operations will continue to increase during 2019 and beyond as a result of the following planned activities:

- The addition of management, sales, marketing, technical and other staff to our workforce;
- Increased spending for the expansion of our research and development efforts, including purchases of additional laboratory and production equipment;

- Increased spending in marketing as our products are introduced into the marketplace;
- Developing and maintaining collaborative relationships with strategic partners;
- Developing and improving our manufacturing processes and quality controls; and
- Increases in our general and administrative activities related to our operations as a reporting public company and related corporate compliance requirements.

Analysis of Cash Flows

For the Nine Months Ended September 30, 2018

Net cash used in operating activities was $3,404,846 for the nine months ended September 30, 2018, primarily attributable to the net loss of $4,509,172 adjusted by $62,731 in warrants issued for services, $339,076 in options issued for services, $135,333 in Common Stock issued for services, $322,495 in depreciation expenses and patent amortization expenses, $10,084 net loss on disposal of equipment, $268,560 in prepaid expenses and ($33,953) in accounts payable and accrued expenses. Net cash used in operating activities consisted of payments for research and development, legal, professional and consulting expenses, rent and other expenditures necessary to develop our business infrastructure.

Net cash used by investing activities was $1,266,594 for the nine months ended September 30, 2018, consisting of $371,320 in cost for intangibles and $897,774 in asset additions primarily for the new Colorado headquarter facility offset by proceeds of $2,500 on the sale of equipment.

Net cash provided by financing activities was $3,393,430 for the nine months ended September 30, 2018 and consisted of $3,612,400 in proceeds from resale of Common Stock to Lincoln Park and $161,500 in proceeds from exercise of warrants and options offset by $380,470 repayment of equipment purchased.

For the year ended December 31, 2017

Net cash used in operating activities was $4,409,696 for the year ended December 31, 2017, primarily attributable to the net loss of $5,749,382 adjusted by $416,934 in warrants issued for services, $794,738 in options issued for

services, $270,343 in Common Stock issued for services, $325,946 in depreciation expenses and patent amortization expenses, ($447,977) in prepaid expenses and ($20,298) in accounts payable and accrued expenses. Net cash used in operating activities consisted of payments for research and development, legal, professional and consulting expenses, rent and other expenditures necessary to develop our business infrastructure.

Net cash used by investing activities was $265,532 for the year ended December 31, 2017, consisting of $81,743 in cost for intangibles and $183,789 in asset additions primarily for the new Colorado headquarters facility.

Net cash provided by financing activities was $6,200,711 for the year ended December 31, 2017 and consisted of $5,722,060 proceeds from Common Stock and $502,500 proceeds from the exercise of warrants offset by $23,849 repayment of equipment purchased.

For the year ended December 31, 2016

Net cash used in operating activities was $3,153,292 for the year ended December 31, 2016, primarily attributable to the net loss of $4,407,208 adjusted by $174,359 in warrants issued for services, $436,228 in options issued for services, $295,885 in Common Stock issued for services, $195,610 in depreciation expenses and patent amortization expenses, $127,549 in prepaid expenses, $24,929 in accounts payable and accrued expenses and $644 gain on disposal of property and equipment. Net cash used in operating activities consisted of payments for research and development, legal, professional and consulting expenses, rent and other expenditures necessary to develop our business infrastructure.

Net cash used by investing activities was $173,759 for the year ended December 31, 2016, consisting of $64,096 for purchase of intangibles, $129,163 in asset additions primarily for the Colorado lab facility and $19,500 in proceeds from sale of equipment.

Net cash provided by financing activities was $1,553,190 for the year ended December 31, 2016 and consisted of $1,553,190 in proceeds from the sale of Common Stock to Lincoln Park.

BUSINESS

Overview

We were incorporated under the laws of the State of Nevada on June 24, 1997 and in 2004 we acquired PSI-TEC Corp., and in 2006 we merged with PSI-TEC Corp. PSI-TEC Corp. was originally founded by Dr. Frederick J. Goetz in 1991 and incorporated under the laws of the State of Delaware on September 12, 1995. In 2008 we changed our name to Lightwave Logic, Inc.

Our principal executive office is located at 369 Inverness Parkway, Suite 350, Englewood, CO 80112, and our telephone number is (720) 340-4949. Our website address is www.lightwavelogic.com. No information found on our website is part of this Registration Statement. Also, this prospectus includes the names of various government agencies and the trade names of other companies. Unless specifically stated otherwise, the use or display by us of such other parties' names and trade names in this prospectus is not intended to and does not imply a relationship with, or endorsement or sponsorship of us by, any of these other parties.

Materials Development

The Company designs and synthesizes organic chromophores for use in its own proprietary electro-optic *polymer systems* and photonic device designs. A polymer system is not solely a material, but also encompasses various technical enhancements necessary for its implementation. These include host polymers, poling methodologies, and molecular spacer systems that are customized to achieve specific optical properties. Our organic electro-optic polymer systems compounds are mixed into solution form that allows for thin film application. Our proprietary electro-optic polymers are designed at the molecular level for potentially superior performance, stability and cost-efficiency. We believe they have the potential to replace more expensive, higher power consuming, slower-performance materials and devices used in fiber-optic communication networks.

Our patented and patent pending molecular architectures are based on a well-understood chemical and quantum mechanical occurrence known as *aromaticity*. Aromaticity provides a high degree of molecular stability that enables our core molecular structures to maintain stability under a broad range of operating conditions.

We expect our patented and patent-pending optical materials along with trade secrets and licensed materials, to be the core of and the enabling technology for future generations of optical devices, modules, sub-systems and systems that

we will develop or potentially out-license to electro-optic device manufacturers. The Company contemplates future applications that may address the needs of semiconductor companies, optical network companies, Web 2.0 media companies, high performance computing companies, telecommunications companies, aerospace companies, and government agencies.

Device Design and Development

Electro-optic Modulators

The Company designs its own proprietary electro-optical modulation devices. Electro-optical modulators convert data from electric signals into optical signals that can then be transmitted over high-speed fiber-optic cables. Our modulators are electro-optic, meaning they work because the optical properties of the polymers are affected by electric fields applied by means of electrodes. Modulators are key components that are used in fiber optic telecommunications, data communications, and data centers networks etc., to convey the high data flows that have been driven by applications such as pictures, video streaming, movies etc., that are being transmitted through the internet. Electro-optical modulators are expected to continue to be an essential element as the appetite and hunger for data increases every year.

Polymer Photonic Integrated Circuits (P^2IC^{TM})

The Company also designs its own proprietary polymer photonic integrated circuits (otherwise termed a polymer PIC). A polymer PIC is a photonic device that integrates several photonic functions on a single chip. We believe that our technology can enable the ultra-miniaturization needed to increase the number of photonic functions residing on a semiconductor chip to create a progression like what was seen in the computer integrated circuits, commonly referred to as Moore s Law. One type of integration is to combine several instances of the same photonic functions such as a plurality of modulators to create a 4 channel polymer PIC. In this case, the number of photonic components would increase by a factor of 4. Another type is to combine different types of devices including from different technology bases such as the combination of a semiconductor laser with a polymer modulator. Our P^2IC platform encompasses both these types of architecture.

Current photonic technology today is struggling to reach faster device speeds. Our modulator devices, enabled by our electro-optic polymer material systems, work at extremely high frequencies (wide bandwidths) and possess inherent advantages over current crystalline electro-optic material contained in most modulator devices such as lithium niobate (LiNbO3), indium phosphide (InP), silicon (Si), and gallium arsenide GaAs). Our advanced electro-optic polymer platform is creating a new class of modulators and associated PIC platforms that can address higher data rates in a lower cost, lower power consuming manner, with much simpler modulation techniques.

Our electro-optic polymers can be integrated with other materials platforms because they can be applied as a thin film coating in a fabrication clean room such as may be found in semiconductor foundries. Our polymers are unique in that they are stable enough to seamlessly integrate into existing CMOS, Indium Phosphide (InP), Gallium Arsenide (GaAs), and other semiconductor manufacturing lines.

Glossary

Glossary of select technology terms to provide you with a better understanding our Company s technology and devices:

Electro-optic devices **-** Electro-optic devices convert data from electric signals into optical signals for use in communications systems and in optical interconnects for high-speed data transfer.

Electro-optic material **-** Electro-optic material is the core active ingredient in high-speed fiber-optic telecommunication systems. Electro-optic materials are materials that are engineered at the molecular level. Molecular level engineering is commonly referred to as nanotechnology.

Electro-optic modulators **-** Electro-optic (E/O) modulators are electro-optic devices that perform electric-to-optic conversions within the infrastructure of the Internet. Data centers may also benefit from this technology through devices that could significantly increase bandwidth and speed while decreasing costs. Polymer E/O modulators can be designed and fabricated with multiple structures such as Ridge waveguide and slot waveguide. The waveguides allow the light to be efficiently coupled into and out of the modulators, and provide a basis for integrating modulators together.

Photonic Devices **-** Photonic devices are components for creating, manipulating or detecting light. This can include modulators, laser diodes, light-emitting diodes, solar and photovoltaic cells, displays and optical amplifiers. Other

examples are devices for modulating a beam of light and for combining and separating beams of light of different wavelength.

Polymers - Polymers, also known as plastics, are large carbon-based molecules that bond many small molecules together to form a long chain. Polymer materials can be engineered and optimized using nanotechnology to create a system in which unique surface, electrical, chemical and electro-optic characteristics can be controlled. Materials based on polymers are used in a multitude of industrial and consumer products, from automotive parts to home appliances and furniture, as well as scientific and medical equipment.

Our Business Opportunity

Lightwave Logic, Inc. is developing next generation proprietary photonic devices that are based on our advanced electro-optical polymer material systems. Current legacy technology is based on inorganic crystalline materials, which has allowed for the proliferation of data over fiber optic cables. However, there are inherent molecular deficiencies that have prevented this technology from scaling down in price and up in functionality, especially in terms of $/Gbps. This is primarily due to a closed valence structure that does not allow for the molecular improvements. The valence or valency of an element is a measure of its combining power with other atoms when it forms chemical compounds or molecules. Also, the physical properties of a crystal do not allow for its implementation into highly miniaturize slot structures that are in simple terms the pathways that light travels through in the device.

Organic polymer materials on the other hand, have free electrons that allow for limitless potential to combine with other molecular structures, which allows for multiple options and combinations to improving performance characteristics. Importantly, because they can be applied to optical structures in thin-film liquid form, it is possible to imbue electro-optic ability to highly miniaturized slot structures. Organic polymer materials are also vastly cheaper to manufacture in comparison to growing exotic crystals that are prone to contamination and further must be sliced into thin wafers. Our Company believes that the combination of less expensive manufacturing cost, ease of application, and better scalability, together with a lower cost of ownership due to marked less heat dissipation (requiring less cooling), will create enormous demand for our products.

Many companies early attempts at developing commercially reliable organic polymers were stymied due to the difficulty of creating organic molecules that could remain electro-optically active after being subjected to the high heat of semiconductor manufacturing temperatures (such as silicon CMOS, InP, GaAs etc.). These early attempts also encountered difficulty synthesizing materials that could withstand photochemical bleaching (loss of sensitivity to specific frequencies) and material degradation due to high operating temperatures.

Over the last several years, our Company has made various scientific breakthroughs that have allowed for the synthesis of proprietary organic polymer materials that can withstand extremely high process temperatures of 175^{0}C. Additionally, these materials have demonstrated photochemical stability, even after being subjected to tensor light for over 4,000 hours and exhibited little electro optic degradation even after 2,500 hours of continuous exposure to temperatures at 110^{0}C exceeding typical commercial operating temperatures of approximately 85^{0}C, as found in data center applications. After successfully achieving material test results that either met or exceeded commercial requirements (subsequently confirmed by an outside entity), in late 2016, the Company began production of its first photonic prototype device, a ***ridge waveguide modulator***.

Our First Product The Ridge Waveguide Modulator

A ridge waveguide modulator is a type of modulator where the waveguide is fabricated within a layer of our electro-optic polymer system. Various cladding materials and electrodes are layered over the core polymer. The polymer materials are then part of an integrated photonics platform that can house other photonic devices, such as lasers, waveguides etc.

In April 2017 we achieved bandwidth suitable for 25Gbps data rates in an all-organic polymer ridge waveguide intensity modulator prototype, a significant improvement over our initial 10Gbps device modulator prototype that was announced in 2016. This breakthrough was significant because a 25Gbps data rate is important to the optical networking industry because this data rate is a major node to achieve 100 Gbps (using 4 channels of 25 Gbps). In July

2017 we advanced our high-speed modulation performance to satisfy 28Gbps data rates for QSFP28 standards and 100Gbps data center applications.

In September 2017 we achieved outstanding performance of our ridge waveguide Mach-Zehnder modulators ahead of schedule, with bandwidth performance levels that will enable 50Gbps modulation in fiber-optic communications. This important achievement will allow users to utilize arrays of 4 x 50Gbps polymer modulators using PAM-4 encoding to access 400Gbps data rate systems. Pulse-Amplitude Modulation (PAM-4) is an encoding scheme that can double the amount of data that can be transmitted.

We are now optimizing our high-performance modulators against typical specifications that are required by the fiber communications industry. Furthermore, we are packaging our modulators with our packaging partner so that potential customers can evaluate our high-performance modulators in their systems. One of the most under-evaluated processes of developing high speed devices onto a new and novel technology platform is robustness and reliability. We have already made extensive progress with our polymer materials on this front, and now we are integrating our robust polymer materials onto an integrated photonics platform to provide customers with a more miniaturized, higher performance solution for their data rich systems.

We have also shown that with standard simulation and modeling of our devices, there is a potential to scale the high-speed performance beyond that of 50Gbps, thus providing a technology platform for even greater data rates in the future. This means that our technology platform using polymers is both scalable in high performance as well as scalable in miniaturization and low cost, something that the fiber communications industry has been searching for a long time.

While our initial focus is to address data communications and telecommunications network applications along with cloud computing/data center needs, we believe that in the future we will have additional opportunities to address other applications such as: backplane optical interconnects, photovoltaic cells, medical applications, satellite reconnaissance, navigation systems, radar applications, optical filters, spatial light modulators; and all-optical switches.

Electro-Optic Polymer Production Our Approach vs. the BLA Approach

Our Electro-Optic Material Approach

Our core material expertise relates to the production of high-performance, high-stability electro-optic polymers for high-speed (wide bandwidth) telecommunication and datacommunications applications. More specifically, it lies in a less mainstream, yet firmly established, scientific phenomenon called aromaticity. Aromaticity causes a high degree of molecular stability. It is a molecular arrangement wherein atoms combine into multi-membered rings and share their electrons among each other. Aromatic compounds are stable because the electronic charge distributes evenly over a great area preventing hostile moieties, such as oxygen and free radicals, from finding an opening to attack.

Previous and Current Competitive Organic Electro-Optic Polymer Efforts

For the past several decades, diverse corporate interests, including, to our knowledge, IBM, Lockheed Martin, DuPont, AT&T Bell Labs, Honeywell, Motorola, HP, 3M, and others in addition to numerous universities and U.S. Government Agencies, have attempted to produce high-performance, high-stability electro-optic polymers for high-speed (wide bandwidth) telecommunication applications. These efforts were largely unsuccessful due, in our opinion, to the industry's singular adherence to an industry pervasive engineering model known as the Bond Length Alternation ("BLA") theory model, which none of our patented molecular designs rely upon. The BLA model, like all other current industry-standard molecular designs, consists of molecular designs containing long strings of atoms called polyene chains. Longer polyene chains provide higher electro-optic performance, but are also more susceptible to environmental threats, which result in unacceptably low-performing, thermally unstable electro-optic polymers.

As a result, high frequency modulators engineered with electro-optic polymers designed on the BLA model or any other polyene chain design models are unstable over typical operating temperature ranges, and often exhibit performance degradation within days, hours or even minutes. Similarly, lower frequency modulators exhibit comparable failings, but to a lesser extent. These flaws, in most cases, have prevented commercial quality polymer-based modulators from entering the commercial marketplace. The thermal stability of these devices does not generally meet the minimum Telcordia GR-468 operating temperature range (-40 degrees Celsius to +85 degrees

Celsius) much less the harsher MILSPEC 883D (military specification) range of -55 degrees Celsius to 150 degrees Celsius. While many new applications do not require full military specifications for polymers, many potential customers prefer to see polymer operate at or near these conditions to convey confidence in the material system. We understand from initial conversations with data center architects and designers that the temperature specifications that our materials achieve are compliant with their equipment design needs.

We are aware of other academic and commercial development efforts some by larger companies with vastly more financial resources than we possess. However, we believe that no one yet has developed organic polymer materials that have demonstrated the combination of thermal stability, photochemical stability that can meet or exceed commercial specifications.

Our Electro-Optic Photonic P^{2}IC^{TM} Device Approach

Our electro-optic devices are built around our proprietary organic polymer material systems that we believe will enable better performance than the current embedded legacy technology built around inorganic materials. We also believe that the inherent flexibility of being able to apply our organic polymer materials in liquid thin-film form will accelerate the move toward ultra-miniaturization of Polymer Photonic Integrated Circuits (P^{2}IC^{TM}) by increasing the number of photonic circuits on a single chip. Polymer photonics (previously referred in industry as silicon organic hybrid (SOH)) is the application of polymers on to a platform such as silicon where there are both active and passive photonic component designs. In polymer photonics, polymer devices such as modulators, waveguides, and multiplexers can be fabricated on to a silicon platform that acts as a package as well as a base for mounting lasers (which are needed to source the light).

Our initial device, a ridge waveguide modulator, though highly miniaturized utilizes conventional design and fabrication techniques in the industry. Our future devices will utilize silicon photonics (SiP) technology, which can support highly miniaturized slot waveguides structures etched in large format, low cost, and less expensive silicon wafers coated with our organic electro-optic polymers. The low-cost structure compares well to compound semiconductor technologies such as GaAs (Gallium arsenide) and InP (Indium Phosphide), which suffer from small format wafers that do not allow the economies of scale in high volume fabrication plants. The degree of miniaturization possible of the slot modulator using SiP is not technically feasible to accomplish with inorganic crystalline materials. Although this may not always remain the case, presently there are nearly insurmountable technical difficulties that are inherent to a crystalline molecule.

Although we believe that our polymers will be the key differentiating factor in Polymer photonic devices, we do not currently possess the technical skills and instrumentation necessary to fabricate and test PICs at this dramatically reduced scale and intend to seek an external partner to assist with development.

Our Intellectual Property

Our research and development efforts over the last 10 years have yielded our Company an extensive patent portfolio as well as critical trade secrets, unpatented technology and proprietary knowledge related to our optical polymer materials. Our intellectual property portfolio has expanded significantly over the last year as we are developing our P^2IC into prototypes. We have filed more than 12 patents during 2017 and 2018 and are currently in the process of readying a number of other inventions for formal filings in early 2019. We expect to continue innovating with our P^2IC platform during 2019, and expect to at least maintain this level of invention at our Company during the whole of 2019. For 2018 our focus was to establish the world s first unique Perkinamine™ polymer based integrated photonics circuit portfolio of patents to support our working prototypes.

In addition to the 12 patents we filed during 2017 and 2018, we expect to file new patents in the first half of 2019. In total, our patent portfolio consists of 30 granted patents that include 20 from the US, 1 from Canada, 5 from the EU, 2 from Japan and 2 from China.

Our materials patent portfolio has also strengthened significantly in 2017 with the filing of additional new patent applications on our core Perkinamine™ molecular compounds as well as recent, innovative inventions that are expected to protect our P^2IC polymer PIC platform from potential competition.

Included in our patent portfolio are the following nonlinear optic chromophore designs:

- Stable Free Radical Chromophores, processes for preparing the same
- Stable Free Radical Chromophores, processes for preparing the same
- Tricyclic Spacer Systems for Nonlinear Optical Devices
- Anti-Aromatic Chromophore Architectures
- Heterocyclical Anti-Aromatic Chromophore Architectures
- Heterocyclical Chromophore Architectures
- Heterocyclical Chromophore Architectures with Novel Electronic Acceptor Systems
- Multi-fiber/port hermetic capsule sealed by metallization and method

Our strategic plan is to utilize our core proprietary technology and leverage our proprietary optical materials to be the core of and the enabling technology for future generations of optical devices, modules, sub-systems and systems that we will develop or potentially out-license to electro-optic device manufacturers. Our Company contemplates future applications that may address the needs of semiconductor companies, aerospace companies and government agencies.

We rely on a combination of patents, patent applications, trademarks, trade secrets and contractual provisions to protect our technologies. Further, employees are required to surrender any inventions or intellectual property developed as part of their employment agreements. We also have a policy of requiring prospective business partners to enter into non-disclosure agreements (NDAs) before disclosure of any of our confidential or proprietary information. Our Company can make no assurances that we will be able to effectively protect our technologies and know-how or that third parties will not be able to develop similar technologies and know-how independently.

The anti-aromatic nature of these structures dramatically improves the "zwitterionic-aromatic push-pull" of the systems, providing for low energy charge transfer. Low energy charge transfer is important for the production of extremely high electro-optic character.

Heterocyclical Steric Hindering System This patent describes a nitrogenous heterocyclical structure for the integration of steric hindering groups that are necessary for the nanoscale material integration. Due to the [pi]-orbital configuration of the nitrogen bridge, this structure has been demonstrated not to interfere with the conductive nature of the electronic conductive pathway and thus is non-disruptive to the electro-optic character of the core molecular construction. The quantum mechanical design of the system is designed to establish complete molecular planarity (flatness) for optimal performance.

Totally Integrated Material Engineering System This patent covers material integration structures under a design strategy known as Totally Integrated Material Engineering. These integration structures provide for the "wrapping" of the core molecule in sterically hindering groups that maximally protect the molecule from environmental threats and maximally protect it from microscopic aggregation (which is a major cause of performance degradation and optical loss) within a minimal molecular volume. These structures also provide for the integration of polymerizable groups for integration of materials into a highly stable cross-linked material matrix.

Recent Significant Events and Milestones Achieved

In December 2016 we achieved high-speed modulation in our first all-organic polymer ridge waveguide intensity modulator prototype, which constituted one of the most significant moments in the history of our Company. Our initial "alpha" prototype device, enabled by our P^2IC polymer system, demonstrated bandwidth suitable for data rates up to about 10 Gbps. This performance exceeds the telecom OC-48 standard (2.5 Gbps). This device demonstrated true amplitude (intensity) modulation in a Mach-Zehnder modulator structure incorporating our polymer waveguides.

In April 2017 we achieved bandwidth suitable for 25Gbps data rates in an all-organic polymer ridge waveguide intensity modulator prototype, a significant improvement over our initial 10Gbps device modulator prototype. This breakthrough was significant because a 25Gbps data rate is important to the optical networking industry because this data rate is a major node to achieve 100 Gbps (using 4 channels of 25 Gbps). In July 2017 we advanced our high-speed modulation performance to satisfy 28Gbps data rates for QSFP28 standards and 100Gbps data center applications.

In September 2017 we achieved outstanding performance of our ridge waveguide Mach-Zehnder modulators ahead of schedule, with bandwidth performance levels that will enable 50Gbps modulation in fiber-optic communications. This important achievement will allow users to utilize arrays of 4 x 50Gbps polymer modulators using PAM-4 encoding to access 400Gbps data rate systems. Pulse-Amplitude Modulation (PAM-4) is an encoding scheme that can double the amount of data that can be transmitted.

During February and March 2018, we moved our Newark, Delaware synthetic laboratory and our Longmont, Colorado optical testing laboratory and corporate headquarters to our new office, laboratory and research and development space located at 369 Inverness Parkway, Suite 350, Englewood, Colorado. The new 13,420 square feet Englewood facility includes fully functional 1,000 square feet of class 1,000 cleanroom, 500 square feet of class 10,000 cleanroom, chemistry laboratories, and analytic laboratories. The new Englewood facility streamlines all of our Company s research and development workflow for greater operational efficiencies.

During March 2018, our Company, together with our packaging partner, successfully demonstrated packaged polymer modulators designed for 50Gbps, which we believe will allow us to scale our P^2IC platform with our Mach-Zehnder ridge waveguide modulator design as well as other photonics devices competitively in the 100Gbps and 400Gbps datacom and telecommunications applications market. We are currently fine-tuning the performance parameters of these prototypes in preparation for customer evaluations.

During June 2018, our Company Acquired the Polymer Technology Intellectual Property Assets of BrPhotonics Productos Optoelectrónicos S.A., a Brazilian corporation, which significantly advanced our patent portfolio of electro-optic polymer technology with 15 polymer chemistry materials, devices, packaging and subsystems patent and further strengthened our design capabilities to solidify our market position as we prepare to enter the 400Gbps integrated photonics marketplace with a highly competitive, scalable alternative to installed legacy systems. Since June 2018, we have made significant progress on integrating this technology into our P^2IC (polymer photonic integrated circuit) platform.

Also, during June 2018, our Company promoted polymer PICs and Solidified Polymer PICs as Part of the Photonics Roadmap at the World Technology Mapping Forum in Enschede, Netherlands, which includes our Company s technology of polymers and polymer PICs that have the potential to drive not only 400Gbps aggregate data rate solutions, but also 800Gbps and beyond.

In August 2018 we announced the completion (ahead of schedule) of our fully equipped on-site fabrication facility, where we are expanding our high-speed test and design capabilities. We also announced the continuation of the building of our internal expertise with the hiring of world-class technical personnel with 100Gbps experience.

As we move forward to diligently to meet our goals, we continue to work closely with our packaging partner for the 50Gbaud prototypes, and we are advancing our reliability and characterization efforts to support our prototyping. We are actively engaged with test equipment manufacturers to deliver the most advanced test equipment for our state-of-the-art polymer results. We continue to engage with multiple industry bodies to promote our roadmap. We continue to fine tune our business model with target markets, customers, and technical specifications. Discussions with prospective customers are validating that our modulators are ideally suited for the datacenter and telecommunications markets that are over 10km in length. Details of what these prospective customers are seeking from a prototype are delivered to our technical team.

The Global Photonic Device Market

General Overview

Lightwave Logic has been reviewing the latest market data as well as its own internal data for its business strategy, and below we detail the global market dynamics both in terms of data traffic as well as how PIC based technologies will grow in the fiber communications segment of the market.

As we have already seen with products such as smart phones, lap top computers, and personal digital assistants (PDAs), Internet traffic is one of the important metrics that is being used to show activity in fiber communications, and particularly telecommunications as well as datacommunications (which includes datacenters and high-performance computing). Internet Protocol (IP) traffic has typically been used to gauge the amount of data that is being used on the internet as shown in the graph below (sourced from Cisco VNI in 2018). The metric is Exabytes per month. An Exabyte is 1E18 which is 1000 Petabytes, or 1000,000 Terabytes or a billion Gigabytes of data. As seen from the graph which has a strong growth of 22% CAGR (2015-2020), the majority of the traffic is being driven by video, traffic, and is fast approaching the metric of Zetta which is 1E21 bytes of data. Some estimates are discussing the further metric of Yotta which is 1E24 bytes of data over the next decade, which is also expected to be driven for the most part by video.

Within the overall market trends of IP traffic growth, the internet will need to be able to support high volumes of data traffic. In order to do this, the fiber-optic infrastructure that allows data to be communicated between network nodes such as datacenters, within datacenters, and optical network switches etc., has to be upgraded. Today, fiber-optic networks are a combination of long, medium and short optical interconnects that range from 3 meters (or 1yard) to over 1000km depending on application in the optical network. Optical components, typically known as photonics components are used to build the fiber-optic infrastructure and consist of things like: laser diode, photodetectors, multipliers, modulators, transceivers etc. These are known as discrete components, while a mix of these components that are integrated or connected on a single substrate (such as silicon, InP, GaAs etc.) are called PICs (Photonic Integrated Components). The summary photonics market has been reviewed in 2017 and is shown below. The summary photonics market is forecast to grow to $43B by 2025 with a 7% CAGR (20-25) that includes both discrete and PIC photonic components. The summary photonics components market is forecasted to reach $21B in 2017.

Within the summary photonics components market, three major segments exist: WAN (wide area networks), access, and Datacom. The WAN segment is forecast to grow to $27B by 2025 with a 19% CARG (20-25) and the Datacom segment is forecast to grow to $12.1B by 2025 with 22% CAGR (20-25). As can be seen from the graph below, the growth of the WAN and Datacom segments is forecasted to be very strong over the next decade and provide the engine for growth in the overall global photonics components market.

One of the key metrics that is needed for any overall market analysis is how photonics components will grow over the next decade from a PIC perspective. This is important as the trend to integrate photonics components is beginning to accelerate. The trend has been driven by customer applications that require smaller photonic component solutions, lower power, high data rates, larger buildings for longer interconnect lengths, and more economic in terms of $/Gbps. PIC technologies, i.e. those technologies that include integrated photonics are forecasted to grow to ~$30B by 2025 with 16% CAGR (20-25). These technologies include InP which is the current incumbent, GaAs, and other newer integrated technology solutions such as SiP (silicon photonics), polymer photonics, and dielectric photonics. The forecast of ~$30B is approximately 69% of the summary photonics components market by 2025, which represents a huge acceleration for PIC based technologies over the next decade. This also means while PIC based technologies are $7B today with 24% of the photonics components market, PIC based technologies become de facto by 2025.

While the rise of PIC based technologies is exciting, what also is exciting in the photonics component market is the rise of fiber-optic transceivers. Transceivers are small boxes located at the end of each fiber-optic link that house photonics components and PIC components which send and receive data. While the global overall photonic components market is expected to reach $43B by 2025, the photonics transceivers sub-segment is forecasted to grow to $25B by this time. This represents that transceivers will accelerate to 58% of the global overall photonics market by 2025 and become a major driver for optical networking over the next decade.

The key segments in photonics based fiber-optic transceivers achieved $11.3B in 2017 with growth from 9 different segments that include: AOC, CATV, Fibre Channel, DWDM, Ethernet-datacom, WAN-client side, Radio etc., based transceivers. Three of these segments are forecasted to grow very well to achieve revenues of $25B by 2025, with the biggest contributions from DWDM, Ethernet-datacom, and WAN-client based transceivers.

The transceiver growth shows which sub-segments that will utilize small boxes at the ends of fiber-optic interconnects, it is well known that transceiver trends over the past decade have been towards smaller boxes i.e. smaller transceiver formats and footprints (such as SFF, SFP, QSFP, and many others), with higher densities of photonics components designed into them. It is expected over the forecast period that transceivers will be an excellent platform for the accelerating trends of PICs in both telecom and datacom applications. The graph below shows the PIC transceiver forecast to 2025. PIC transceivers are forecast to reach $20B by 2025 with 17% CARG (20-25) growing from $3.2B in 2017. What is more interesting is that by about 2021, PIC transceivers will lead discrete photonic component transceivers from a revenue standpoint. This means that the trend to integrate photonics components inside a transceiver is accelerating quickly, driven by the customer interest for smaller, denser, and higher performance metrics of transceivers. This trend is ideal for our polymer based integrated photonics platform to have a huge impact in the market segment over the next decade.

Within the PIC transceivers market there are a number of sub-segments that summate to $20B by 2025. The major segments that drive this forecast are Ethernet, DWDM, and WAN-client-side applications as can be seen from the graph below. In particular these segments are technologically driven by PIC based technologies that operate at 100Gbps and 400Gbps data rates that generally are considered high performance solutions.

Data rates and high performance of transceivers can be seen by the graph below which depicts PIC based technologies in the Ethernet sub-segment. For Ethernet applications only, transceivers are driven by 100GE based PIC technologies. The market is forecast with 100GE to grow to $4.5B by 2025 with 6% CAGR (20-25) and with 400GE to grow to $0.98B by 2025 with 16% CAGR (20-25). This is a clear drive for the PIC based transceivers in the Ethernet application is 100GE over the forecast period and sets the scene for polymer based integrated photonics to have the opportunity to grow extremely quickly.

As the Company is developing polymer based photonic devices such as fiber-optic modulators, these devices translate electric signals into optical signals and allow laser based technology to operate effectively at 50Gbps and beyond. Lasers with modulator are used in fiber communication systems to transfer data over fiber-optic networks today and are expected to be a key driver in photonics components for PIC based technological solutions over the next decade. Optical data transfer using lasers and modulators is significantly faster and more efficient than transfer technologies using only electric signals, permitting more cost-effective use of bandwidth for broadband Internet and voice services.

Our Target Markets

Cloud computing and data centers

Big data is a general term used to describe the voluminous amount of unstructured and semi-structured data a Company creates -- data that would take too much time and cost too much money to load into a relational database for analysis. Companies are looking to cloud computing in their data centers to access all the data. Inherent speed and bandwidth limits of traditional solutions and the potential of organic polymer devices offer an opportunity to increase the bandwidth, reduce costs and improve speed of access.

Datacenters have grown to enormous sizes with hundreds of thousands and even millions of servers in a single datacenter. The number of so-called hyperscale datacenters are expected to continue to increase in number. Due to their size, a single datacenter may consist of multiple large warehouse-size buildings on a campus or even several locations distributed around a metropolitan area. Data centers are confronted with the problem of moving vast amounts of data not only around a single data center building, but also between buildings in distributed data center architecture. Links within a single datacenter building may be shorter than 500 meters, though some will require optics capable of 2 km. Between datacenter buildings, there is an increasing need for high performance interconnects over 10km in reach.

Our modulators are suitable for single-mode fiber optic links. We believe that our single mode modulator solutions will be competitive at 500m to 10km link distances, but it will be ideally suited at greater than 10km link distances.

Telecommunications/Data Communications

The telecommunications industry has evolved from transporting traditional analogue voice data over copper wire into the movement of digital voice and data. Telecommunication companies are faced with the enormous increasing

challenges to keep up with the resulting tremendous explosion in demand for bandwidth. The metropolitan network is especially under stress now and into the near future. Telecommunications companies provide services to some data center customers for the inter-data center connections discussed above. 5G mobile upgrade, autonomous driving and IoT are expected to increase the need for data stored and processed close to the end user in edge data centers. This application similarly requires optics capable of very high speeds and greater than 10 km reach.

Industry issues of scaling

The key issues facing the fiber-optic communications industry are the economic progress and scalability of any PIC based technological platform. The polymer platform is unique in that it is truly scalable. Scalable means being able to scale up for high speed data rates, while simultaneously being able to scale down in cost. This allows a competitive cost per data rate or cost per Gbps metric to be achieved.

Fiber optic datacentre and high-performance computing customers want to achieve the metric of $1/Gbps @ 400Gbps (this essentially means a single mode fiber optic link that has a total cost of $400 and operates with a data rate of 400Gbps à which also means that each transceiver at each end of the fiber optic link must be able to be priced at $200), but as industry tries to match this target, it is already falling behind as can be seen in the Figure below which plots generic typical PIC based technology:

In the above figures (where the left-hand graph is a linear vertical scale, and the right-hand graph is a log scale), it can be seen that the orange curve plots the customer expectation, while the other color curves show $/Gbps improvement over time for various high-speed data rate transceivers using PIC based technologies. A gap is appearing between what customer expect and what the technologists can produce.

Polymers play an important role in PICs over the next decade as they can reduce or close the gap between customer expectations and technical performance through effective scaling increase of high performance with low cost. This is shown in the Figure below how polymers have the potential to scale to the needs of the customers over the next 3-5years.

Some of the things needed to achieve the scaling performance of polymers in n integrated photonics platform is within sight today:

1) Increased r33 (which leads to very low Vpi in modulator devices) and we are currently optimizing our polymers for this.
2) Increase temperature stability so that the polymers can operate at broader temperature ranges effective, where we have made significant progress over the past few years.
3) Low optical loss in waveguides and active/passive devices for improved optical budget metrics which is currently an ongoing development program at our Company
4) Higher levels of hermeticity for lower cost packaging of optical sub-assemblies within a transceiver module, where our advanced designs are being implemented into polymer-based packages.

Our Business Strategy

Our business strategy anticipates that our revenue stream will be derived from one or some combination of the following: (i) technology licensing for specific product application; (ii) joint venture relationships with significant industry leaders; or (iii) the production and direct sale of our own electro-optic device components. Our objective is to be a leading provider of proprietary technology and know-how in the electro-optic device market. In order to meet this objective, we intend to:

- Further the development of proprietary organic electro-optic polymer material systems
- Develop photonic devices based on our P^2IC^{TM} technology
- Continue to develop proprietary intellectual property
- Grow our commercial device development capabilities
- Grow our product reliability and quality assurance capabilities
- Grow our optoelectronic packaging and testing capabilities
- Grow our commercial material manufacturing capabilities
- Maintain/develop strategic relationships with major telecommunications and data communications companies to further the awareness and commercialization of our technology platform
- Continue to add high-level personnel with industrial and manufacturing experience in key areas of our materials and device development programs.

Create Organic Polymer-Enabled Electro-Optic Modulators

We intend to utilize our proprietary optical polymer technology to create an initial portfolio of commercial electro-optic polymer product devices with applications for various markets, including telecommunications, data communications and data centers. These product devices will be part of our proprietary photonics integrated circuit (PIC) technology platform.

We expect our initial modulator products will operate at data rates at least 50 Gbaud (capable of 50 Gbps with standard data encoding of NRZ and 100 Gbps with more complex PAM-4 encoding). Our devices are highly linear, enabling the performance required to take advantage of the more advance complex encoding schemes. We are currently developing our polymer technology to operate at the next industry node of 100Gbaud.

Our P^2IC platform will have the flexibility to allow multiple channels through integration. For example, where 4 modulated channels are expected each to operate at least 50 Gbaud per channel, the aggregate optical signal output could carry 400 Gbps with PAM-4 advanced data encoding, and potentially 100Gbaud per channel. Pulse-Amplitude Modulation (PAM-4) is an industry standard encoding scheme that can double the amount of data that can be

transmitted with a given device speed. This relationship between baudrate and bitrate by encoding scheme is described in a number of places, including in a white paper publicly available on our website. We believe the capability of the electro-optic polymer technology up to these speeds will be highly attractive to potential customers seeking to assure their own product roadmaps. This will allow our Company to participate in opportunities that range up to 800Gbaud using a 4 channel P[2]IC platform, and potentially 1600Gbaud (or 1.6Tbaud) with an 8 channel P[2]IC platform.

Continue to Expand Our Intellectual Property Portfolio and Reliance on Trade Secrets

We plan to continuously advance the development of unique organic electro-optic polymer materials along with proprietary designs and device configurations. We intend to protect our technology by filing patent applications where appropriate or by obtaining exclusive technology rights where available. However, in some cases, we will refrain from protecting certain proprietary information with patents in favor of trade secrets.

Continue to Recruit Technical Expertise

In December 2011, we retained Dr. Frederick Leonberger, PhD as our Senior Advisor. Dr. Leonberger is the former Chief Technology Officer of JDS Uniphase, Inc. We previously retained EOvation Advisors LLC, a technology and business advisory firm founded by Dr. Frederick Leonberger, as a consultant to the Company. Dr. Leonberger is presently assisting our Company with strategic planning and the design of optical modulators that we intend to develop. In May 2017, Dr. Leonberger was elected to our Board of Directors and serves as a member of the operations committee and assists with the technical direction and strategy of the Company.

In July 2018 we retained Dr. Karen Liu, a former industry analyst and marketing executive in datacom and telecom fiber optic communications, as our Vice President of Sales and Marketing to advance our customer-facing position in the datacom and telecom markets and to assist with engaging with customers on our 400Gbps and 800Gbps prototypes.

Our Research and Development Process

Our research and development process consist of the following steps:

- We develop novel polymer materials utilizing our patented and patent pending technology to meet certain performance specifications. We then develop methods to synthesize larger quantities of such material.
- We conduct a full battery of tests at the completion of the synthesis of each new polymer material to evaluate its characteristics. We also create development strategies to optimize materials to meet specifications for specific applications. We model and simulate each new polymer material so that we can further understand how to optimize the material for device operation.
- We integrate data from the material characterization and test results to fabricate devices. We analyze device-testing results to refine and improve fabrication processes and methods. In addition, we investigate alternative material and design variations to possibly create more efficient fabrication processes.
- We create an initial device design using simulation software. Following device fabrication, we run a series of optical and electronic tests on the device.

We have and expect to continue to make significant operating and capital expenditures for research and development. Our research and development expenses were $2,830,785 and $3,519,129 for the nine months ended September 30, 2018 and the year ended December 31, 2017, respectively.

Our Proprietary Products in Development

As part of a two-pronged marketing strategy, our Company is developing several optical devices, which are in various stages of development and that utilize our organic nonlinear optical materials. They include:

Ridge Waveguide Modulator

Our ridge electro-optic waveguide modulator was designed and fabricated in our Longmont, Colorado laboratory. The fabrication of our first in-house device is significant to our entire device program and is an important starting point for modulators that are being developed for target markets. We have multiple generations of new materials that we will soon be optimizing for this specific design. In September 2017 we announced that our initial alpha prototype ridge waveguide modulator, enabled by our P^2IC polymer system, demonstrated bandwidth performance levels that will enable 50Gbps modulation in fiber-optic communications. This device demonstrated true amplitude (intensity) modulation in a Mach-Zehnder modulator structure incorporating our polymer waveguides. This important achievement will allow users to utilize arrays of 4 x 50Gbps polymer modulators using PAM-4 encoding to access 400Gbps data rate systems. Pulse-Amplitude Modulation (PAM-4) is an encoding scheme that can double the amount of data that can be transmitted. These ridge waveguide modulators are currently being packaged with our partner and will be available for evaluation by potential customers in 2019. In parallel, we are simulating and modeling the modulators for scalability to higher data rates above 50Gbps and lower cost structures that will be competitive with incumbent technology. This provides our technology platform with higher levels of scalability and will provide potential customers with technological solutions that they are currently looking for.

The ridge waveguide modulator represents our first commercially viable device, and targets metro networks (< 10Km) within large scale telecommunications and data communications networks and represents at least a $300M per year market opportunity for us.

Slot Waveguide Modulator

Our functional polymer photonics slot waveguide modulator utilizes an existing modulator structure with one of our proprietary electro-optic polymer material systems as the enabling material layer, and is functional as an operating prototype device.

Preliminary testing and initial data on our polymer photonics slot waveguide modulators demonstrated several promising characteristics. The tested polymer photonic chip had a 1-millimeter square footprint, enabling the possibility of sophisticated integrated optical circuits on a single silicon substrate. In addition, the waveguide structure was approximately 1/20 the length of a typical inorganic-based silicon photonics modulator waveguide.

With the combination of our proprietary electro-optic polymer material and the extremely high optical field concentration in the slot waveguide modulator, the test modulators demonstrated less than 2.2 volts to operate. Initial speeds exceeded 30-35 GHz in the telecom, 1550 nanometer frequency band. This is equivalent to four, 10Gb/sec, inorganic, lithium niobate modulators that would require approximately 12-16 volts to move the same amount of information.

Our material also operates in the 1550 nanometer frequency band, which is suitable for data communications applications. We continued with our collaborative development of our SOH/ Polymer photonic slot waveguide modulator in 2014 and continued our collaboration with an associated third-party research group in 2017 and expect to see initial results in 2019.

Our Long-Term Device Development Goal - Multichannel Integrated Nanophotonic Transceiver

While we consider our ridge waveguide and slot waveguide modulators currently under development to be commercially viable products, in another sense they are intermediate steps in the development of our long-term goal a multichannel integrated nanophotonic transceiver for application in data communications.

The transceiver consists of a silicon photonic chip fabricated with nonlinear polymer infused modulators (polymer photonic), multiplexers, demultiplexers, detectors and grating fiber couplers to an external light source. The CMOS-compatible optical modulators are key components for future silicon-based photonic transceivers. Our solution, the silicon-organic hybrid (polymer photonic) platform has been proposed and is being prototyped. In the polymer photonic approach, the optical signal is guided by a silicon waveguide while an organic cladding provides the electro-optic effect.

Other Potential Applications for Our Products

We believe that there are myriad potential applications for our organic polymer materials and devices outside of our initial focus of data communications, telecommunications and data centers. These potential applications encompass areas as diverse as military, space, optical computing, and life sciences. We believe that as viable organic polymer materials gain acceptance, their increased flexibility, functionality and low cost will create new applications that may not yet be technically feasible. Two such future applications with revolutionary potential are:

All-Optical Switches

An all-optical switch is one that enables signals in optical fibers or networks to be selectively switched from one fiber or circuit to another. Many device designs have been developed and commercialized in today s telecom networks to effect optical switching by using mechanical or electrical control elements to accomplish the switching event. Future networks will require all-optical switches that can be more rapidly activated with a low energy and short duration optical (light) control pulse.

Multi-Channel Optical Modem

The availability of low cost electro-optic modulators will enable low cost multichannel optical modems that will use many wavelengths in parallel and employ high efficiency modulation techniques such as QAM (quadrature amplitude modulation). Such modems would enable an order of magnitude increase in the Internet capacity of legacy fiber. Our Company is in the early feasibility stage of such a multichannel optical modem.

Our Past Government Program Participation

Our Company has been a participant in several vital government sponsored research and development programs with various government agencies that protect the interests of our country. The following is a list of some of the various divisions of government agencies that have provided us with advisory, financial and/or materials support in the pursuit of high-speed electro-optic materials. We are not currently partnered with, strategically related to, or financially supported by any governmental agency at this time, however, we may explore future opportunities as our Company grows and gains the additional resources and personnel necessary to support these efforts. Our previous relationships included:

- National Reconnaissance Office (NRO)
- Properties Branch of the Army Research Laboratory on the Aberdeen Proving Grounds in Aberdeen, Maryland.
- Defense Advance Research Project Agency (DARPA)
- Naval Air Warfare Center Weapons Division in China Lake, California
- Air Force Research Laboratory at Wright-Patterson Air Force Base in Dayton, Ohio

Our Competition

Competitive Technologies - PIC Based Technologies

PIC technologies have historically been driven using III-V compound semiconductors, namely InP, although GaAs remains a strong PIC platform, and is expected to strengthen via the VCSEL based 3D sensing applications. Indium Phosphide has been used since the 1980s as the first PIC platform with laser modulator chips where both the laser and modulator were fabricated monolithically. Since the 1980s, there have been InP based transmitters, receivers, and other functional elements that all support the fiber-communications industry. In fact, over the past 3 decades it has the been the fiber communications industry that has driven the increased performance, miniaturization and simplicity in packaging for PIC based technologies. Also, back in the 1980s, optoelectronics was the key word to describe having both electronic and photonic functions or devices on a single chip. This was known in early publications as an optoelectronics integrated circuit (OEIC). Today optoelectronics is synonymous with photonics , and hence the common-place use of photonics integrated circuits for PICs.

In the below figure, it can be seen in red that the incumbent technology for PICs is InP. InP is capable of providing a number of devices and opportunities in both electronics as well as photonics. InP main weakness from a function standpoint is that although it can provide HFETs, JFETs, bipolar electronic devices, it has not been able to successfully penetrate LSI, or VLSI with digital IC circuitry. Chips such as ASICs are not practically available with the InP platform mostly due to advancement in electronic transistor design, and also through limited maturity in large format wafer manufacturing. Today the majority of InP fabrication is based on 4 or 100mm wafers, and only in the past year have folks been seriously looking at 6 or 150mm InP wafer infrastructure. From the photonics standpoint, there are very good reasons why InP is the incumbent technology it provides world class performance in lasers, modulators, simple electronics such as drivers and TIAs (transimpedance amplifiers), as well as highly performing active and passive devices such as SOAs, waveguides, spot-size converters, and mux/demux blocks such as AWG and Eschelle gratings.

Over the past decade, the rise of silicon-based photonics has accelerated quickly (as can be seen in blue in the Figure). Silicon has a huge history in electronics, and it s been said by many that if the existing infrastructure could be utilized effectively, then the cost of producing photonics with similar fabrication, design, testing, and simulation tools, would become competitive with the current incumbent technology: InP. As can be seen by the figure, silicon is capable of handling many photonics devices in addition to all electronic functionality with CMOS and BiCMOS based technologies. The only photonic device that remains impossible (at least for the time being) is the emitter or laser where light is generated. This has spawned a new segment for silicon photonics (SiP) where engineers and scientists have developed creative ways to implement InP into device, wafer, and epi-designs that are silicon based. These solutions are typically referred to as heterogeneous solutions where both InP and silicon are utilized to create PIC platforms with emitter or laser-based functionality.

While the red area of the Figure represents the incumbent technology InP, the blue areas, Silicon Photonics, the middle areas that are shaded green represent PIC based technologies that can utilize either III-V compound semiconductor platforms such as InP, GaAs, even GaN, as well as silicon platforms such as silicon wafers, and various combinations of silicon-based materials such as SOI (silicon on insulator), SiGe etc. The green areas are represented by both polymers and dielectric materials that can be deposited onto either silicon or III-V material wafers. These combinations of technology allow flexibility in PIC designs where both polymers and dielectrics can provide a multitude of active and passive photonic devices such as: waveguides (W/G), spot size converters (SSC), modulators (such as Mach Zehnder and slot types), multipliers and demultipliers (Mux/Demux variants such as AWGs, MMI, and Echelle gratings). The interesting part of the polymer and dielectric technology is that combinations of active and passive devices can be mixed and matched with either III-V compound devices as well as silicon based, heterogeneous based devices to design more effective and efficient PICs. For polymers, very low voltage can be utilized for low cost, low power consumption, very high-speed modulators that can be deposited onto a semiconductor platform. For dielectric photonics, very low temperature sensitivity mux/demux devices (such as athermal designs) can be deposited onto a semiconductor platform. As can be seen from the Figure, polymer and dielectric technology suffers from that the fact that high density ICs and laser-based emitters are not available but could be integrated with the appropriate designs for the PIC with III-V compound semiconductors and/or silicon based technology that have both DSP/ASIC type circuits and laser emitters.

PIC technologies have a number various and broad applications as can be seen by the Figure below. In this Figure applications range from fiber optic communications, self-driving vehicles, sensing, internet of things, bio-photonics, healthcare, industrial, military, high performance computing etc.

PIC technologies are based upon semiconductor wafers (such as III-V compound semiconductors InP, GaAs etc.) as well as silicon wafers (which can be tailored to become SiGe heterogeneous, SOI, etc.). As these platforms are semiconductor based, the wafers are processed in fabs or fabrication facilities to produce devices. As a general rule, silicon has the largest wafers with 8 (200mm) and 12 (300mm) format discs. GaAs typically is running 3 (75mm), 4 (100mm) and 6 (150mm) wafers in production fabs or fabrication plants around the world. There is an expectation that GaAs will eventually move to 8 (200mm) wafers in the next 5 years. InP is in production today on 2 (50mm), 3 (75mm) and 4 (100mm) wafers with an expectation to move to 6 (150mm) in the next 5 years. Heterogeneous solutions with silicon photonics that utilize materials such as SiGe and InP are typically 8 (200mm) and 12 (300mm) format wafers. Polymer photonics can be deposited on either III-V compound semiconductor wafers as well as silicon wafers which makes it suitable for the next generation of PIC based technological platforms for the fiber communications industry.

The supply chain for the PIC industry starts with the wafer development and continues through epitaxial growth, device fabrication, optical sub-assembly, module or transceiver builds, and sub-systems which are implemented into optical networking applications. Within these supply chain segments, a number of combinations of technology can be utilized. For example, CMOS IC circuits can be fabricated onto silicon wafers together with silicon photonics, heterogeneous solutions, that could have the advantage of polymer active devices, and dielectric passive devices on board. InP may be combined with polymer photonics to house on-board or on-wafer emitters to source light for the optical signaling with modulators. Included in the wafers can be combinations of electrical and optical circuitry. Electrical circuitry is usually set up as both as single as well as multilevel interconnects. Optical circuitry is usually set up as a waveguide or optical layer as part of the device fabrication design. PICs can interconnect electrical devices with photonic devices, and also increase chip functionality through the use of electrical and optical active and passive device solutions. Polymer technologies can provide active device function through for example Mach Zehnder modulators, as well as providing passive device function with waveguides, multipliers, and demultipliers.

Competitors

The markets we are targeting for our electro-optic polymer technology are intensely competitive. Among the largest fiber-optic component manufactures are Finisar, Lumentum, Oclaro, NeoPhotonics, Molex, Avago. Additionally, the five largest inorganic modulator component manufacturers hold approximately 85% of the electro-optic modulator component market. They are Lumentum, Sumitomo, Oclaro, Fujitsu and ThorLabs. These companies are heavily invested in the production of crystalline-based electro-optic modulator technologies, as well as the development of novel manufacturing techniques and modulator designs.

Our Plan to Compete

We believe that as our organic polymer technology gains industry acceptance, we will be poised to obtain a significant portion of the component manufacturing market. Electro-optic polymers demonstrate several advantages over other technologies, such as inorganic-based technologies, due to their reduced manufacturing and processing costs, higher performance and lower power requirements. Our patented organic polymers and future electro-optic photonic devices have demonstrated significant stability advantages over our known competitor's materials.

We believe the principal competitive factors in our target markets are:

- The ability to develop and commercialize highly stable optical polymer-based materials and optical devices in commercial quantities.
- The ability to obtain appropriate patent and proprietary rights protection.
- Lower cost, high production yield for these products.
- The ability to enable integration and implement advanced technologies.
- Strong sales and marketing, and distribution channels for access to products.

We believe that our current business planning will position our Company to compete adequately with respect to these factors. Our future success is difficult to predict because we are an early stage company with all of our potential products still in development.

Many of our existing and potential competitors have substantially greater research and product development capabilities and financial, scientific, marketing and human resources than we do. As a result, these competitors may:

- Succeed in developing products that are equal to or superior to our potential products or that achieve greater market acceptance than our potential products.
- Devote greater resources to developing, marketing or selling their products.
- Respond quickly to new or emerging technologies or scientific advances and changes in customer requirements, which could render our technologies or potential products obsolete.
- Introduce products that make the continued development of our potential products uneconomical.
- Obtain patents that block or otherwise inhibit our ability to develop and commercialize our potential products.
- Withstand price competition more successfully than we can.
- Establish cooperative relationships among themselves or with third parties that enhance their ability to address the needs of our prospective customers.
- Take advantage of acquisition or other opportunities more readily than we can.

Employees

We currently have 17 full-time employees, and we retain several independent contractors on an as-needed basis. Based on our current development plan we expect to add 2to 4 additional full-time employees in 2019. We believe that we have good relations with our employees.

Properties and Laboratory Facilities

Our principal executive offices and research and development facility is located at our new office, laboratory and research and development space located at 369 Inverness Parkway, Suite 350, Englewood, Colorado. The new 13,420 square feet Englewood facility includes fully functional 1,000 square feet of class 1,000 cleanroom, 500 square feet of class 10,000 cleanroom, chemistry laboratories, and analytic laboratories. The new Englewood facility streamlines all of our Company s research and development workflow for greater operational efficiencies.

Legal Proceedings

We are not currently a party to or engaged in any material legal proceedings and we are not aware of any litigation or threatened litigation of a material nature. However, we may be subject to various claims and legal actions arising in

the ordinary course of business from time to time.

MANAGEMENT

Identity of directors, executive officers and significant employees

Name	Age	Position	Director Class/ Term
Michael Lebby	58	Director; Chief Executive Officer	Class II Expires 2019
James S. Marcelli	71	Director; President; Chief Operating Officer, Secretary	Class III Expires 2020
Thomas E. Zelibor	64	Chair of the Board of Directors	Class III Expires 2020
Joseph A. Miller	77	Director	Class II Expires 2019
Ronald A Bucchi	64	Director	Class II Expires 2019
Siraj Nour El-Ahmadi	54	Director	Class I Expires 2021
Frederick J. Leonberger	71	Director	Class I Expires 2021

Business experience of directors, executive officers, and significant employees

Dr. Michael Lebby. Dr. Lebby has served as our Chief Executive Officer since May 1, 2017 and as a director of our Company since August 26, 2015. He also previously served a member of our Operations Committee until April 30, 2017. Dr. Lebby is in charge of the overall general management of the Company and supervision of Company policies, setting the Company s strategies, formulating and overseeing the Company s business plan, raising capital, expanding the Company s management team and the general promotion of the Company From June 2013 to 2015, Dr. Lebby has served as President and CEO of OneChip Photonics, Inc., a privately held company headquartered in Ottawa, Canada, that is a leading provider of low-cost, small-footprint, high-performance indium phosphide (InP)-based photonic integrated circuits (PICs) and PIC-based optical sub-assemblies (OSAs) for the Data Center markets. Also, from 2013 to 2015 Dr. Lebby presently served as part-time full professor, and chair of optoelectronics at Glyndwr University in Wales, UK, to bring forward advanced materials, device, and integrated photonics based technologies for the datacenter and high performance computing markets. During the period 2014 to 2016, Dr. Lebby focused on a foundry based model for InP-based photonic integrated circuits (PICs) and optoelectronic integrated circuits (OEICs) in the datacenter segment and was been instrumental in assembling California s proposal (via USC) to the Federal Government for an integrated photonics manufacturing institute. Dr. Lebby holds a Doctor of Engineering, a Ph.D., a MBA and a bachelor s degree, all from the University of Bradford, United Kingdom. Dr. Lebby has well over 200 issued utility patents with the USPTO. This number expands to over 450 if international derivative patents are included.

Mr. James S. Marcelli. Mr. Marcelli has served as an officer and director of our Company since August 2008. Since May 2012, Mr. Marcelli has served as our Company s President and Chief Operating Officer, and he was named our Secretary in March 2018. Previously, from August 2008 to April 2012, Mr. Marcelli served as our President and Chief

Executive Officer. Mr. Marcelli is in charge of the day-to-day operations of our Company and its movement to a fully functioning commercial corporation, and also serves as our Company s principal financial officer. Since 2000, Mr. Marcelli has served as the president and chief executive officer of Marcelli Associates, a consulting company that offers senior management consulting, mentoring, and business development services to start-up and growth companies. Business segments Mr. Marcelli has worked with included an Internet networking gaming center, high-speed custom gaming computers, high tech manufacturing businesses and business service companies.

Thomas E. Zelibor, Rear Admiral, USN (Ret). RADM Zelibor has served as our Chair of the Board of Directors (non-executive) since May 1, 2017. Previously, has served as our Chief Executive Officer and Chair of the Board of Directors (executive) from May 2012 to April 30, 2017. Mr. Zelibor also previously served as Chair of the Board of Directors (non-executive) of our Company since October 2011 and has served as a director of our Company since July 2008. He also previously served on our Operation Committee. Mr. Zelibor is currently the Chief Executive Officer of the Space Foundation and a director of Nuvectra Corp. Mr. Zelibor previously served as the Chief Executive Officer and President of Zelibor & Associates, LLC, a management-consulting firm and as the Chief Executive Officer and President of Flatirons Solutions Corp. Prior to that time, Mr. Zelibor served in the U.S. Navy in a number of positions, including as the Dean of the College of Operational and Strategic Leadership at the United States Naval War College where he was responsible for the adoption of a corporate approach to leadership development; Director of Global Operations, United States Strategic Command; Director, Space, Information Warfare, Command and Control on the Navy staff; Department of the Navy, Deputy Chief Information Officer (CIO), Navy; Commander, Carrier Group Three and Commander, Naval Space Command. Mr. Zelibor earned his bachelor s degree from the United States Naval Academy and has been a participant in the Senior Leader in Residence Program and a visiting scholar for the Zell Center for Risk Research at the Kellogg School of Management, Northwestern University.

Dr. Joseph A. Miller, Jr. Dr. Miller has served as a director of our Company since May 10, 2011. From 2002 to May 2012, Dr. Miller served as Executive Vice President and Chief Technology Officer of Corning Incorporated, having joined Corning Incorporated in 2001 as Senior Vice President and Chief Technology Officer. Prior to joining Corning Incorporated, Dr. Miller was with E.I. DuPont de Nemours, Inc., where he served as Chief Technology Officer and Senior Vice President for Research and Development since 1994. Dr. Miller began his career with DuPont in 1966. Dr. Miller is a director and Non-executive Chairman of Nuvectra Corp., and he previously served as a director for Greatbatch, Inc. He holds a doctorate degree in Chemistry from Penn State University.

Mr. Ronald A. Bucchi. Mr. Bucchi has served as a director of our Company since June 11, 2012, and he currently serves a member of our Audit Committee. Mr. Bucchi is currently a self employed C.P.A. with a specialized practice that concentrates in CEO consulting, strategic planning, mergers, acquisitions, business sales and tax. He works with domestic and international companies. Mr. Bucchi is currently a member of the board of directors of First Connecticut Bancorp, Inc., serving on Asset Liability Committee, the Governance and Loan committees in addition to chairing the Audit committee. He is currently the Treasurer and a member of the Board of Directors of the Petit Family Foundation, Inc. He has served on numerous other community boards and is past Chairman of the Wheeler Clinic and the Wheeler YMCA. He is a member of the Connecticut Society of Certified Public Accountants, American Institute of Certified Public Accountants and the National Association of Corporate Directors. Mr. Bucchi is a graduate of the Harvard Business School Executive Education program with completed course studies in general board governance, audit and compensation and a graduate of Central Connecticut State University where he received his B.S. in Accounting.

Mr. Siraj Nour El-Ahmadi. Mr. El-Ahmadi has served as a director of our Company since October 2, 2013, and he currently serves a member of our Audit Committee. Since 2004, Mr. El-Ahmadi has served as Founder, President and Chief Executive Officer of Menara Networks, a developer of innovative products and solutions that simplify layered optical transport networks. Mr. El-Ahmadi has over 17 years of experience in optical transmission in particular and the telecom industry in general. Prior to founding Menara, Mr. El-Ahmadi served as Vice President-Marketing & Product Management at Nortel where he was responsible for the OPTera LH 4000 ULR product (acquired from Qtera) that achieved over $200M in revenues in its first two years. Prior to that, Mr. El-Ahmadi was the Product Architect & Vice President of Product Management at Qtera Corporation, a successful technology start-up acquired by Nortel in 2000 for $3.25 billion. Mr. El-Ahmadi also held a Senior Manager position at Bell Northern Research and worked as a Transmission Engineer at WilTel (WorldCom) where he evaluated and deployed the world first bidirectional EDFA and bi-directional WDM transmission. Mr. El-Ahmadi holds a BS and MS in Electrical Engineering from the University of Oklahoma, is a member of Eta Kappa Nu and is the inventor of 11 patents, issued or pending, in the area of optical communications. He has authored a number of publications and is a frequent speaker at telecom and optical networking events and conferences.

Dr. Frederick J. Leonberger. Dr. Leonberger has served as a director of our Company since April 1, 2017. Since 2010, Dr. Leonberger has served as the Principal of EOvation Advisors LLC, a private technology and business advisory firm and presently serves as a board member for various private photonics companies. Dr. Leonberger is a widely known technologist and industry leader in the field of photonics and fiber optics. For nearly 40 years he has been a leading contributor to the development of a variety of important optical devices, company leadership, product and

business strategy, and commercialization. The integrated optical modulator technology he and his colleagues pioneered has been used pervasively for over 20 years to encode data at multi-Gb/s rates in long-haul fiber optic networks (the Internet "superhighways"). He previously served as senior vice president and chief technology officer of JDS Uniphase Corporation (JDSU, now Lumentum), a leading optical components company, from 1995 until his retirement in 2003, where he played a lead role in technology strategy, mergers and acquisitions and intellectual property activities. Prior to JDSU, he was co-founder and general manager of United Technologies Photonics (UTP), a high-speed optical modulator company, and held research management positions at United Technologies Research Center (UTRC) and MIT Lincoln Laboratory. He is a member of the National Academy of Engineering and the recipient of several industry awards.

The Board of Directors believes that each of the Directors named above has the necessary qualifications to be a member of the Board of Directors. Each Director has exhibited during his prior service as a director the ability to operate cohesively with the other members of the Board of Directors. Moreover, the Board of Directors believes that each director brings a strong background and skill set to the Board of Directors, giving the Board of Directors as a whole competence and experience in diverse areas, including corporate governance and board service, finance, management and industry experience.

Our bylaws provide that the number of directors who constitute our Board of Directors is determined by resolution of the Board of Directors, but the total number of directors constituting the entire Board of Directors shall not be less than three or more than nine. Our Board of Directors currently consists of seven directors. Our Board of Directors is divided into three classes, as nearly equal in number as possible, designated: Class I, Class II and Class III, with staggered terms and with each director serving for a term ending on the date of the third annual meeting following the annual meeting at which such director was elected; provided that the term of each director shall continue until the election and qualification of a successor and be subject to such director's earlier death, resignation or removal.

Director Independence

Although we are currently traded on the Over-the-Counter Markets, our Board of Directors has reviewed each of the Directors relationships with the Company in conjunction with NASDAQ Listing Rule 5605(a)(2) that provides that an independent director is a person other than an Executive Officer or employee of the Company or any other individual having a relationship which, in the opinion of the Company's board of directors, would interfere with the exercise of independent judgment in carrying out the responsibilities of a director. Our Board of Directors has affirmatively determined that following directors, Joseph A. Miller, Jr., Ronald A. Bucchi, Siraj Nour El-Ahmadi and William C. Pickett III (who served as a director until August 15, 2018) are (or were) independent directors in that they are independent of management and free of any relationship that would interfere with their independent judgment as members of our Board of Directors. In making such determination, our Board of Directors considered the relationships that each such non-employee director has with our Company and all other facts and circumstances that our Board of Directors deemed relevant in determining their independence, including the beneficial ownership of our capital stock by each non-employee director. The following members of our Board of Directors, Thomas E. Zelibor, Dr. Michael Lebby, James S. Marcelli and Frederick J. Leonberger are not independent directors pursuant to the standards described above.

Our Company does not have a separately designated nominating or compensation committee or committee performing similar functions; therefore, our full Board of Directors currently serves in these capacities.

Family Relationships

There are no family relationships among any of our current or former directors or executive officers.

Involvement in Certain Legal Proceedings

We are not aware of any of our directors or officers being involved in any legal proceedings in the past ten years relating to any matters in bankruptcy, insolvency, criminal proceedings (other than traffic and other minor offenses), or being subject to any of the items set forth under Item 401(f) of Regulation S-K.

EXECUTIVE COMPENSATION

Summary Compensation Table

Name and Principal Position	Year	Salary	Bonus	Stock Awards	Option Awards	All Other Compensation	Total
		($)	($)	($)	($)	($)	($)
(a)	(b)	(c)[1]	(d)	(e)[2]	(f)[2]	(g)[3]	(h)
Dr. Michael S. Lebby[4]	2018	265,000			38,448	2,840	306,288
CEO; Director	2017	176,667		8,000	305,662	29,893	520,222
James S. Marcelli[5]	2018	250,000				2,355	252,355
President; COO; Sec., Director	2017	241,667				2,282	243,949

(1)

The named executive officer s compensation includes the amount for services rendered to the Company in his capacity as both an officer and a director.

(2)

The aggregate fair value of awards and options in columns (e) and (f) are computed in accordance with FASB ASC 718. The amounts shown in columns (f) do not reflect dollar amounts actually received by our named executive officers.

(3)

The amount in column (g) reflects a salary gross up for long term disability premium payments.

(4)

Dr. Lebby became our Chief Executive Officer on May 1, 2017. During 2017, the amounts in column (e) and (g) include compensation for serving on the Operations Committee of the Board of Directors in the amounts of $8,000 and $28,000, respectively. Dr. Lebby resigned from the Operations Committee of the Board of Directors effective April 30, 2017. The amount in column (g) also includes a salary gross up for long term disability premium payments of $1,893, in 2017 and $2,840 in 2018.

(5)

The amounts in column (g) include a salary gross up for long term disability premium payments of 2,136 in 2017 and $2,355 in 2018

At no time during the last fiscal year was any outstanding option otherwise modified or re-priced, and there was no tandem feature, reload feature, or tax-reimbursement feature associated with any of the stock options we granted to our executive officers or otherwise.

We grant stock awards and stock options to our executive officers based on their level of experience and contributions to our Company. The aggregate fair value of awards and options are computed in accordance with FASB ASC 718 and are reported in the Summary Compensation Table above in the columns (e) and (f).

Employee, Severance, Separation and Change in Control Agreements

Dr. Michael S. Lebby Employee Agreement- Chief Executive Officer

On March 20, 2017, we entered into an employment agreement with Dr. Michael S. Lebby (the Lebby Employment Agreement). The term of the Lebby Employment Agreement commenced on May 1, 2017 for a period of 24 months, following which time the Lebby Employment Agreement will be renewed for successive 12-month periods at the end of each term upon the written agreement of the parties that shall be delivered by each party to the other not less than 60 days prior to the expiration of the existing term. Pursuant to the Lebby Employment Agreement, Dr. Lebby s 2018 base compensation was $265,000 per year. Upon entering into the Lebby Employment Agreement, Dr. Lebby was granted (i) 350,000 stock options, which have an exercise price of $0.70 per share. The options vest quarterly over one year in equal installments of 87,500 shares per quarter beginning May 1, 2017.

If Dr. Lebby s employment terminates upon the expiration of the term of the Lebby Employment Agreement, and the Company elects for any reason not to renew the Lebby Employment Agreement for an additional 12-month term, then our Company will continue to pay to Dr. Lebby the compensation described in the Lebby Employment Agreement for a period of 9 months the after the termination. If Dr. Lebby s employment is terminated by the Company without cause during the term of the Lebby Employment Agreement, the Company will pay to Dr. Lebby s the compensation described in the Lebby Employment Agreement for the remainder of the term of Lebby Employment Agreement or 12 months, whichever is longer.

Mr. James S. Marcelli Employee Agreement- President; Chief Operating Officer

On August 10, 2015, we entered into a new employment agreement with Mr. Marcelli, which was amended during 2015 and 2017 (collectively, the Marcelli Employment Agreement), which replaced his previous employment agreement, as amended. The ter