As filed with the Securities and Exchange Commission on September 9, 2019

Registration Statement No. [●]

UNITED STATES
SECURITIES AND EXCHANGE COMMISSION

WASHINGTON, DC 20549

FORM S-1

REGISTRATION STATEMENT
UNDER THE
SECURITIES ACT OF 1933

YIELD10 BIOSCIENCE, INC.

(*Exact Name of Registrant as Specified in Its Charter)*

Delaware	**2870**	**04-3158289**
(State or other jurisdiction of incorporation or organization)	(Primary Standard Industrial Classification Code Number)	(I.R.S. Employer Identification Number)

19 Presidential Way
Woburn, Massachusetts 01801
(617) 583-1700
(Address, including zip code, and telephone number, including area code, of registrant's principal executive offices)

Dr. Oliver P. Peoples
President & Chief Executive Officer
Yield10 Bioscience, Inc.
19 Presidential Way
Woburn, Massachusetts 01801
(617) 583-1700
(Name, address, including zip code, and telephone number, including area code, of agent for service)

Copies to:

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Michael F. Nertney, Esq. Ellenoff Grossman & Schole LLP 1345 Avenue of the Americas New York, New York 10105 (212) 370-1300

Approximate date of commencement of proposed sale to the public: As soon as practicable after this registration statement becomes effective.

If any of the securities being registered on this Form are to be offered on a delayed or continuous basis pursuant to Rule 415 under the Securities Act of 1933 check the following box. ☒

If this Form is filed to register additional securities for an offering pursuant to Rule 462(b) under the Securities Act, please check the following box and list the Securities Act registration statement number of the earlier effective registration statement for the same offering. o

If this Form is a post-effective amendment filed pursuant to Rule 462(c) under the Securities Act, check the following box and list the Securities Act registration statement number of the earlier effective registration statement for the same offering. o

If this Form is a post-effective amendment filed pursuant to Rule 462(d) under the Securities Act, check the following box and list the Securities Act registration statement number of the earlier effective registration statement for the same offering. o

Indicate by check mark whether the registrant is a large accelerated filer, an accelerated filer, a non-accelerated filer, smaller reporting company, or an emerging growth company. See the definitions of “large accelerated filer,” “accelerated filer,” “smaller reporting company,” and "emerging growth company" in Rule 12b-2 of the Exchange Act.

Large accelerated filer	o	Accelerated filer	o
Non-accelerated filer	☒	Smaller reporting company	☒
		Emerging growth company	o

If an emerging growth company, indicate by check mark if the registrant has elected not to use the extended transition period for complying with any new or revised financial accounting standards provided pursuant to Section 7(a)(2)(B) of the Securities Act. o

CALCULATION OF REGISTRATION FEE

Title of each class of securities to be registered (1)	**Proposed maximum aggregate offering price (1)(2)**	**Amount of registration fee**
Class A Units consisting of:		
(i) Shares of common stock, par value $0.01 per share		
(ii) Warrants to purchase common stock		
Class B Units consisting of:		
(i) Shares of Series A Preferred Stock, par value $0.01 per share		
(ii) Shares of common stock issuable on conversion of Series A Preferred Stock (3)		
(iii) Warrants to purchase common stock		
Common stock issuable upon exercise of Warrants		
Total	$ 6,000,000.00	$ 727.20

(1) Estimated solely for the purpose of computing the amount of the registration fee pursuant to Rule 457(o) under the Securities Act of 1933, as amended (the “Securities Act”).

(2) Includes the price of additional shares of common stock and warrants to purchase shares of common stock that the underwriters have the option to purchase to cover over-allotments, if any.

(3) No separate fee is required pursuant to Rule 457(i) under the Securities Act.

The Registrant hereby amends this registration statement on such date or dates as may be necessary to delay its effective date until the Registrant shall file a further amendment which specifically states that this registration statement shall thereafter become effective in accordance with Section 8(a) of the Securities Act of 1933, as amended, or until the registration statement shall become effective on such date as the Securities and Exchange Commission, acting pursuant to said Section 8(a), may determine.

THE INFORMATION IN THIS PROSPECTUS IS NOT COMPLETE AND MAY BE CHANGED. THE COMPANY MAY NOT SELL THESE SECURITIES UNTIL THE REGISTRATION STATEMENT FILED WITH THE SECURITIES AND EXCHANGE COMMISSION IS EFFECTIVE.

SUBJECT TO COMPLETION, DATED SEPTEMBER 9, 2019

PRELIMINARY PROSPECTUS

YIELD10 BIOSCIENCE, INC.

[●] Class A Units consisting of one share of common stock and 0.5 warrants and
[•] Class B Units consisting of one share of Series A Preferred Stock and warrants (and [●] shares of common stock underlying shares of Series A Preferred Stock and warrants)

We are offering Class A Units, with each Class A Unit consisting of one share of common stock, par value $0.01 per share (the "common stock"), and a warrant to purchase 0.5 shares of our common stock (together with the shares of common stock underlying such warrants, the "Class A Units") at a public offering price of $ [•] per Class A Unit. Each warrant included in the Class A Units entitles its holder to purchase 0.5 shares of common stock at an exercise price per share of $ [●].

We are also offering to those purchasers whose purchase of our Class A Units in this offering would result in the purchaser, together with its affiliates and certain related parties, beneficially owning more than 4.99% (or, at the election of the purchaser, 9.99%) of our outstanding common stock following the consummation of this offering, the opportunity to purchase, if they so choose, in lieu of the number of Class A Units that would result in ownership in excess of 4.99% (or, at the election of the purchaser, 9.99%), Class B Units. Each Class B Unit will consist of one share of our Series A Preferred Stock, par value $0.01 per share (the "Series A Preferred Stock"), convertible into [●] shares of common stock and [●] warrants to purchase shares of our common stock (together with the shares of common stock underlying such shares of Series A Preferred Stock and such warrants, the "Class B Units" and, together with the Class A Units, the "Units") at a public offering price of $ [●] per Class B Unit. Each warrant included in the Class B Units entitles its holder to purchase a number of shares equal to 50% of the common stock underlying each share of Series A Preferred Stock at an exercise price per share of $ [●].

The Class A Units and Class B Units have no stand-alone rights and will not be certificated or issued as stand-alone securities. The shares of common stock, Series A Preferred Stock and warrants comprising such units are immediately separable and will be issued separately in this offering. The underwriters have the option to purchase additional shares of common stock and/or warrants to purchase shares of common stock to cover over-allotments, if any, at the price to the public less the underwriting discounts and commissions. The over-allotment option may be used to purchase shares of common stock, or warrants, or any combination thereof, as determined by the underwriters, but such purchases cannot exceed an aggregate of 15% of the number of shares of common stock (including the number of shares of common stock issuable upon conversion of shares of Series A Preferred Stock) and warrants sold in the offering. The over-allotment option is exercisable for 45 days from the date of this prospectus.

Our common stock is listed on The Nasdaq Capital Market under the symbol "YTEN." On September 6, 2019, the last reported sale price for our common stock was $0.79 per share. All numbers of the securities being offered included in this prospectus are based on an assumed public offering price per unit of $ [●]. We do not intend to apply for listing of the warrants offered hereby or the shares of Series A Preferred Stock on any securities exchange or trading system.

	Per Class A Unit	Per Class B Unit	Total
Public offering price [1]	$ [●]	$ [●]	$ [●]
Underwriting discounts and commissions [2][3][4]	$ [●]	$ [●]	$ [●]
Proceeds, before expenses, to us	$ [●]	$ [●]	$ [●]

(1) The public offering price and underwriting discount corresponds to (x) in respect of the Class A Units (i) a public offering price per share of common stock of $ [●] and (ii) a public offering price per whole warrant of $ [●] and (y) in respect of the Class B Units (i) a public offering price per share of Series A Preferred Stock of $ [●] and (ii) a public offering price per whole warrant of $ [●].

(2) We have also agreed to reimburse the representative for certain expenses. See "Underwriting."

(3) We have granted the representative an option, which is exercisable not later than 45 days after the date of this prospectus, to purchase a number of additional shares of common stock in an amount that is up to 15% of the number of shares of common stock sold in the primary offering (which number includes the number of shares of common stock issuable upon conversion of shares of the Series A Preferred Stock, but excludes any shares of common stock underlying the warrants issued in this offering, and any shares of common stock issued upon any exercise of the over-allotment option). These shares would be sold to the representative at the public offering price per share of common stock sold in the primary offering, less the underwriting discounts and commissions. Further, the option we have granted to the representative is also exercisable not later than 45 days after the date of this prospectus to purchase a number of additional warrants in an amount that is up to 15% of the warrants sold in the primary offering at the public offering price per warrant set forth on the cover page hereto (which is $ [●] per warrant), less the underwriting discounts and commissions. The representative may exercise the option to cover over-allotments, if any, made in connection with this offering. If any additional shares of common stock and/or warrants are purchased from us under this over-allotment option, the representative will offer these shares of common stock and/or warrants on the same terms as those on which the other securities are being offered.

(4) Underwriting discounts and commissions per Unit with respect to the sale of Units to the Public will be 8% and underwriting discounts and commissions per Unit with respect to the sale of Units to certain Company investors and insiders will be 3%.

Delivery of the securities offered hereby is expected to be made on or about **[●]**

AN INVESTMENT IN OUR SECURITIES INVOLVES RISKS. SEE THE SECTION ENTITLED "RISK FACTORS" BEGINNING ON PAGE 9

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

Ladenburg Thalmann

The date of this prospectus is [●], 2019

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You should read this prospectus before making an investment in the securities of Yield10 Bioscience, Inc. See “Where You Can Find More Information” for more information. You should rely only on the information contained in this prospectus. The Company has not authorized anyone to provide you with different information. This document may be used only in jurisdictions where offers and sales of these securities are permitted. You should assume that information contained in this prospectus is accurate only as of any date on the front cover of the applicable document. Our business, financial condition, results of operations and prospects may have changed since that date. Unless otherwise noted in this prospectus, “Yield10 Bioscience,” “Yield10,” “the Company,” “we,” “us,” “our” and similar terms refer to Yield10 Bioscience, Inc.

Smaller Reporting Company – Scaled Disclosure

Pursuant to Item 10(f) of Regulation S-K promulgated under the Securities Act of 1933, as amended (the "Securities Act"), as indicated herein, we have elected to comply with the scaled disclosure requirements applicable to “smaller reporting companies,” including providing two years of audited financial statements.

PROSPECTUS SUMMARY

This summary highlights some information from this prospectus. It may not contain all the information important to making an investment decision. You should read the following summary together with the more detailed information regarding our Company and the securities being sold in this offering, including "Risk Factors" and other information incorporated by reference herein.

Business Overview

Yield10 Bioscience, Inc. is an agricultural bioscience company which uses its "Trait Factory" to develop high value seed traits for the agriculture and food industries. Specifically, Yield10 plans to efficiently develop superior gene traits for the major grain crops, including corn, soybean, canola, wheat and rice that will enable step-change increases in crop yield of at least 10-20 percent. While maintaining our focus on the development of novel yield traits for grain crops based on a licensing model, we have recently begun to execute the second part of our strategy which is to develop independent business opportunities for Yield10 in the specialty oils and niche crop space using the oilseed Camelina. The target of this effort is sustainable business solutions to support agriculture, global food production and other specialty applications. Yield10 brings a unique history, skill set and tools, captured in our **G**ene **R**anking **A**rtificial **I**ntelligence **N**etwork ("GRAIN") platform for developing advanced crop traits and increasing the concentration of specific biochemicals of commercial interest in crops. Our plan is to develop a source of revenue from funded research and development collaborations for traits, products and crops not being directly pursued internally. The Company is currently engaged in a range of discussions with third parties with respect to different crops, traits and products in the feed, food and pharmaceutical sectors. Yield10 Bioscience is headquartered in Woburn, Massachusetts and has an oilseed development Center of Excellence in Saskatoon, Saskatchewan, Canada.

We are currently progressing several novel yield gene traits in our pipeline in the major North American row crops canola, soybean and corn, and the niche crop Camelina, among others. Camelina is an oilseed crop similar to canola, with significant upside potential as a source of edible oils and polyhydroxyalkanoate ("PHA") biomaterials. Our approach is to focus internal resources on progressing our traits through development and field trials in Camelina and canola while leveraging third party resources to progress our traits in soybean and corn while retaining control of our intellectual property. Over the last three years, we have evaluated certain of our traits in greenhouse studies and field tests conducted in the United States and Canada. We currently have non-exclusive research license agreements in place with the Crop Science division of Bayer AG, for the evaluation of our C3003 and C3004 traits in soybean and with Forage Genetics International, LLC, a division of Land O'Lakes, Inc. for the evaluation of five yield traits in forage sorghum. Our business strategy is to progress our traits into field tests to generate validating yield data. We have progressed our evaluation of C3003 in field tests with Camelina and canola and we are planning to expand our field tests with more C3003 canola events as well as additional traits in Camelina, canola and corn in 2019 and 2020. We plan to leverage data that we generate to support the performance of our traits in key crops to establish collaborations or to sign licenses to the traits with major agricultural companies in order to generate revenue.

According to a United Nations report, crop production must be increased by over 70 percent in the next 35 years to feed the growing global population, which is expected to increase from 7 billion to more than 9.6 billion by 2050. During that time period, there will be a reduction in available arable land as a result of infrastructure growth and increased pressure on scarce water resources. Consumption of meat, fish, and dairy products is also expected to increase based on dietary changes associated with increasing wealth and living standards. Harvestable food production per acre and per growing season must be increased to meet this demand. At the same time, with the increasing focus on health and wellness, food safety and sustainability in developed countries, we anticipate a rise in demand for new varieties of food and food ingredients with improved nutritional properties. With crop intensification (less land available and more production needed), we expect that improved crop genetics based on new gene traits will be a key driver of increased productivity, potentially resulting in the best performing yield traits commanding disproportionate value and disrupting the seed sector. We expect farmers and growers to be the major beneficiaries of these drivers, which represent potential opportunities for increased revenue and crop diversification. Today the global food market has an estimated value of $5 trillion.

Exciting new genetic engineering technologies like the CRISPR technology and other approaches to genome editing hold promise to accelerate the deployment of novel traits into commercial crops. This method of making insertions or deletions of DNA into plants without the use of foreign DNA has been described as “precision breeding.” We signed a research license, with rights to convert to a commercial license, to CRISPR/Cas-9 technology in 2018 to support our genome editing program. We have taken two genome edited traits designed to boost oil content in oilseed crops through the U.S. Department of Agriculture ("USDA")—Animal and Plant Health Inspection Service ("APHIS") “Am I Regulated?” petitioning process and confirmed that the agency does not consider two of our lines to be regulated pursuant to 7 CFR part 340, clearing the way to conduct field tests in the United States. Genome editing technology as well as the streamlined regulatory process supported by USDA-APHIS for certain types of plant traits may enable agricultural innovators such as Yield10 to deploy and field test new traits more quickly, potentially resulting in a shorter path to market and reduced costs as compared to the more highly regulated path required for traditional biotechnology-derived traits.

Founded in 1992 as Metabolix, Inc., the Company was previously focused on redirecting carbon flow in living systems to produce bioplastics and biobased chemicals. In 1997, Metabolix started a crop science research program with the intent to produce polyhydroxybutyrate (“PHB”), a natural biomaterial produced in crops such as Camelina. The PHB biomaterial, which is chemically the simplest member of the PHA family, is potentially useful as a natural water treatment product and as a replacement for petroleum-based plastics. As we made progress on our crop program, we learned that the rate of carbon supply from photosynthesis was a bottleneck to the effective utilization of carbon, and we initiated a series of exploratory programs to develop new technologies to fundamentally increase the plants’ ability to fix and capture more carbon. These early research programs resulted in the establishment of our crop yield trait gene discovery platforms and the identification of a series of promising proprietary yield trait genes, even as the PHB biomaterial produced in Camelina remained interesting.

Based on challenges in the industrial biotechnology space and encouraging early results from these gene discovery programs, we refocused our crop science efforts to yield improvement in major food and feed crops in 2015 and rebranded the effort as Yield10 Bioscience (Yield10: increasing soybean and canola yields by 10 bushels per acre in North America could generate around $10 billion in added value). In 2016, we sold our fermentation based biopolymers assets. In January 2017, we completed this transition and changed the name of the company to Yield10 Bioscience, Inc. Today, we are developing proprietary, breakthrough plant biotechnologies to improve crop productivity and seed yield in commercial crops for licensing to the major agricultural companies as well as new business opportunities focused on niche crop products based on our GRAIN proprietary discovery platform. The GRAIN platform is not only an important part of Yield10's discovery and development capabilities but has the potential to be leveraged as a source of near-term revenue.

Yield10 has a pipeline of more than 10 novel yield traits in research and development and we expect to generate several proof points for our traits in various crops over the next two years. We are developing our lead yield trait C3003 in canola and recently completed the second year of field tests of C3003 in Canada. Field tests are continuing in 2019 as we advance the trait towards commercial development by developing additional commercial canola lines (events) with the trait and expanding field testing. We are conducting our first field testing of C3004 in our Camelina platform in 2019 and are currently working to deploy and test this promising trait in canola and soybean, as well as in corn in the future. We have proven capabilities with genome editing using the CRISPR/Cas9 system and have been granted “non-regulated” status from USDA-APHIS for single and multiple genome edited lines of Camelina designed to increase oil content. In 2019, we are field testing these plant lines and plan to use the data to optimize the deployment of these traits to boost oil content in canola and potentially soybean. We recently successfully edited C3007, a novel target gene for increasing oil content, in canola and these plants are now progressing through our development pipeline. We are progressing initial development and testing of multiple traits in wheat and rice as a means to attract funded partnerships for these crops. Our approach is to engineer rice and wheat plants with our gene regulator traits to increase photosynthesis and grain yield and use those plants as a source of data to generate new gene targets for genome editing. Yield10 has no plans to field test or develop wheat or rice using traditional genetic engineering technologies. We anticipate that data generated on our traits will enable us to establish revenue generating collaborations in the future for the development and commercialization of our novel yield traits in commercial crops.

We are building a portfolio of intellectual property around our crop technologies and traits. As of June 30, 2019, we owned or held exclusive rights to 20 pending patent applications worldwide related to advanced technologies for increasing yield in crops and for increasing the oil content in oilseed crops. In June 2019, we filed a new patent on what we believe to be a breakthrough technology for sustainable low-cost production of PHB biomaterials in engineered oilseeds such as Camelina. Our portfolio of patent applications includes plant science technologies we have in-licensed globally and exclusively from the University of Massachusetts and North Carolina State University related to the yield trait gene C3003 and other advanced technologies based on advanced metabolic engineering methods to improve carbon capture and selectively control carbon partitioning in plants. Our portfolio of patent applications also includes advanced technologies for increasing oil content in oilseed crops such as Camelina and canola that we in-licensed globally and exclusively from the University of Missouri in 2018 and 2019 related to the yield trait genes C3007, C3010 and C3012.

One of the critical unmet needs in the agricultural sector is to increase the fundamental yield potential of crops to address global food security. This challenge is well suited to Yield10's unique background and expertise in metabolic modeling, genetic engineering, genome editing and next generation microbial gene systems which collectively form the foundation of Yield10's trait development process. We refer to this trait development process as the "Trait Factory." The Trait Factory encompasses discovery gene targets using our GRAIN platform, genetic engineering of crops using traditional approaches or genome editing to modify those targets, and generation of field data with the engineered crops. Performance and molecular data from the engineered crops are then fed back into the GRAIN system to enable refinement of specific gene targets and the identification of new trait gene targets. Modified crops with improved performance enter the development pipeline and progress on the regulated or non-regulated path to market depending on how the plants are genetically engineered. GRAIN is a powerful new tool developed primarily to focus on Yield10 trait targets including performance traits for major row crops including, corn, soybean, and canola as well as our niche product opportunities based on our Camelina platform. We believe we may also be able to generate additional revenue streams by providing access to our GRAIN platform for third parties interested in other trait targets and/or crops Yield10 is not pursuing.

Business Strategy

Our goal is to build a successful agricultural biotechnology company centered on demonstrating and capturing the value of our traits and technologies based on three potential revenue streams in major food and feed crops for licensing to established agricultural companies and building other revenue generating business from our new niche crop opportunities we have begun developing based on our patent protected technologies. These potential revenue stream consist of:

- Licensing of our yield and performance traits for use in major row crops;
- Product sales revenue from niche products produced in our Camelina platform and other oilseeds; and
- R&D revenue for access to our GRAIN trait gene discovery platform.

We have identified and are evaluating novel yield trait genes in our Trait Factory to help address the growing global yield gap in food and feed crops. As the primary driver of financial returns each season, crop yield is the key decision variable for farmers in making seed buying decisions, and as a result is critical to the seed industry. Improvements in yield to the levels targeted by Yield10, for example 10-20 percent increases, would be expected to generate significant value to the seed and crop industry. For example, Yield10 is targeting an approximately 10-20 percent increase in canola and soybean yields, which, if successfully deployed across North American acreage, could result in annual incremental crop value of up to $10 billion. By ultimately increasing the output of major food and feed crops and potentially reducing strains on scarce natural resources, we believe that Yield10’s technologies will also contribute to addressing global food security.

Recognizing the highly concentrated nature of the seed business, the prevalence of cross-licensing of traits, and the need to stack multiple crop traits in elite seed germplasm to provide the best options for farmers for large acreage commodity crops, Yield10 does not expect to become an integrated seed company. The current major seed companies dominate the biotech crop space based largely on the early technology innovations that resulted in herbicide and pest resistance traits and have a very successful operating track record in the sector. Yield10 plans to

develop yield traits that enable farmers to increase their revenue and secure a share of that added value. To do this Yield10 plans to license its trait innovations to the major agricultural companies so that they can be deployed in elite seed varieties. The licensing - incremental value sharing model is well established in the seed sector so we intend to seek industry collaborations and partnerships with the current seed industry participants.

Yield10 will focus on its core competency, which is breakthrough science and technology innovation directed at the development of performance traits for the seed sector and new niche product opportunities such as nutritional oils and PHA biomaterials utilizing our Camelina platform. One goal of our niche crop products is to enable a clear path to product based sales and revenue to complement our licensing strategy for major crops. Here we plan to take advantage of the progress we have made using our Camelina Fast Field Testing platform for identifying and validating yield and oil content traits for major row crops and our recent breakthrough technology for low cost PHA biomaterial production, which have a wide range of potential applications and markets including water treatment and replacements for petroleum plastics.

Risks Affecting Us

Our business is subject to a number of risks and uncertainties that you should understand before making an investment decision. For example, we have a history of net losses and our commercial products may not achieve commercial success. Furthermore, our technologies are in the early stages of development and we may never commercialize a technology or product that will generate meaningful, or any, revenues. A portion of our revenue to date has been from government grants. Over time, we expect our revenue to shift from being derived primarily from collaborations and government grants to royalties based on licensing of Yield10 traits and/or sales derived from niche crop products based on our technologies, but we may not be successful in achieving this transition. As of June 30, 2019, we had an accumulated deficit of $356.1 million. With the exception of 2012, we have incurred losses since our inception. We expect to have significant losses and negative cash flow for at least the next several years, as we incur additional costs and expenses for the continued development of our technology, including the ongoing expenses of research, development, commercialization and administration. The Company held unrestricted cash and cash equivalents of $4.2 million at June 30, 2019. Our present capital resources are not sufficient to fund our planned operations for a twelve month period, and therefore, raise substantial doubt about our ability to continue as a going concern. As a result, our independent registered public accounting firm included an explanatory paragraph in its report on our financial statements as of and for the year ended December 31, 2018 with respect to this uncertainty. Additional risks are discussed more fully in the section entitled “Risk Factors” following this prospectus summary. These risks include, but are not limited to, the following:

- We have a history of net losses and our future profitability is uncertain.
- We will be required to raise additional funds to finance our operations and remain a going concern; we may not be able to do so when necessary, and/or the terms of any financings may not be advantageous to us.
- Raising additional funds may cause dilution to our existing stockholders, restrict our operations or require us to relinquish rights to our technologies.
- We have recently changed our corporate strategy to focus on the crop science industry, and our technologies in this area are at a very early stage of development. We may never commercialize a technology or product that will generate meaningful, or any, revenues.
- A portion of our revenue to date has been generated from government grants; continued availability of government grant funding is uncertain and contingent on compliance with the requirements of the grant.
- Our government grants may subject us to government audits, which could expose us to penalties.
- Our crop science product development cycle is lengthy and uncertain and will depend heavily on future collaborative partners.

- Our crop science program may not be successful in developing commercial products.
- Even if we or our collaborators are successful in developing commercial products that incorporate our traits, such products may not achieve commercial success.
- We may not be successful using our Camelina platform to develop and commercialize niche crops to produce specialty oils and/or PHA biomaterials.
- Consumer and government resistance to genetically modified organisms may negatively affect the ability to commercialize crops containing our traits, as well as our public image.
- We may not be able to obtain or maintain the necessary regulatory approvals for our products, which could restrict our ability to sell those products in some markets.
- If ongoing or future field trials conducted by us or our collaborators are unsuccessful, we may be unable to complete the regulatory process for, or commercialize, our products in development on a timely basis.
- Competition in traits and seeds is intense and requires continuous technological development, and, if we are unable to compete effectively, our financial results will suffer.
- Our business is subject to various government regulations and if we or our collaborators are unable to timely complete the regulatory process for our products in development, our or our collaborators' ability to market our traits could be delayed, prevented or limited.
- The products of third parties or the environment may be negatively affected by the unintended appearance of our yield trait genes.
- We rely on third parties to conduct, monitor, support, and oversee field trials and, in some cases, to maintain regulatory files for those products in development, and any performance issues by third parties, or our inability to engage third parties on acceptable terms, may impact our or our collaborators' ability to complete the regulatory process for or commercialize such products.
- If we lose key personnel or are unable to attract and retain necessary talent, we may be unable to develop or commercialize our products under development.
- Patent protection for our technologies is both important and uncertain.
- Third parties may claim that we infringe their intellectual property, and we could suffer significant litigation or licensing expense as a result.
- Portions of our crop science technology are owned by or subject to retained rights of third parties.
- We may not be successful in obtaining necessary rights to additional technologies for the development of our products through acquisitions and in-licenses.
- The intellectual property landscape around genome editing technology, such as CRISPR, is highly dynamic and uncertain, and any resolution of this uncertainty could have a material adverse effect on our business.
- We rely in part on trade secrets to protect our technology, and our failure to obtain or maintain trade secret protection could harm our business.
- A material weakness was identified in our internal control over financial reporting, which could impact our business and financial results.

- Trading volume in our stock is low and an active trading market for our common stock may not be available on a consistent basis to provide stockholders with adequate liquidity. Our stock price may be extremely volatile, and our stockholders could lose a significant part of their investment.
- We may not be able to maintain the listing of our common stock on The Nasdaq Capital Market.
- Provisions in our certificate of incorporation and by-laws and Delaware law might discourage, delay or prevent a change of control of our company or changes in our management and, therefore, depress the trading price of our common stock.
- Concentration of ownership among our existing officers, directors and principal stockholders may prevent other stockholders from influencing significant corporate decisions and depress our stock price.

Our Corporate Information

We were incorporated in Massachusetts in 1992 under the name Metabolix, Inc. In September 1998, we reincorporated in Delaware. We changed our name to Yield10 Bioscience, Inc. in January 2017 to reflect our change in mission around innovations in agricultural biotechnology focused on developing disruptive technologies for step-change improvements in crop yield and niche crop products. Our corporate headquarters are located at 19 Presidential Way, Woburn, MA 01801, and our telephone number is +1 (617) 583-1700. Our website address is www.yield10bio.com. The information contained on our website or that can be accessed through our website is not part of this prospectus and investors should not rely on any such information in deciding whether to purchase our securities.

THE OFFERING	
Issuer	Yield10 Bioscience, Inc.
Class A Units Offered	We are offering [•] Class A Units. Each Class A Unit consists of one share of common stock and a warrant to purchase 0.5 shares of our common stock (together with the shares of common stock underlying such warrants).
Offering Price per Class A Unit	$ [●] combined price for each Class A Unit.
Class B Units Offered	We are offering [•] Class B Units to purchasers who prefer not to beneficially own more than 4.99% (or, at the election of the purchaser, 9.99%) of our outstanding common stock following the consummation of this offering. Each Class B Unit will consist of (i) one share of Series A Preferred Stock, par value $0.01 per share, convertible into a number of shares of common stock equal to $1,000 divided by $ [•] (the "Conversion Price") and (ii) a number of warrants to purchase [•] shares of our common stock equal to 50% of the common stock underlying each share of Series A Preferred Stock (together with the shares of common stock underlying such shares of Series A Preferred Stock and such warrants).
Offering Price per Class B Unit	$ [•] combined price for each Class B Unit.
Description of warrants	The warrants will be exercisable beginning on the closing date and expire on the fifth anniversary of the closing date and have an initial exercise price per share equal to $ [•] per share, subject to appropriate adjustment in the event of recapitalization events, stock dividends, stock splits, stock combinations, reclassifications, reorganizations or similar events affecting our common stock.
Description of Series A Preferred Stock	Each share of Series A Preferred Stock is convertible at any time at the holder's option into a number of shares of common stock equal to $1,000 divided by the Conversion Price. Notwithstanding the foregoing, we shall not effect any conversion of Series A Preferred Stock, with certain exceptions, to the extent that, after giving effect to an attempted conversion, the holder of shares of Series A Preferred Stock (together with such holder's affiliates, and any persons acting as a group together with such holder or any of such holder's affiliates) would beneficially own a number of shares of our common stock in excess of 4.99% (or, at the election of the purchaser, 9.99%) of the shares of our common stock then outstanding after giving effect to such exercise. For additional information, see "Description of Capital Stock" on page 53 of this prospectus.
Shares of common stock underlying the warrants	[●] shares
Common stock to be outstanding after this offering	[●] shares
Series A Preferred Stock to be outstanding after this offering	[●] shares

Over-allotment option	We have granted to the underwriters an option to purchase a number of additional shares of common stock in an amount that is up to 15% of the number of shares of common stock sold in the primary offering (which number includes the number of shares of common stock issuable upon conversion of shares of the Series A Preferred Stock, but excludes any shares of common stock underlying the warrants issued in this offering, and any shares of common stock issued upon any exercise of the over-allotment option). These shares would be sold to the underwriters at the public offering price per share of common stock sold in the primary offering, less the underwriting discounts and commissions. This option also allows the underwriters to purchase a number of additional warrants in an amount that is up to 15% of the warrants sold in the primary offering at the public offering price per warrant set forth on the cover page hereto (which is $ [•] per warrant), less the underwriting discounts and commissions. This option is exercisable, in whole or in part, for a period of 45 days from the date of this prospectus.
Use of proceeds	We estimate that the net proceeds to us from this offering will be approximately $ [•] million, assuming no exercise by the underwriters of their over-allotment option. We intend to use net proceeds from this offering for working capital and general corporate purposes.
Nasdaq Capital Market symbol	YTEN
Risk factors	Investing in our securities involves a high degree of risk. See “Risk Factors” on page 9 of this prospectus to read about factors that you should consider carefully before buying our securities.

The number of shares of common stock that will be outstanding after this offering is based on 12,494,731 shares outstanding as of June 30, 2019, and excludes:

- 2,446,082 shares of common stock issuable upon exercise of options to purchase our common stock outstanding as of June 30, 2019 at a weighted average exercise price of $4.61 per share;
- 63,773 shares of common stock reserved as of June 30, 2019 for future issuance under our 2018 Stock Option and Incentive Plan;
- 570,784 shares of common stock issuable upon exercise of warrants issued pursuant to the Securities Purchase Agreement we entered into with certain investors on July 3, 2017 (which warrants became exercisable on January 7, 2018 at an exercise price of $5.04 per share and expire on January 7, 2024);
- 30,000 shares of common stock issuable upon exercise of immediately vested warrants outstanding as of June 30, 2019 and issued to an investor relations consultant on September 12, 2017 at an exercise price of $2.90 per share and which expire on September 11, 2024; and
- 6,439,000 shares of common stock issuable upon exercise of vested Series A warrants outstanding as of June 30, 2019 pursuant to the Securities Purchase Agreement we entered into with certain investors on December 21, 2017 at an exercise price of $2.25 per share and which expire on December 21, 2022.

Unless otherwise indicated, all information contained in this prospectus assumes no exercise by the underwriters of their over-allotment option.

RISK FACTORS

An investment in shares of our common stock involves a high degree of risk. You should carefully consider the following information about these risks, together with the other information appearing elsewhere in this prospectus, including our financial statements and related notes thereto, before deciding to invest in our common stock. The occurrence of any of the following risks could have a material adverse effect on our business, financial condition, results of operations and future growth prospects. In these circumstances, the market price of our common stock could decline, and you may lose all or part of your investment. We undertake no obligation to update any forward-looking statements, whether as a result of new information, future events or otherwise. You are advised, however, to consult any further disclosure we make in our reports filed with the Securities and Exchange Commission (the "SEC").

Risks Relating to our Financial Position

We have a history of net losses and our future profitability is uncertain.

We have recorded losses in every year since our inception, with the exception of 2012. As of June 30, 2019, our accumulated deficit was $356.1 million. Since 1992, we have been engaged primarily in research and development and early-stage commercial activities. Because our crop science technology is at an early stage of development, we cannot be certain that the Yield10 Bioscience business will generate sufficient revenue to become profitable. We expect to continue to have significant losses and negative cash flow for at least the next several years, as we incur additional costs and expenses for the continued development of our technology, including the ongoing expenses of research, development, commercialization and administration. The amount we spend will impact our need for capital resources as well as our ability to become profitable and this will depend, in part, on the number of new technologies that we attempt to develop. We may not achieve any or all of these goals and, thus, we cannot provide assurances that we will ever be profitable or achieve significant, or any, product revenues.

We will need to secure additional funding to finance our operations and may not be able to do so when necessary, and/or the terms of any financings may not be advantageous to us.

As of June 30, 2019, we held unrestricted cash and cash equivalents of $4.3 million. In March 2019, we closed on a registered direct offering of our common stock, raising $2.6 million, net of offering costs. We believe that these resources and the cash generated from existing grants will be sufficient to meet our projected operating requirements into the fourth quarter of 2019. We follow the guidance of Accounting Standards Codification ("ASC") Topic 205-40, *Presentation of Financial Statements-Going Concern*, in order to determine whether there is substantial doubt about the Company's ability to continue as a going concern for one year after the date its financial statements are issued. We have concluded, and our independent auditors have agreed, that substantial doubt does exist as to our ability to continue as a going concern under this standard, and as a result, our auditors have included an explanatory paragraph in their audit opinion for our fiscal year ended December 31, 2018. We will need to secure additional funds in the near term to continue operations.

We continue to face significant challenges and uncertainties and, as a result, our available capital resources may be consumed more rapidly than currently expected due to any or all of the following:

- lower than expected revenues from grants and licenses related to our technologies;
- changes we may make to the business that affect ongoing operating expenses;
- further changes we may make to our business strategy;
- changes in our research and development spending plans; and
- other items affecting our forecasted level of expenditures and use of cash resources.

We will require additional capital resources to support the implementation of our business strategy and we may pursue one or more of a variety of financing options, including public or private equity financing, secured or unsecured debt financing, equity or debt bridge financing, as well as licensing or other collaborative arrangements.

There can be no assurance that our financing efforts will be successful. If we are not able to secure such additional capital resources or otherwise fund our operations, we will be forced to explore strategic alternatives and/or wind down our operations and pursue options for liquidating our remaining assets, including intellectual property and equipment.

If we issue equity or debt securities to raise additional funds in the future, we may incur fees associated with such issuances, our existing stockholders may experience dilution from the issuance of new equity securities, we may incur ongoing interest expense and be required to grant a security interest in our assets in connection with any debt issuance, and the new equity or debt securities may have rights, preferences and privileges senior to those of our existing stockholders. In addition, utilization of our net operating loss and research and development credit carryforwards may be subject to significant annual limitations under Section 382 of the Internal Revenue Code of 1986, as amended (the "Code"), due to ownership changes resulting from equity financing transactions. If we raise additional funds through collaboration, licensing or other similar arrangements, it may be necessary to relinquish valuable rights to our potential products or proprietary technologies or grant licenses on terms that are not favorable to us.

Inadequate funding for the SEC could hinder our ability to access the public markets and obtain necessary capital in order to properly capitalize and continue our operations.

Government funding of the SEC is subject to the political process, which is inherently fluid and unpredictable. Over the last several years, including a period from late December 2018 through January 2019, the U.S. government has shut down several times and regulatory agencies such as the SEC have had to furlough employees and stop activities. Future government shutdowns could affect our ability to access the public markets and obtain necessary capital in order to properly capitalize and continue our operations, to the extent we need or elect to pursue a financing for which a registration statement must be declared effective by the SEC Staff.

We have changed our corporate strategy to focus on the crop science industry, and our technologies in this area are at a very early stage of development. We may never commercialize a technology or product that will generate meaningful, or any, revenues.

In July 2016, our board of directors approved a plan to implement a strategic restructuring under which Yield10 Bioscience has become our core business. As part of the restructuring, we discontinued our biopolymer operations, eliminated positions in our biopolymer operations and corporate organization, and sold certain of our biopolymer business assets.

The crop science products and technologies we are currently developing as a result of our strategic repositioning are at a very early stage of development, and the process of developing them is lengthy and uncertain. In addition, our current management has limited experience in developing technologies for the crop science industry and has never commercialized a product or technology in this industry. We may never reach a point at which our efforts result in products that allow us to achieve revenue from their license or sale.

There can be no assurance that we will be able to comply with the continued listing standards of The Nasdaq Capital Market.

We cannot assure you that we will be able to comply with the standards that we are required to meet in order to maintain a listing of our common stock on The Nasdaq Capital Market ("Nasdaq"). Nasdaq listing rules require us to maintain certain closing bid price, stockholders' equity and other financial metric criteria in order for our common stock to continue trading on Nasdaq. Nasdaq Listing Rule 5550(a)(2) requires listed securities to maintain a minimum bid price of $1.00 per share, and Listing Rule 5810(c)(3)(A) provides that a failure to meet the minimum bid price requirement exists if the deficiency continues for a period of 30 consecutive business days.

On June 25, 2019, we were notified by Nasdaq that our common stock had not maintained the minimum closing bid price of $1.00 per share for thirty consecutive business days. We have 180 days, or until December 23, 2019, to regain compliance by maintaining a closing bid price of $1.00 or higher for a minimum of ten consecutive business days. In the event that we do not regain compliance by December 23, 2019, we may be eligible for an

additional 180 days provided that we continue to meet all other Nasdaq continued listing standards and provide a written notice of our intention to cure the deficiency during the additional extension period by effecting a reverse stock split, if necessary. If we fail to cure our current stock price deficiency or we do not continue to meet all applicable Nasdaq requirements in the future and Nasdaq determines to delist our common stock, the delisting could substantially decrease trading in our common stock and adversely affect the market liquidity of our common stock; adversely affect our ability to obtain financing on acceptable terms, if at all, for the continuation of our operations; and harm our business. Additionally, the market price of our common stock may decline further, and stockholders may lose some or all of their investment.

Currently, the sole source of our revenue is government grants; continued availability of government grant funding is uncertain and contingent on compliance with the requirements of the grant.

Historically, a portion of our revenue has been generated from payments to us from government entities in the form of government grants, whereby we are reimbursed for certain expenses incurred in connection with our research and development activities, subject to our compliance with the specific requirements of the applicable grant, including rigorous documentation requirements. To the extent that we do not comply with these requirements, the expenses that we incur may not be reimbursed. Any of our existing grants or new grants that we may obtain in the future may be terminated or modified.

Our ability to obtain grants or incentives from government entities in the future is subject to the availability of funds under applicable government programs and approval of our applications to participate in such programs. The application process for these grants and other incentives is highly competitive. We may not be successful in obtaining any additional grants, loans or other incentives. Recent political focus on reducing spending at the U.S. federal and state levels may continue to reduce the scope and amount of funds dedicated to crop science products, if such funds will continue to be available at all. To the extent that we are unsuccessful in being awarded any additional government grants in the future, we would lose a potential source of revenue.

Our government grants may subject us to government audits, which could expose us to penalties if we have failed to comply with the terms of the grants.

We may be subject to audits by government agencies as part of routine audits of our activities funded by our government grants. As part of an audit, these agencies may review our performance, cost structures and compliance with applicable laws, regulations and standards and the terms and conditions of the grant. If any of our costs are found to be allocated improperly, the costs may not be reimbursed, and any costs already reimbursed for such contract may have to be refunded. Accordingly, an audit could result in a material adjustment to our results of operations and financial condition. Moreover, if an audit uncovers improper or illegal activities, we may be subject to civil and criminal penalties and administrative sanctions.

Risks Relating to our Yield10 Bioscience Crop Science Program

The crop science product development cycle is lengthy and uncertain, and our progress will depend heavily on our ability to attract third-party investment in research under license agreements and on our ability to establish future collaborative partnerships to develop and commercialize our innovations.

The technology and processes used in our crop science program and the application of our technology to enhance photosynthetic efficiency of crops are at an early stage of development. Research and development in the seed, agricultural biotechnology, and larger agriculture industries is expensive and prolonged and entails considerable uncertainty. Completion of development work with respect to our products will require a significant investment of both time and money, if it can be completed at all. We expect that collaborations with established agricultural industry companies will be required to successfully develop and commercialize our innovations. Our initial development strategy is to make it attractive for established agricultural industry companies to invest financial and technical resources to introduce our traits into their elite germplasm for event selection and evaluation under research licenses. For example, in 2017 we entered into a non-exclusive research license with Monsanto, which was subsequently acquired by Bayer AG (“Bayer”), pursuant to which we granted Monsanto a non-exclusive research license to evaluate our novel C3003 and C3004 yield traits in soybean. We expanded the agreement with

Bayer in 2019 to cover a new discovery and intellectual property related to C3004. In September 2018, we granted a non-exclusive research license to Forage Genetics, a subsidiary of Land O'Lakes, Inc., to evaluate five of our novel yield traits in forage sorghum. The traits included in the research license include C3003 as well as four traits from our GRAIN platform, C4001, C4002, C4003 and C4029. We may not be successful in establishing or maintaining suitable relationships with established agricultural industry companies for research licenses in the future, and there can be no assurance that any such relationships will result in future collaboration agreements to develop and commercialize our innovations, with terms that are satisfactory to us or at all. In addition, industry collaborators have significant resources and development capabilities and may develop products and technologies that compete with or negatively impact the development and commercialization of our technologies.

Any potential collaborative partnerships that we may enter into in the future may not be successful, which could adversely affect our ability to develop and commercialize our innovations.

We expect that collaborations with established agricultural industry companies will be required for us to successfully develop and commercialize our innovations. The agriculture industry is highly concentrated and dominated by a small number of large companies, which could impact efforts to form the collaborations that we will need in order to complete the development of our products. To the extent that we pursue such arrangements, we will face significant competition in seeking appropriate partners. Moreover, such arrangements are complex and time-consuming to negotiate, document, implement and maintain. We may not be successful in establishing or implementing such arrangements. The terms of any partnerships, joint ventures or other collaborative arrangements that we may establish may not be favorable to us.

The success of any future collaborative partnerships is uncertain and will depend heavily on the efforts and activities of our potential partners. Such arrangements are subject to numerous risks, including the risks that:

- our partners may have significant discretion in determining the efforts and resources that they will apply to the arrangement;
- our partners may not pursue the development and commercialization of our product candidates based on trial results, changes in their strategic focus, competing priorities, availability of funding, or other external factors;
- our partners may delay or abandon field trials, fail to conduct field trials that produce sufficient conclusory data, provide insufficient funding for field trials, or repeat or conduct new field trials;
- partners who have marketing, manufacturing and distribution rights with respect to a product may not commit sufficient resources to, or otherwise not perform satisfactorily in carrying out, these activities;
- to the extent that such arrangements provide for exclusive rights, we may be precluded from collaborating with others;
- our partners may not properly maintain or defend our intellectual property rights, or may use our intellectual property or proprietary information in a way that gives rise to actual or threatened litigation that could jeopardize or invalidate our intellectual property or proprietary information or expose us to potential liability;
- disputes may arise between us and a partner that causes the delay or termination of the research, development or commercialization of our current or future products, or that results in costly litigation or arbitration that diverts management attention and resources;
- such arrangements may be terminated, and, if terminated, may result in a need for additional capital for our independent pursuit of matters previously covered by such arrangement;
- our partners may own or co-own intellectual property that results from our arrangement; and

- a partner's sales and marketing activities or other operations may not be in compliance with applicable laws resulting in civil or criminal proceedings.

Our crop science program may not be successful in developing commercial products.

We and our potential future collaborators may spend many years and dedicate significant financial and other resources developing traits that will never be commercialized. Seeds containing the traits that we develop may never become commercialized for any of the following reasons:

- our traits may not be successfully validated in the target crops;
- our traits may not achieve our targeted yield improvements;
- we may not be able to secure sufficient funding to progress our traits through development and commercial validation;
- our traits may not have the desired effects sought by future collaborators for the relevant crops;
- development and validation of traits, particularly during field trials, may be adversely affected by environmental or other circumstances beyond our control;
- we or our future collaborators may be unable to obtain the requisite regulatory approvals for the seeds containing our traits, to the extent regulatory approvals are required;
- competitors may launch competing or more effective seed traits or seeds;
- a market may not exist for seeds containing our traits or such seeds may not be commercially successful;
- future collaborators may be unable to fully develop and commercialize products containing our seed traits or may decide, for whatever reason, not to commercialize such products;
- we may be unable to patent our traits in the necessary jurisdictions; and
- our efforts to develop niche crop products based on our Camelina platform, including specialty oils and PHB biomaterials are in the early stages and may not be successful.

If any of these things were to occur, it could have a material adverse effect on our business and our results of operations. Research and development in the crop science industry is expensive and prolonged and entails considerable uncertainty. Because of the stringent product performance and safety criteria applied in development of crop science products, products currently under development may neither survive the development process nor ultimately receive any requisite regulatory approvals that may be needed to market such products. Even when such approvals are obtained, there can be no assurance that a new product will be commercially successful. In addition, research undertaken by competitors may lead to the launch of competing or improved products, which may affect sales of any products that we are able to develop.

Even if we or our future collaborators are successful in developing commercial products that incorporate our traits, such products may not achieve commercial success.

Our strategy depends upon our or our future collaborators' ability to incorporate our traits into a wide range of crops in significant markets and geographies. Even if we or our future collaborators are able to develop commercial products that incorporate our traits, any such products may not achieve commercial success for one or more of the following reasons, among others:

- products may fail to be effective in particular crops, geographies, or circumstances, limiting their commercialization potential;
- our competitors, or competitors of our collaborators, may launch competing or more effective traits or products;

- significant fluctuations in market prices for agricultural inputs and crops could have an adverse effect on the value of our traits;
- farmers are generally cautious in their adoption of new products and technologies, with conservative initial purchases and proof of product required prior to widespread deployment, and accordingly, it may take several growing seasons for farmers to adopt our or our collaborators' products on a large scale;
- we may not be able to produce high-quality seeds in sufficient amounts to meet demand; and
- we may not be able to secure the financial or other resources needed to achieve commercial success.

Our financial condition and results of operations could be materially and adversely affected if any of the above were to occur.

Our estimates of market opportunity and forecasts of market growth may prove to be inaccurate, and even if the markets in which we may compete in the future achieve growth, our business could fail to achieve the same growth rates as others in the industry.

Market opportunity estimates and market growth forecasts are subject to significant uncertainty and are based on assumptions and estimates that may not prove to be accurate. Our estimates and forecasts relating to the size and expected growth of the global seed industry and the biotechnology seeds market, and the estimated ranges of incremental value increase that a novel, newly developed crop trait may produce, may prove to be inaccurate. Even if the markets in which we may compete in the future achieve these opportunity estimates and market growth forecasts, our business could fail to grow at similar rates, if at all.

If ongoing or future field trials conducted by us or our future collaborators are unsuccessful, we may be unable to complete the regulatory process for, or commercialize, our products in development on a timely basis.

The successful completion of multi-year, multi-site field trials is critical to the success of product development and marketing efforts for products containing our traits. If our ongoing or future field trials, or those of our future collaborators, are unsuccessful or produce inconsistent results or unanticipated adverse effects on crops, or if we or our collaborators are unable to collect reliable data, regulatory review of products in development containing our traits could be delayed or commercialization of products in development containing our traits may not be possible. In addition, more than one growing season may be required to collect sufficient data to develop or market a product containing our traits, and it may be necessary to collect data from different geographies to prove performance for customer adoption. Even in cases where field trials are successful, we cannot be certain that additional field trials conducted on a greater number of acres, or in different crops or geographies, will be successful. Generally, we or our research licensees conduct these field trials, or we pay third parties, such as farmers, consultants, contractors, and universities, to conduct field trials on our behalf. Poor trial execution or data collection, failure to follow required agronomic practices, regulatory requirements, or mishandling of products in development by our collaborators or these third parties could impair the success of these field trials.

Many factors that may adversely affect the success of our field trials are beyond our control, including weather and climatic variations, such as drought or floods, severe heat or frost, hail, tornadoes and hurricanes, uncommon or unanticipated pests and diseases, or acts of protest or vandalism. For example, if there were a prolonged or permanent disruption to the electricity, climate control, or water supply operating systems in our greenhouses or laboratories, the crops in which we or our collaborators are testing our traits and the samples we or our collaborators store in freezers, both of which are essential to our research and development activities including field tests, could be severely damaged or destroyed, adversely affecting these activities and thereby our business and results of operations. Unfavorable weather conditions including drought or excessive rain, or fluctuations in temperature, which we have experienced from time to time in our field trials, can also reduce both acreages

planted and incidence, or timing of, certain crop diseases or pest infestations, each of which may halt or delay our field trials. Any field test failure we may experience may not be covered by insurance and, therefore, could result in increased cost for the field trials and development of our traits, which may negatively impact our business, results of operations, and ability to secure financing. Such factors outside of our control can create substantial volatility relating to our business and results of operations.

Competition in the market for traits and seeds is intense and requires continuous technological development, and, if we are unable to compete effectively, our financial results will suffer.

We face significant competition in the markets in which we operate. The markets for traits and agricultural biotechnology products are intensely competitive and rapidly changing. In most segments of the seed and agricultural biotechnology market, the number of products available to consumers is steadily increasing as new products are introduced. At the same time, the expiration of patents covering existing products reduces the barriers to entry for competitors. We may be unable to compete successfully against our current and future competitors, which may result in price reductions, reduced margins and the inability to achieve market acceptance for any products that we or our future collaborators commercialize containing our traits. In addition, most of our competitors have substantially greater financial, marketing, sales, distribution, research and development, and technical resources than we have, and some of our potential future collaborators have more experience in research and development, regulatory matters, manufacturing, and marketing. We anticipate increased competition in the future as new companies enter the market and new technologies become available. Our technologies may be rendered obsolete or uneconomical by technological advances or entirely different approaches developed by one or more of our competitors, which will prevent or limit our ability to generate revenues from the commercialization of our traits being developed.

Our business is subject to various government regulations in the United States and Canada, the regulatory requirements for our future products in development are evolving and are subject to change, and if there are adverse changes to the current regulatory framework, our or our future collaborators' ability to market our traits could be delayed, prevented or limited.

In the United States and Canada, where our seed traits and biotechnology-derived plant lines are developed and field tested, changes in regulatory requirements applicable to our seed traits or future products in development containing our traits could result in a substantial increase in the time and costs associated with developing and commercializing future products containing our traits, and could materially affect our ability to meet our desired development timelines or to develop and commercialize a future product containing our traits at all.

In the United States, our seed traits and any future products that are successfully developed containing our seed traits are or will be subject to USDA and U.S. Food and Drug Administration ("FDA") regulatory requirements. The USDA and FDA requirements will vary depending on the particular seed trait and the intended use of any product that will be commercialized. Our business strategy is focused on crop yield traits and we have no current plans for the development of pesticide or herbicide traits, which would be subject to regulation by the U.S. Environmental Protection Agency ("EPA").

Within USDA, the APHIS is responsible for protecting agricultural plants under the Plant Protection Act. USDA-APHIS regulates organisms and products that are known or are suspected to be plant pests or to pose a plant pest risk, including those that have been altered or produced through various genetic engineering techniques. These genetically engineered plants are called “regulated articles” in the relevant USDA-APHIS regulations, which control the import, handling, interstate movement and release into the environment of regulated articles, including certain genetically engineered organisms undergoing confined experimental use or field trials. Seed traits developed using the insertion of recombinant DNA, such as our C3003 yield trait that leverages the biological functions of an algal gene, are regulated articles and are therefore subject to extensive USDA-APHIS oversight, including but not limited to permitting requirements for import, handling, interstate movement and release into the environment.

In recent years, we and others have submitted various petitions to USDA-APHIS to determine whether particular biotechnology-derived plants developed through the use of different genome editing techniques may be considered to be not regulated under the framework administered by the agency. In general, genome editing

approaches to novel plant trait development have been considered not regulated by USDA-APHIS. In particular, we have submitted two petitions (also known as the "Am I Regulated?" letter) to USDA-APHIS's Biotechnology Regulatory Services in order to confirm that the following two oil content traits are not going to be regulated by the agency under 7 CFR part 340: (i) the single trait C3008 Camelina plant line, developed using CRISPR genome editing technology for increased oil content; and (ii) the triple-edited Camelina line that combines three gene traits, C3008a, C3008b and C3009, to increase oil production. In both cases, USDA-APHIS approved our petitions and confirmed in writing that each of these novel plant lines would not be treated as a regulated article.

The USDA also announced in March 2018 that it would not require an assessment on products that used modern forms of mutagenesis if it was clear these outcomes could occur in nature. The USDA stated at that time that it did not "have any plans to regulate plants that could otherwise have been developed through traditional breeding techniques as long as they are developed without the use of a plant pest as the donor or vector and they are not themselves plant pests." This USDA policy statement applies to genetic deletions of any size, which would include genome editing through CRISPR-Cas9 and other emerging technologies, although it remains to be seen how this policy announcement will be implemented by USDA-APHIS and what practical effect that may have on seed trait developers like us and our competitors.

There can be no guarantee that the USDA-APHIS governing regulations and policies will not change. We cannot predict whether advocacy groups will challenge existing regulations and USDA determinations, whether the USDA will alter its interpretations of existing regulations, modify existing regulations or promulgate new regulations, or whether additional laws will come into effect. If these or other developments resulted in adverse changes to the current regulatory framework, our seed traits or future products in development containing our traits could be subjected to more burdensome regulatory standards, thereby substantially increasing the time and costs associated with developing and commercializing any future products. Moreover, we cannot assure you that USDA-APHIS will analyze any of our future yield traits or products in development containing our traits in a manner consistent with its analysis of our genome edited yield traits to date. Complying with the USDA's plant pest regulations for traits that are classified as "regulated articles," including the permitting requirements for field testing and environmental release, is a costly, time-consuming process and could substantially delay or prevent the commercialization of any future products containing traits that we expected to be deemed non-regulated by USDA-APHIS under 7 CFR part 340.

In addition to USDA-APHIS regulation of plant breeding and planting, a biotechnology-derived plant also will be regulated by the FDA if it is intended to be used as human food or animal feed. The FDA regulates the safety of food for humans and animals, and foods derived from novel plant varieties must meet the same food safety requirements as foods derived from traditionally bred plants (also called conventional foods). Since 1992, the FDA has had in place a voluntary consultation process for developers of bioengineered food ("Biotechnology Consultations").

Biotechnology Consultations are data-intensive and examine the new food product's safety and nutritional profile, among other issues. Generally, the FDA has found that such food products do not pose unique health risks to humans or animals, but if a novel allergen or other distinction from the conventional food is present in the new plant variety, the agency may require specific label statements on the product to ensure that consumers are made aware of material differences between genetically engineered and conventional versions. When such a determination cannot be made, the novel plant variety may become subject to FDA premarket review and approval as a food additive.

As part of a broader effort to modernize its regulatory approach to all biotechnology-derived products, the FDA is currently re-evaluating its regulatory approach in light of the increasing prevalence of certain genome edited plants. In January 2017, the FDA asked for public input to help inform its thinking about human and animal foods derived from new plant varieties produced using genome editing techniques. Among other things, the FDA's request for comments asked for data and information in response to questions about the safety of foods from genome edited plants, such as whether certain categories of genome edited plants present food safety risks different from other plants produced through traditional plant breeding. Subsequently, in October 2018, FDA leadership issued a document entitled the "Plant and Animal Biotechnology Innovation Action Plan" ("Action Plan") that identified three key priorities for the agency in this area and stated that the FDA has reviewed the comments and other information it received in response to the January 2017 request for comments. The FDA also stated that it intends to

develop guidance for industry explaining how the FDA's existing regulatory policy for foods derived from new plant varieties applies to foods produced using genome editing. The forthcoming draft guidance is expected to be released for public comment in 2019. The FDA also stated in the Action Plan that it intends to begin updating the existing procedures for voluntary Biotechnology Consultations to reflect the agency's 25 years of experience with foods derived from biotechnology plants and to incorporate any additional issues related to genome editing of food crops. Such procedural updates are expected to be developed and implemented over the next two years.

We have not participated in any Biotechnology Consultations or engaged in any informal discussions with the FDA about our novel yield traits, whether those traits have been developed using genome editing or traditional genome modification using the insertion of recombinant DNA. Any delay in the regulatory consultation process, or a determination by the FDA that future product candidates containing our traits raise different safety issues than the relevant conventional crop and therefore must be approved by the agency as a new food additive through an intensive premarket safety review process, could increase the costs associated with or delay or prevent the commercialization of the future product candidate. Such delays may lead to reduced acceptance by farmers, food manufacturers or the public and an increase in competitor products that may directly compete with ours. Further, if the FDA enacts new regulations or policies with respect to genome edited plants in particular, such policies could result in additional compliance costs or delay or prevent the commercialization of any potential commercial products containing our seed traits, which could adversely affect our ability to generate revenues and to achieve profitability.

In Canada, genetically engineered crops and the food products into which they are incorporated are regulated by multiple government agencies under a federal framework for the regulation of biotechnology products that is similar to the U.S. system. First, the Canadian Food Inspection Agency ("CFIA") is the lead agency for ensuring that a new agricultural biotechnology crop will not pose new risks to Canadian plants, animals and other agricultural commodities. The CFIA's Plant Biosafety Office ("PBO") is responsible for conducting environmental assessments of biotechnology-derived plants, referred to as "plants with novel traits" ("PNT"). Authority for the PBO includes both approving confined field trials with the PNT through permits and authorizing their "unconfined release" as a first step towards commercialization. Second, under the Food and Drugs Act and related regulations, Health Canada is responsible for reviewing a pre-market safety assessment that must be submitted by the manufacturer or importer of a "novel food," a term of art that includes any PNT or other biotechnology-derived foods. Health Canada will evaluate the data and information about the novel food and make a determination regarding whether it is safe and nutritious before it can be sold in Canada, as well as whether any restrictions are warranted under applicable law or the product's safety profile. Any commercialization of our yield crops in Canada is expected to be done by a third-party collaborator or other partner and complying with Health Canada's pre-market notification requirement and safety assessment for novel foods would be the obligation of that third-party collaborator.

Our work involving the development, greenhouse testing and field testing of novel yield trait genes in crop plants requires certain government and municipal permits and we must ensure compliance with all applicable regulations including regulations relating to genetically engineered crops. With laboratories and greenhouses in both the U.S. and Canada, we are also subject to regulations governing the shipment of seeds and other plant material between our facilities in the U.S. and Canada, including USDA-APHIS permits for the import and export of plant materials that could pose a risk to domestic agriculture. We also have been conducting field studies of various yield traits in Canada since 2016 under PNT permits issued by Canadian regulators.

Complying with the Canadian regulations is a costly, time-consuming process and could substantially delay or prevent the commercialization of our products. In addition, we cannot assure you that CFIA and Health Canada regulations or the agencies' implementation of those regulations will not change or that the legislative framework in Canada for biotechnology-derived crops, whether for genome edited plants or plants modified using the insertion of recombinant DNA, will not be amended or otherwise changed in a manner that could result in additional compliance costs or delay or prevent the commercialization of any potential commercial products containing our seed traits, which could adversely affect our ability to generate revenues and to achieve profitability.

Failure to comply with applicable regulatory requirements may, among other things, result in fines, suspensions of regulatory approvals, product recalls, product seizures, operating restrictions and criminal prosecution.

If we or our future collaborators are unable to comply with and timely complete the regulatory process in the United States and Canada for our future products in development, our or our future collaborators' ability to market our traits could be delayed, prevented or limited.

We apply for and maintain the regulatory permits in the United States and Canada necessary for our operations, particularly those covering our field trials. We anticipate that we or our future collaborators will apply for and maintain regulatory approvals, if any, necessary for the commercialization of any future products containing our seed traits. Even if we and our collaborators make timely and appropriate applications for regulatory permits for our field trials, government delays in issuing such permits can significantly affect the development timelines for our traits, particularly if the planting period for a crop growing season expires before the necessary permits are obtained.

The regulatory process is expensive and time-consuming, and the time required to complete the process is difficult to predict and depends upon numerous factors, including the substantial discretion of the regulatory authorities. We have not completed all phases of the regulatory process for any of our traits in development. Our traits could require a significantly longer time to complete the regulatory process than expected, or may never gain approval, even if we and our collaborators expend substantial time and resources seeking such approval. The time required for regulatory approval, or any delay or denial of such approval, could negatively impact our ability to generate revenues and to achieve profitability and finance our ongoing operations. In addition, changes in regulatory review policies during the development period of any of our traits, changes in, or the enactment of, additional regulations or statutes, or changes in regulatory review practices for a submitted product application may cause a delay in obtaining approval or result in the rejection of an application for regulatory approval. Regulatory approval, if obtained, may be made subject to limitations on the intended uses for which we or our collaborators may market a future product containing our traits. These limitations could adversely affect our potential revenues.

The regulatory environment for genetically engineered crops in jurisdictions outside the United States and Canada varies greatly, and some jurisdictions have more restrictive regulations that could delay, prevent or limit our or our future collaborators' ability to market our traits.

Other jurisdictions and governmental authorities, including in South America and Asia, are increasingly taking an interest in regulating agricultural products of biotechnology. Regulatory approaches vary by jurisdiction as a result of the existing public health frameworks and phytosanitary laws, as well as other less tangible factors such as cultural and religious norms that may have an impact on individual country risk assessments and decision-making. Each jurisdiction may have its own regulatory framework, which may include restrictions and regulations on planting and growing genetically engineered plants and in the consumption and labeling of foods derived from such novel plants, and which may apply to future products containing our traits. We cannot predict future changes in the global regulatory landscape regarding genetically engineered plants or commercial products incorporating such novel plant varieties. The regulatory environment for such plants is greatly uncertain outside of the U.S. and Canada, and some jurisdictions have more restrictive regulations that could delay, prevent or limit our or our future collaborators' ability to market our traits.

For example, regulation of all genetically engineered plants in the European Union ("EU") is far more stringent than in the U.S. and Canada. U.S. and Canadian regulators have determined that genome edited plants pose fewer risks than traditional biotechnology-derived plants subjected to modification through the insertion of recombinant DNA. In contrast, a recent EU legal ruling indicated that the existing EU regulations for genetically engineered plants modified by the insertion of recombinant DNA, which were already more stringent than corresponding U.S. and Canadian regulations, should be strictly applied to genome edited plants as well. As a result, there is a sharp distinction between how EU and U.S. and Canadian regulatory agencies oversee novel seed traits, and in particular those that are generated using the more modern techniques of genome editing.

Although we are not currently targeting EU markets for the development or commercialization of future products containing our traits, emerging oversight regimes for genetically engineered products in other jurisdictions may follow the EU approach and impose similarly strict requirements for the release of such products into the environment and their incorporation into human food or other consumer products. Such jurisdictions may also elect to regulate genetically engineered plants without distinguishing between traditional biotechnology-derived plants modified with recombinant DNA and genome edited plants. There is no guarantee that countries for which we may

have or may develop future marketing plans would not take a stricter legal and regulatory approach to controlling genetically engineered plants similar to that of the EU, which could increase regulatory costs and delay, prevent or limit our or our future collaborators' ability to market our traits in such jurisdictions.

Consumer resistance to genetically engineered crops may negatively affect the ability to commercialize future crops containing our traits, as well as our public image, and may reduce any future sales of seeds containing our yield traits.

Food and feed made from genetically engineered seeds and plants are not accepted by some consumers, and in certain countries production of certain genetically engineered crops is effectively prohibited, including throughout the EU, due to concerns over such products' effects on food safety and the environment. Advocacy groups have engaged in publicity campaigns and filed lawsuits in various countries against companies and regulatory authorities, seeking to halt regulatory approval activities or influence public opinion against genetically engineered and/or genome edited products. Actions by consumer groups and others also may disrupt research and development or production of genetically engineered plants, seeds or food products that incorporate such novel plant varieties. The high public profile of the biotechnology industry in food and feed production, and a lack of consumer acceptance of the types of products to which we have devoted substantial development resources, could have a negative impact on the commercial success of any of products incorporating our traits that may successfully complete the development process, as to which no assurance can be given, and could materially and adversely affect our ability to obtain future collaborations and to finance our crop science program. Further, we could incur substantial liability and/or legal expenses if there are claims that genetically engineered crops damage the environment or contaminate other farm crops. This could distract our management and cause us to spend resources defending against such claims.

Government policies and regulations, particularly those affecting the agricultural sector and related industries, could adversely affect our operations and our ability to generate future revenues and to achieve profitability.

Agricultural production and trade flows are subject to government policies and regulations. Governmental policies and approvals of technologies affecting the agricultural industry, such as taxes, tariffs, duties, subsidies, incentives and import and export restrictions on agricultural commodities and commodity products can influence the planting of certain crops, the location and size of crop production, and the volume and types of imports and exports. Future government policies in the United States, Canada or in other countries could discourage farmers from using any of our products that may successfully complete the development process, as to which no assurance can be given. Similarly, these policies could discourage food processors from purchasing harvested crops containing our traits or could encourage the use of our competitors' products, which would put us at a commercial disadvantage and could negatively impact our ability to generate any revenues and to achieve profitability.

The products of third parties, or the environment itself, may be negatively affected by the unintended appearance of our yield trait genes.

The potential for unintended but unavoidable trace amounts, sometimes called "adventitious presence," of yield trait genes in conventional seed, or in the grain or products produced from conventional or organic crops, could affect acceptance by the general public or by the agricultural industry of these traits. Trace amounts of yield trait genes may unintentionally be found outside our containment area in the products of third parties, which may result in negative publicity and claims of liability brought by such third parties against us. Furthermore, in the event of an unintended dissemination of our genetically engineered materials to the environment, we could be subject to claims by multiple parties, including environmental advocacy groups, as well as governmental actions such as mandated crop destruction, product recalls or additional stewardship practices and environmental cleanup or monitoring. The occurrence of any of these events could have a material adverse effect on our business and results of operations.

Loss of or damage to our elite novel trait events and plant lines would significantly slow our product development efforts.

We have a collection of elite novel trait events and plant lines in which we are developing traits for incorporation into elite germplasm and potential seed products. Our elite novel trait events and plant lines are a key

strategic asset since they form the basis for the introgression of our traits into plant breeding programs. If we suffer loss or damage to our elite novel trait events and plant lines, our research and development activities could be negatively impacted.

Our insurance coverage may be inadequate to cover all the liabilities we may incur.

We face the risk of exposure to liability claims if any products that are successfully developed containing our seed traits, as to which no assurance can be given, are defective and if any product that we develop or any product that uses our technologies or incorporates any of our traits causes injury. Although we carry insurance at levels customary for companies in our industry, such coverage may become unavailable or be inadequate to cover all liabilities we may incur. There can be no assurance that we will be able to continue to maintain such insurance, or obtain comparable insurance at a reasonable cost, if at all. If we are unable to obtain sufficient insurance coverage at an acceptable cost or otherwise, or if the amount of any claim against us exceeds the coverage under our policies, we may face significant expenses.

We rely on third parties to conduct, monitor, support, and oversee field trials and, in some cases, to maintain regulatory files for those products in development, and any performance issues by third parties, or our inability to engage third parties on acceptable terms, may impact our or our future collaborators' ability to complete the regulatory process for or commercialize such products.

We rely on third parties to conduct, monitor, support, and oversee field trials. As a result, we have less control over the timing and cost of these trials than if we conducted these trials with our own personnel. If we are unable to maintain or enter into agreements with these third parties on acceptable terms, or if any such engagement is terminated prematurely, we may be unable to conduct and complete our trials in the manner we anticipate. In addition, there is no guarantee that these third parties will devote adequate time and resources to our studies or perform as required by our contract or in accordance with regulatory requirements, including maintenance of field trial information regarding our products in development. If any of these third parties fail to meet expected deadlines, fail to transfer to us any regulatory information in a timely manner, fail to adhere to protocols, or fail to act in accordance with regulatory requirements or our agreements with them, or if they otherwise perform in a substandard manner or in a way that compromises the quality or accuracy of their activities or the data they obtain, then field trials of our traits in development may be extended or delayed with additional costs incurred, or our data may be rejected by the applicable regulatory agencies. Ultimately, we are responsible for ensuring that each of our field trials is conducted in accordance with the applicable protocol and with legal, regulatory and scientific standards, and our reliance on third parties does not relieve us of our responsibilities. We could be subject to penalties, fines and liabilities if our third-party contractors fail to perform as required.

If our relationship with any of these third parties is terminated, we may be unable to enter into arrangements with alternative parties on commercially reasonable terms, or at all. Switching or adding service providers can involve substantial cost and require extensive management time and focus. Delays may occur, which can materially impact our ability to meet our desired development timelines. If we are required to seek alternative service arrangements, the resulting delays and potential inability to find a suitable replacement could materially and adversely impact our business.

In addition, there has been an increasing trend towards consolidation in the agricultural biotechnology industry. Consolidation among our competitors and third parties upon whom we rely could lead to changes in the competitive landscape, capabilities, and strategic priorities among potential service providers, which could have an adverse effect on our business and operations.

If we lose key personnel or are unable to attract and retain necessary talent, we may be unable to develop or commercialize our products under development.

We are highly dependent on our key technical and scientific personnel, who possess unique knowledge and skills related to our research and technology. If we were to lose the services of these individuals, we may be unable to readily find suitable replacements with comparable knowledge and the experience necessary to advance the research and development of our products. Because of the unique talents and experience of many of our scientific and technical staff, competition for our personnel is intense. The loss of key personnel or our inability to hire and retain personnel who have the required expertise and skills could have a material adverse effect on our research and development efforts, our business, and our ability to secure additional required financing.

Our business and operations would suffer in the event of system failures.

We utilize information technology systems and networks to process, transmit and store electronic information in connection with our business activities. As use of digital technologies has increased, cyber incidents, including deliberate attacks and attempts to gain unauthorized access to computer systems and networks, have increased in frequency and sophistication. These threats pose a risk to the security of our systems and networks and the confidentiality, availability and integrity of our data. There can be no assurance that we will be successful in preventing cyber-attacks or successful in mitigating their efforts.

Despite the implementation of security measures, our internal computer systems and those of our contractors and consultants are vulnerable to damage from such cyber-attacks, including computer viruses, unauthorized access, natural disasters, terrorism, war and telecommunication and electrical failures. Such an event could cause interruption of our operations. For example, the loss of data from completed field tests for our yield traits could result in delays in our regulatory approval efforts and significantly increase our costs. To the extent that any disruption or security breach were to result in a loss of or damage to our data, or inappropriate disclosure of confidential or proprietary information, we could suffer reputational harm or face litigation, or adverse regulatory action and the development of our product candidates could be delayed.

Risks Relating to Intellectual Property

Patent protection for our technologies is both important and uncertain.

Our commercial success may depend in part on our obtaining and maintaining patent protection for our technologies in the United States and other jurisdictions, as well as successfully enforcing and defending this intellectual property against third-party challenges. If we are not able to obtain or defend patent protection for our technologies, then we will not be able to exclude competitors from developing or marketing such technologies, and this could negatively impact our ability to generate sufficient revenues or profits from product sales and/or licensing to justify the cost of development of our technologies and to achieve or maintain profitability. Our currently issued patents relate mainly to our historical business, and have expiration dates ranging from 2020 through 2030. New outstanding patent applications owned by or licensed to us relating to crop yield improvements have filing dates ranging from 2013 through 2019 including the recently filed new patent application on a breakthrough technology for producing PHA biomaterials in crops. This patent would have an expiration date in 2039 if granted, however, we may not be able to get sufficiently broad claims to cover the new invention.

Our patent position involves complex legal and factual questions. Accordingly, we cannot predict the breadth of claims that may be allowed or enforced in our patents or in third-party patents. Patents may not be issued for any pending or future pending patent applications owned by or licensed to us, and claims allowed under any issued patent or future issued patent owned or licensed by us may not be valid or sufficiently broad to protect our technologies. Moreover, we may be unable to protect certain of our intellectual property in the United States or in foreign countries. Foreign jurisdictions may not afford the same protections as U.S. law, and we cannot ensure that foreign patent applications will have the same scope as the U.S. patents. There will be many countries in which we will choose not to file or maintain patents because of the costs involved. Competitors may also design around our patents or develop competing technologies.

Additionally, any issued patents owned by or licensed to us now or in the future may be challenged, invalidated, or circumvented. We could incur substantial costs to bring suits or other proceedings in which we may assert or defend our patent rights or challenge the patent rights of third parties. An unfavorable outcome of any such litigation could have a material adverse effect on our business and results of operations.

Third parties may claim that we infringe their intellectual property, and we could suffer significant litigation or licensing expense as a result.

Various U.S. and foreign issued patents and pending patent applications owned by third parties exist in areas relevant to our products and processes. We could incur substantial costs to challenge third-party patents. If third parties assert claims against us or our customers alleging infringement of their patents or other intellectual property rights, we could incur substantial costs and diversion of management resources in defending these claims, and the defense of these claims could have a material adverse effect on our business. In addition, if we are unsuccessful in defending against these claims, these third parties may be awarded substantial damages, as well as injunctive or other equitable relief against us, which could effectively block our ability to make, use, sell, distribute, or market our technologies and services based on our technologies in the United States or abroad. Alternatively, we may seek licenses to such third-party intellectual property. However, we may be unable to obtain these licenses on acceptable terms, if at all. Our failure to obtain the necessary licenses or other rights could prevent the sale, manufacture, or distribution of some of our products based on our technologies and, therefore, could have a material adverse effect on our business.

Portions of our crop science technology are owned by or subject to retained rights of third parties.

We have licensed and optioned from academic institutions certain patent rights that may be necessary or important to the development and commercialization of our crop science technology. These licenses and options may not provide exclusive rights to use such intellectual property in all fields of use in which we may wish to develop or commercialize our technology. If we fail to timely exercise our option rights and/or we are unable to negotiate license agreements for optioned patent rights on acceptable terms, the academic institutions may offer such patent rights to third parties. If we fail to comply with our obligations under these license agreements, or if we are subject to a bankruptcy or insolvency proceeding, the licensor may have the right to terminate the license. In some circumstances, we may not have the right to control the preparation, filing and prosecution of licensed patent applications or the maintenance of the licensed patents. Therefore, we cannot be certain that these patents and applications will be prosecuted, maintained and enforced in a manner consistent with the best interests of our business. Furthermore, the research resulting in certain of our licensed and optioned patent rights was funded by the U.S. government. As a result, the government may have certain rights to such patent rights and technology.

We may not be successful in obtaining necessary rights to additional technologies for the development of our products through acquisitions and in-licenses.

We may be unable to acquire or in-license additional technologies from third parties that we decide we need in order to develop our business. A number of more established companies may also pursue strategies to license or acquire crop science technologies that we may consider attractive. These established companies may have a competitive advantage over us due to their size, cash resources and greater development and commercialization capabilities. Any failure on our part to reach an agreement for any applicable intellectual property could result in a third party acquiring the related rights and thereby harm our business.

In addition, companies that perceive us to be a competitor may be unwilling to assign or license rights to us. We also may be unable to license or acquire relevant crop science technologies on terms that would allow us to make an appropriate return on our investment.

We expect that competition for acquiring and in-licensing crop science technologies that are attractive to us may increase in the future, which may mean fewer suitable opportunities for us as well as higher acquisition or licensing costs. If we are unable to successfully obtain rights to suitable crop science technologies on reasonable terms, or at all, our business and financial condition could suffer.

Our license agreements include royalty payments that we are required to make to third parties.

We are party to license agreements that require us to remit royalty payments and other payments related to our licensed intellectual property. Under our in-license agreements, we may pay upfront fees and milestone payments and be subject to future royalties. We cannot precisely predict the amount, if any, or timing of royalties we may owe in the future. Furthermore, we may enter into additional license agreements in the future, which may also include royalty, milestone and other payments.

The intellectual property landscape around genome editing technology, such as CRISPR, is highly dynamic and uncertain, and any resolution of this uncertainty could have a material adverse effect on our business.

The field of genome editing, especially in the area of CRISPR technology, is still in its infancy, and no products using this technology have reached the market. In 2018, we entered into a non-exclusive research license agreement jointly with the Broad Institute of MIT and Harvard and Pioneer, part of Corteva Agriscience™, Agriculture Division of DowDuPont Inc., for the use of CRISPR-Cas9 genome-editing technology for crops in order to demonstrate the utility of our yield trait genes in this field. The joint license covers intellectual property consisting of approximately 48 patents and patent applications on CRISPR-Cas9 technology controlled by the Broad Institute and Corteva Agriscience. Under the agreement, we have the option to renew the license on an annual basis and the right, subject to specified conditions, to convert the research license to a commercial license in the future, although there can be no assurance that we will be able to secure such commercial license on acceptable terms. CRISPR technology is uniquely suited to agricultural applications as it enables precise changes to plant DNA without the use of foreign DNA to incorporate new traits. Plants developed using CRISPR genome-editing technology have the potential to be considered not regulated by USDA-APHIS under 7 CFR part 340 for development and commercialization in the U.S., which could result in shorter developmental timelines and lower costs associated with commercialization of new traits in the U.S. as compared to regulated crops. Due to the intense research and development that is taking place by several companies, including us and our competitors, in this field, the intellectual property landscape is in flux, and it may remain uncertain for the coming years. There has been, and may continue to be, significant intellectual property related litigation and proceedings relating to this area in the future. If it is later determined that the patent rights using the CRISPR technology that we obtained under license are invalid or owned by other parties, this could have a material adverse effect on our business.

We rely in part on trade secrets to protect our technology, and our failure to obtain or maintain trade secret protection could harm our business.

We rely on trade secrets to protect some of our technology and proprietary information, especially where we believe patent protection is not appropriate or obtainable as is the case for our GRAIN trait gene discovery platform. However, trade secrets are difficult to protect. Litigating a claim that a third party had illegally obtained and was using our trade secrets would be expensive and time consuming, and the outcome would be unpredictable. Moreover, if our competitors independently develop similar knowledge, methods and know-how, it will be difficult for us to enforce our rights and our business could be harmed.

Risks Relating to Owning our Common Stock

Raising additional funds may cause dilution to our existing stockholders, restrict our operations or require us to relinquish rights to our technologies.

Execution of our business plan requires additional financing. If we raise additional funds through equity offerings or offerings of equity-linked securities, including warrants or convertible debt securities, we expect that our existing stockholders will experience significant dilution, and the terms of such securities may include liquidation or other preferences that adversely affect your rights as a stockholder. Debt financing, if available, may subject us to restrictive covenants that could limit our flexibility in conducting future business activities, including covenants limiting or restricting our ability to incur additional debt, dispose of assets or make capital expenditures. We may also incur ongoing interest expense and be required to grant a security interest in our assets in connection with any debt issuance. If we raise additional funds through strategic partnerships or licensing agreements with

third parties, we may have to relinquish valuable rights to our technologies or grant licenses on terms that are not favorable to us.

Trading volume in our stock can fluctuate and an active trading market for our common stock may not be available on a consistent basis to provide stockholders with adequate liquidity. Our stock price may be extremely volatile, and our stockholders could lose a significant part of their investment.

The public trading price for our common stock will be affected by a number of factors, including:

- any change in the status of our Nasdaq listing;
- the need for near-term financing to continue operations;
- reported progress in our efforts to develop crop related technologies, relative to investor expectations;
- changes in earnings estimates, investors' perceptions, recommendations by securities analysts or our failure to achieve analysts' earnings estimates;
- quarterly variations in our or our competitors' results of operations;
- general market conditions and other factors unrelated to our operating performance or the operating performance of our competitors;
- future issuances and/or sales of our securities;
- announcements or the absence of announcements by us, or our competitors, regarding acquisitions, new products, regulatory developments, significant contracts, commercial relationships or capital commitments;
- commencement of, or involvement in, litigation;
- any major change in our board of directors or management;
- changes in governmental regulations or in the status of our regulatory approvals;
- announcements related to patents issued to us or our competitors and to litigation involving our intellectual property;
- a lack of, or limited, or negative industry or security analyst coverage;
- uncertainty regarding our ability to secure additional cash resources with which to operate our business;
- a decision by our significant stockholders to increase or decrease their holdings in our common stock;
- short-selling or similar activities by third parties; and
- other factors described elsewhere in these risk factors.

As a result of these factors, our stockholders may not be able to resell their shares at, or above, their purchase price. In addition, the stock prices of many technology companies have experienced wide fluctuations that have often been unrelated to the operating performance of those companies. Any negative change in the public's perception of the prospects of industrial or agricultural biotechnology companies could depress our stock price regardless of our results of operations. These factors may have a material adverse effect on the market price and liquidity of our common stock and affect our ability to obtain required financing.

Provisions in our certificate of incorporation and by-laws and Delaware law might discourage, delay or prevent a change of control of our company or changes in our management and, therefore, depress the trading price of our common stock.

Provisions of our certificate of incorporation and by-laws and Delaware law may discourage, delay or prevent a merger, acquisition or other change in control that stockholders may consider favorable, including transactions in which our stockholders might otherwise receive a premium for their shares of our common stock. These provisions may also prevent or frustrate attempts by our stockholders to replace or remove our management.

In addition, Section 203 of the Delaware General Corporation Law ("DGCL") prohibits a publicly-held Delaware corporation from engaging in a business combination with an interested stockholder, which generally refers to a person which together with its affiliates owns, or within the last three years has owned, 15 percent or more of our voting stock, for a period of three years after the date of the transaction in which the person became an interested stockholder, unless the business combination is approved in a prescribed manner.

The existence of the foregoing provisions and anti-takeover measures 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 our stockholders could receive a premium for their common stock in an acquisition.

Concentration of ownership among our officers, directors and principal stockholders may prevent other stockholders from influencing significant corporate decisions and depress our stock price.

Based on the number of shares outstanding as of August 16, 2019, our officers, directors and stockholders who hold at least 5% of our stock beneficially own a combined total of approximately 45.2 percent of our outstanding common stock, including shares of common stock subject to stock options and warrants that are currently exercisable or are exercisable within 60 days after August 16, 2019. If these officers, directors, and principal stockholders or a group of our principal stockholders act together, they will be able to exert a significant degree of influence over our management and affairs and control matters requiring stockholder approval, including the election of directors and approval of mergers, business combinations or other significant transactions. The interests of one or more of these stockholders may not always coincide with our interests or the interests of other stockholders. For instance, officers, directors, and principal stockholders, acting together, could cause us to enter into transactions or agreements that we would not otherwise consider. Similarly, this concentration of ownership may have the effect of delaying or preventing a change in control of our company otherwise favored by our other stockholders. As of August 16, 2019, Jack W. Schuler (and his related entities) beneficially owned approximately 40.3 percent of our common stock. To the extent that this or any other significant stockholders oppose any proposal put forth for stockholder approval by our board of directors, they control a sufficient percentage of our outstanding shares to cause such proposal to either fail or be very difficult to achieve without their support. This, in turn, could have a negative effect on the market price of our common stock. It could also prevent our stockholders from realizing a premium over the market price for their shares of common stock. The concentration of ownership also may contribute to the low trading volume and volatility of our common stock.

The comprehensive tax reform bill known as the Tax Cuts and Jobs Act could adversely affect our business and financial results.

On December 22, 2017, President Trump signed into law the Tax Cuts and Jobs Act of 2017, or ("TCJA"), that significantly reformed the Code. The TCJA, among other things, includes changes to U.S. federal tax rates, imposes significant additional limitations on the deductibility of interest and net operating loss carryforwards, allows for the expensing of capital expenditures, and puts into effect the migration from a "worldwide" system of taxation to a territorial system. Our net deferred tax assets and liabilities have been revalued at the newly enacted U.S. corporate rate as of December 31, 2018. We continue to examine the impact this tax reform legislation may have on our business and we urge our stockholders to consult with their legal and tax advisors with respect to such legislation and the potential tax consequences of investing in our common stock.

SPECIAL NOTE REGARDING FORWARD-LOOKING STATEMENTS

This prospectus and the information incorporated by reference in this prospectus contain forward-looking statements within the meaning of Section 27A of the Securities Act of 1933, as amended, or Securities Act, and Section 21E of the Securities Exchange Act of 1934 ("Exchange Act"), regarding our strategy, future, operations, future financial position, future revenues, projected costs, and plans and objectives of management. You can identify these forward-looking statements by their use of words such as “anticipate,” “believe,” “estimate,” “expect,” “intend,” “may,” “plan,” “project,” “target,” “potential,” “will,” “would,” “could,” “should,” “continue,” and similar expressions. You also can identify them by the fact that they do not relate strictly to historical or current facts. There are a number of important risks and uncertainties that could cause our actual results to differ materially from those indicated by forward-looking statements. For a description of these risks and uncertainties, please refer to the section entitled “Risk Factors,” any other risk factors set forth in any information incorporated by reference in this prospectus, as well as any other risk factors and cautionary statements we include or incorporate by reference into this prospectus in the future. While we may elect to update forward-looking statements wherever they appear in this prospectus or in the documents incorporated by reference in this prospectus, we do not assume, and specifically disclaim, any obligation to do so, whether as a result of new information, future events or otherwise.

USE OF PROCEEDS

We estimate that the net proceeds from this offering will be approximately $[●] million, based on an assumed offering price of $[●] per share, which is the last reported sales price per share of our common stock on The Nasdaq Capital Market on [●], after deducting the underwriting discounts and commissions and estimated offering expenses payable by us. If the underwriters exercise their over-allotment option in full, we estimate that our net proceeds will be approximately $[●] million, after deducting the underwriting discounts and commissions and estimated offering expenses payable by us.

We intend to use net proceeds from this offering for working capital and general corporate purposes. We have not yet determined the amount of net proceeds to be used specifically for any particular purpose or the timing of these expenditures. Accordingly, our management will have significant discretion and flexibility in applying the net proceeds from the sale of these securities.

MARKET FOR OUR COMMON STOCK

Market Information

Our common stock currently trades under the symbol “YTEN” on The Nasdaq Capital Market.

Stockholders

As of August 16, 2019, there were approximately 36 stockholders of record. On September 6, 2019, the closing price of our common stock as reported by The Nasdaq Capital Market was $0.79 per share.

DIVIDEND POLICY

We have never declared or paid any cash dividends on our capital stock and do not expect to pay any cash dividends for the foreseeable future. We intend to use future earnings, if any, in the operation and expansion of our business. Any future determination relating to our dividend policy will be made at the discretion of our board of directors, based on our financial condition, results of operations, contractual restrictions, capital requirements, business properties, restrictions imposed by applicable law and other factors our board of directors may deem relevant.

BUSINESS

Overview

Yield10 Bioscience, Inc. is an agricultural bioscience company which uses its "Trait Factory" to develop high value seed traits for the agriculture and food industries. Specifically, Yield10 plans to efficiently develop superior gene traits for the major grain crops including corn, soybean, canola, wheat and rice that will enable step-change increases in crop yield of at least 10-20 percent. While maintaining our focus on the development of novel yield traits for key grain crops based on a licensing model, we have recently begun to execute the second part of our strategy which is to develop independent business opportunities for Yield10 in the specialty oils and niche crop product space using the oilseed Camelina. The target of this effort is sustainable business solutions to support agriculture, sustainable global food production and other specialty applications. Yield10 brings a unique history, skill set and tools, captured in its GRAIN platform, for developing advanced crop traits and increasing the concentration of specific biochemicals of commercial interest in crops. Our plan is to use GRAIN to develop a source of revenue from funded research and development collaborations for traits, products and crops not being directly pursued internally. We are currently engage in a range of discussions with third parties with respect to different crops, traits and products in the feed, food and pharmaceutical sectors.

We are currently progressing several novel yield gene traits in our pipeline in the major North American row crops canola, soybean and corn, and the niche crop Camelina, among others. Camelina is an oilseed crop similar to canola, with significant upside potential as a production platform for edible oils and PHA biomaterials. Our approach is to focus internal resources on progressing our traits through development and field trials in Camelina and canola while leveraging third party resources to progress our traits in soybean and corn while retaining control of our intellectual property. Over the last three years, we have evaluated certain of our traits in greenhouse studies and field tests conducted in the United States and Canada. We currently have non-exclusive research license agreements in place with the Crop Science, division of Bayer AG, for the evaluation of our C3003 and C3004 traits in soybean and with Forage Genetics International, LLC, a division of Land O'Lakes, Inc. for the evaluation of five yield traits in forage sorghum. Our business strategy is to progress our traits into field tests to generate validating yield data. We have progressed our evaluation of C3003 in field tests with Camelina and canola and we are planning to expand our field tests with more C3003 canola events as well as additional traits in Camelina, canola and corn in 2019 and 2020. We plan to leverage data that we generate to support the performance of our traits in key crops to establish collaborations or to sign licenses to the traits with major agricultural companies in order to generate revenue. Yield10 Bioscience is headquartered in Woburn, Massachusetts and has an oilseed development Center of Excellence in Saskatoon, Saskatchewan, Canada.

According to a United Nations report, crop production must be increased by over 70 percent in the next 35 years to feed the growing global population, which is expected to increase from 7 billion to more than 9.6 billion by 2050. During that time period, there will be a reduction in available arable land as a result of infrastructure growth and increased pressure on scarce water resources. Consumption of meat, fish, and dairy products is also expected to increase based on dietary changes associated with increasing wealth and living standards. Harvestable food production per acre and per growing season must be increased to meet this demand. At the same time, with the increasing focus on health and wellness, food safety and sustainability in developed countries, we anticipate a rise in demand for new varieties of food and food ingredients with improved nutritional properties. With crop intensification (less land available and more production needed), we expect that improved crop genetics based on new gene traits will be a key driver of increased productivity, potentially resulting in the best performing yield traits commanding disproportionate value and disrupting the seed sector. We expect farmers and growers to be the major beneficiaries of these drivers, which represent potential opportunities for increased revenue and crop diversification. Today the global food market has an estimated value of $5 trillion.

Crop yield is determined by the efficiency by which crops fix carbon dioxide from the air through photosynthesis and convert that fixed carbon through carbon metabolism during the growing season into harvestable grain or biomass. Yield10 brings unique capabilities and experience in advanced metabolic engineering and systems biology to optimize photosynthesis and carbon efficiency in crops to increase grain or biomass yield. These capabilities were developed based on sustained investment over many years when the Company was named Metabolix. As Metabolix, the Company solved complex biological problems in the industrial/synthetic biology space to produce bioplastics. By 2012, the Company had

begun work to increase photosynthesis in crops as part of those activities, which led to the creation in 2015 of the current Yield10 business focused on crop yield. In mid-2016 we sold our bioplastics assets to focus on our agricultural innovations and the Company was rebranded as Yield10 Bioscience in January 2017.

Exciting new genetic engineering technologies like the CRISPR technology and other approaches to genome editing hold promise to accelerate the deployment of novel traits into commercial crops. This method of making insertions or deletions of DNA into plants without the use of foreign DNA has been described as “precision breeding.” We signed a research license, with rights to convert to a commercial license, to CRISPR/Cas-9 technology in 2018 to support our genome editing program. We have taken two genome edited traits designed to boost oil content in oilseed crops through the USDA-APHIS “Am I Regulated?” petitioning process and have confirmed that the agency does not consider two of our lines to be not regulated pursuant to 7 CFR part 340, clearing the way to conduct field tests in the United States. Genome editing technology as well as the streamlined regulatory process supported by USDA-APHIS for certain types of plant traits may enable agricultural innovators such as Yield10 to deploy and field test new traits more quickly, potentially resulting in a shorter path to market and reduced costs as compared to the more highly regulated path required for traditional biotechnology-derived traits.

SUMMARY OF OUR CROP YIELD TRAITS IN DEVELOPMENT	
R&D Area	**Crops Under Evaluation**
Seed Yield Traits-Likely Regulated[1]	
C3003	Canola, soybean, sorghum and corn
C3011	Corn, Camelina and canola
Seed Yield Traits-Likely Not-Regulated[2]	
C3004	Camelina, canola and corn
Oil Enhancing Traits-Likely Not-Regulated[2]	
C3007	Camelina and canola
C3008a	Camelina (not-regulated[4])
Oil trait combinations - C3008a, C3008b and C3009	Camelina (not-regulated[4])
Additional oil traits and combinations	Research in progress (target crops to be determined)
Yield Improvement Trait Discovery Platform (Traits Potentially Non-Regulated)[3]	
C4001	Wheat, rice, sorghum and corn
C4002	Sorghum and corn
C4003	Wheat, rice, sorghum and corn
C4004	Wheat and rice
C4029	Sorghum

(1) C3003 and C3011 consist of microbial genes and are likely to be subject to regulation by USDA-APHIS.

(2) These traits are accessible using genome editing or other methods that do not result in the insertion of non-plant DNA. These approaches may be deemed not to be regulated by USDA-APHIS pursuant to 7CFR part 340 based on recent filings by us and other groups.

(3) Traits in this area were developed in our T3 platform and all are potentially deployable through approaches which may be not-regulated by USDA-APHIS pursuant to 7 CFR part 340.

(4) USDA-APHIS does not consider lines submitted by Yield10 to be regulated pursuant to 7 CFR part 340. Commercial plant or plant lines or plant products derived from these lines may be regulated by the FDA or EPA.

One of the critical unmet needs in the agricultural sector is to increase the fundamental yield potential of crops to address global food security. This challenge is well suited to Yield10's unique background and expertise in metabolic modeling, genetic engineering, genome editing and next generation microbial gene systems which collectively form the

foundation of Yield10's trait development process. We refer to this trait development process as the "Trait Factory." The Trait Factory encompasses discovery of gene targets using our GRAIN platform (which stands for **G**ene **R**anking **A**rtificial **I**ntelligence **N**etwork), genetic engineering of crops using traditional approaches or genome editing to modify those targets and generation of field data with the engineered crops. Performance and molecular data from the engineered crops are then fed back into the GRAIN system to enable refinement of specific gene targets and the identification of new trait gene targets. Modified crops with improved performance enter our development pipeline and progress on the regulated or non-regulated path to market depending on how the plants are genetically engineered. GRAIN is a powerful new tool developed primarily to focus on Yield10 trait targets including performance traits for major row crops including corn, soybean, and canola as well as our niche product opportunities based on our Camelina platform. We believe we may also be able to generate a revenue stream by providing access to our GRAIN platform to third parties interested in other trait targets and/or crops Yield10 is not pursuing.

As we continue to develop the GRAIN platform, key elements of this system have proven effective and have enabled Yield10 to produce several promising crop yield traits in our development pipeline. Yield10 has achieved and published in peer reviewed journals scientific data from growth chamber and greenhouse studies showing that significant improvements to crop yield are possible. We have achieved these results by improving fundamental crop yield through enhanced photosynthetic carbon capture and increased carbon utilization efficiency to increase seed yield. Examples of these traits and their impact on crop yield are shown below. The C3005 trait results required a complex combination of microbial genes to enhance carbon fixation during seed development and serves to highlight the power of our advanced metabolic engineering/systems biology approach. Results we have obtained based on preliminary testing of our C3003 and C3004 traits as well as our C4000 series traits support our plans to test and develop these traits in major row crops.

Examples of our traits and their impact on crop yield in growth chamber and greenhouse studies
C3003/C3004 traits: 23% - 65% increase in seed yield in oilseed crops (Camelina)
C3005 advanced synthetic biology trait: 128% increase in oilseed yield (Camelina)
C4001, C4003 traits: 70% increase in photosynthesis, 150% increase in biomass (switchgrass)

Yield10 has a pipeline of more than 10 novel yield traits in research and development and we expect to generate several proof points for our traits in various crops over the next two years. We are developing our lead yield trait C3003 in canola and recently completed its second year of field tests in Canada. We anticipate that field tests will continue in 2019 as we advance the trait towards commercial development by developing additional commercial canola lines with the trait and expanding field testing. We plan to undertake our first field testing of C3004 in our Camelina platform in 2019 and are working to deploy and test this promising trait in canola, soybean and corn in the future. We have proven capabilities with genome editing using the CRISPR/Cas9 system and USDA-APHIS has determined that single and multiple genome edited lines of Camelina designed to increase oil content are not regulated by the agency under 7 CFR part 340. We plan to field test these plant lines and use the data to optimize the deployment of these traits to boost oil content in canola and potentially soybean. We recently successfully edited C3007, a novel target gene for increasing oil content, in canola and these plants are now progressing through our development pipeline. We plan to continue to progress initial development and testing of multiple traits in wheat and rice. Our approach is to engineer rice and wheat plants with our gene regulator traits to increase photosynthesis and grain yield and use those plants as a source of data to generate new gene targets for genome editing. Yield10 has no plans to field test or develop wheat or rice using traditional genetic engineering technologies. We anticipate that data generated on our traits will enable us to establish revenue generating collaborations in the future for the development and commercialization of our novel yield traits in commercial crops.

We are building a portfolio of intellectual property around our crop yield technology and traits. As of June 30, 2019, we owned or held exclusive rights to 20 patents or pending patent applications worldwide related to advanced technologies for increasing yield in crops. Our portfolio of patent applications includes plant science technologies we have in-licensed globally and exclusively from the University of Massachusetts and North Carolina State University related to the yield trait gene C3003 and other advanced technologies based on advanced metabolic engineering methods to improve carbon capture and selectively control carbon partitioning in plants. Our portfolio of patent applications also includes advanced technologies for increasing oil content in oilseed crops that we in-licensed globally and exclusively from the University of Missouri in 2018 and 2019 related to the yield trait genes C3007, C3010 and C3012. We also recently filed a new patent application on a breakthrough technology for producing PHA biomaterials in oilseeds which offers the potential for very low cost production of a specialty crop with applications in water treatment and plastics replacement.

The Unmet Need: Global Population Growth Outpacing Anticipated Global Food Supply

Yield10 is targeting a critical unmet need in agriculture based on the future disconnect between agricultural supply and the growing global population. According to a United Nations study, the global population is expected to exceed 9.6 billion people by 2050 and therefore there is a need to increase global food production including in grains, protein, dairy and edible oils to meet this demand. This will need to be achieved in the face of increased pressure on land and water resources in addition to increasingly variable weather patterns. Solving this problem is a major global challenge requiring new crop innovation and technologies to fundamentally enhance crop productivity.

The Yield Gap

According to several studies described in an article published in the Public Library of Science in 2013, crop yields may no longer be increasing in different regions of the globe, and current rates of crop yield increase based on traditional plant breeding approaches are expected to fall significantly behind the levels needed to meet the demand for global food production. The researchers found that the top four global crops—maize (corn), rice, wheat and soybean—are currently witnessing average yield improvements of only between 0.9 to 1.6 percent per year, far slower than the required rates to double their production by 2050 solely from incremental yield gains. At these rates, global production of maize, rice, wheat and soybean crops may be required to increase by about 67 percent, 42 percent, 38 percent and 55 percent, respectively, by 2050, in order to meet the anticipated increase in demand for food production caused by population growth. For corn and soybean, the benefits of currently available biotechnology traits were already factored into the data cited in the studies referenced above. The yield increases needed to meet the demands of the growing global population show that a significant “yield gap” exists for each of the crops evaluated in the study.

Yield10 is focused on addressing the yield gap for major crops by utilizing modern biotechnology strategies, including metabolic engineering (synthetic biology approaches) to “build better plants,” by using our Trait Factory to optimize photosynthesis and carbon efficiency in crops to increase grain or biomass yield. Enhancement of the photosynthetic capacity of major crops is fundamentally important to crop science and an essential first step to increase the seed and/or biomass yield of plants and, therefore, food production. We have been working in the area of increasing photosynthetic carbon capture and crop yield technologies since 2012 and we have identified several potentially promising genes for increasing yield or improving crop performance.

Health and Wellness, Food Safety and Sustainability

At the same time, with the increasing focus on health and wellness, food safety and sustainability in developed countries, we anticipate a rise in demand for new varieties of food and food ingredients with improved nutritional properties. Further, concerns about food safety have led to the concept of "seed to plate," with a focus on stringent quality control along the entire value chain. If this concept takes hold with consumers, it is likely to require identity preservation from seed to harvest and involve contract farming. This concept is currently being implemented in agricultural biotechnology, in both canola and soybean which have been modified to alter the composition of the oil produced. High oleic canola and soybean oils are being marketed as "healthier" where the value driver is the ability to make marketing claims directly to the consumer. Camelina oil has also recently been shown in clinical studies to be more effective than fish oil for controlling LDL cholesterol indicating potential use in reducing heart disease. Consumer demand to preserve the identity of specialty ingredients is expected to rise, and we believe that Yield10's crop yield technologies and crop gene editing targets could be useful in this emerging field. Yield10 believes that these types of small acreage specialty crops have the potential for a broader range of future partnering opportunities along the entire value chain. Camelina also has considerable potential as a cover crop to reduce soil erosion and nutrient run-off from land used for row crop production. Production of PHA biomaterials in Camelina could provide economic returns for farmers to justify large acreage adoption and enable the low-cost production this product for new markets including water treatment and plastics replacement applications.

Business Strategy

Our goal is to build a successful agricultural biotechnology company centered on demonstrating and capturing the value of our traits and technologies based on three potential revenue streams. In major food and feed crops for licensing to established agricultural companies and building other revenue generating business from our new niche crop opportunities we have begun developing based on our patent protected technologies. These potential revenue streams consist of:

- Licensing of our yield and performance traits for use in major row crops;

- Product sales revenue from niche products produced in our Camelina platform and other oilseeds; and
- R&D revenue for access to our GRAIN trait gene discovery platform.

We have identified and are evaluating novel yield trait genes in our Trait Factory to help address the growing global yield gap in food and feed crops. As the primary driver of financial returns each season, crop yield is the key decision variable for farmers in making seed buying decisions, and as a result, is critical to the seed industry. Improvements in yield to the levels targeted by Yield10, for example 10-20 percent increases, would be expected to generate significant value to the seed and crop industry. For example, Yield10 is targeting an approximately 10-20 percent increase in canola and soybean yields, which, if successfully deployed across North American acreage, could result in annual incremental crop value of up to $10 billion. By ultimately increasing the output of major food and feed crops and potentially reducing strains on scarce natural resources, we believe that Yield10's technologies will also contribute to addressing global food security.

Recognizing the highly concentrated nature of the seed business, the prevalence of cross-licensing of traits, and the need to stack multiple crop traits in elite seed germplasm to provide the best options for farmers for large acreage commodity crops, Yield10 does not expect to become an integrated seed company. The current major seed companies dominate the biotech crop space based largely on the early technology innovations that resulted in herbicide and pest resistance traits and have a very successful operating track record in the sector. Yield10 plans to develop yield traits that enable farmers to increase their revenue and secure a share of that added value. To do this Yield10 plans to license our trait innovations to the major agricultural companies so that they can be deployed in elite seed varieties. The incremental value sharing model is well established in the seed sector. Therefore, rather than replicating the downstream elements of these operations and developing our own regulatory, crop breeding or seed production capabilities, we intend to seek industry collaborations and partnerships to leverage these existing core competencies of the current seed industry. Yield10 will focus on its core competency, which is breakthrough science and technology innovation applied to the seed sector.

The type of collaborations and partnerships we seek will depend on the specific anticipated path to market for the crop. For large acreage biotech crops including canola, soybean and corn, we plan to develop proof points for our yield traits as a basis for licensing to major agricultural companies with a focus on capturing downstream value. By developing gene traits that enable the farmer to increase revenue. Yield10 believes that it can secure a share of that increased revenue in much the same way Uber generates revenue by enabling private car owners to operate in the taxi business. According to industry estimates, the timeline from discovery to full commercialization of a biotech trait in a commodity crop can be up to 13 years at a cost of up to $130 million. Our C3003 yield trait is an algal gene, and we believe that it will be regulated as a biotech trait. As we are in the construct optimization/event selection stage, we believe that we are approximately half way along the anticipated development timeline for C3003 in canola. Our strategy is to make it attractive for major agricultural companies to invest financial and technical resources to introduce our traits into their elite germplasm for event selection and evaluation. In 2017, we signed a non-exclusive research license with the Crop Science division of Bayer AG ("Bayer") (formerly Monsanto Company), to test C3003 and C3004 in soybean. In 2019, the license was expanded to cover a new discovery and intellectual property related to C3004. Similarly, in 2018 we signed a non-exclusive research license with Forage Genetics International LLC, a division of Land O'Lakes, Inc. ("Forage Genetics"), to test a series of traits in forage sorghum. We may sign additional non-exclusive research licenses on a crop by crop basis in the future, allowing the licensees to invest their resources in progressing the trait. Our focus is on securing a share of the upside value of our traits when we finalize the economic terms of license agreements at the point where the value of the trait is well understood.

For small acreage specialty oil crops, we believe we can leverage our Camelina platform, seed yield and oil content traits to add value to the development of specialty oils focused on human nutrition and aquaculture feed markets. These crops can cost more to produce because of the unique supply chain needed when identity preservation from seed planting to final product is desired. In this area, there may be opportunities for establishing partnerships and license agreements with consumer facing companies in the food and feed sector. Our high oil content traits developed through genome editing may have shorter timelines to commercialization (3-6 years) if deployed in specialty oil crops. We are at an early stage of developing our strategy in this area but believe it may have considerable potential for Yield10.

We believe that the production of PHA biomaterials in Camelina could provide economic returns for farmers to justify large acreage adoption and enable the low-cost production of this product for new markets including water treatment and plastics replacement. We believe crop based production will enable an advantageous cost structure thereby eliminating one of the remaining significant barriers to entry for broad adoption of these biomaterials. In water treatment the PHA biomaterial acts as a growth substrate and energy source for denitrifying bacteria which convert nitrate, a primary cause of water pollution and algal growth to nitrogen gas which returns to the air. This application is technically

straight-forward, requiring only the production and shipment of PHA biomaterials in pellet form. Yield10 is in the early stages of developing a revenue generating business model for this opportunity.

PHA biomaterials are also widely useful for functionally replacing petroleum-based plastics in a wide range of packaging applications. The plastics industry, which produces more than 350 million tons of material per year globally, is facing intensive scrutiny due to the failures in plastics recycling and increasing plastic waste in the environment. As natural biomaterials, PHAs fully degrade over time in the environment yet have excellent shelf life in use. We estimate that PHA biomaterials can be produced at very low cost in oilseeds based on our newly patented technology. When we made the transition to the Yield10 business we divested our fermentation-based PHA bioplastics assets and related application technology, based on the microbial fermentation platform but retained the patents and field of PHA production in engineered crops. Yield10 plans to produce resin-grade PHA biomaterial for supply to the plastics sector.

Yield10 plans to build on its core strengths bringing new technology approaches to exploit an innovation gap in the agricultural biotechnology space that exists due to reduced investment in basic research and development resulting from the ongoing consolidation and restructuring in the agricultural sector. Yield10's mission is to translate and optimize our step-change yield trait innovations in six major food and feed crops and demonstrate their economic value to farmers and seed companies. We intend to create high-value assets in the form of proprietary yield trait gene technologies and to de-risk these assets by progressing them along the path to commercial development with increasingly larger scale field tests and multi-site field trials in major crops. We are currently deploying our yield trait genes into canola, soybean, rice, wheat and corn, by designing and progressing genetically engineered events that we believe to be suitable for the applicable regulatory approval processes and which can be readily bred into the industry's elite crop lines by plant breeding. We expect the customers for Yield10's innovations to be the large and mid-size agricultural companies that would either license or acquire rights to Yield10's yield trait genes and incorporate them into their proprietary commercial crop lines for subsequent commercialization.

We are focused on identifying and developing technologies that will enable us to produce step-change improvements to crop yield.

Yield10 is targeting a critical unmet need in agriculture based on the anticipated disconnect between agricultural supply and the growing global population. Food production must be increased by over 70 percent in the next 35 years to feed the growing global population, which is expected to increase from 7 billion to more than 9.6 billion by 2050. Global climate change is also resulting in regional shifts to historical growing conditions. Given the projection for population growth, recent studies show a "yield gap" for major food and feed crops that cannot be addressed by incremental improvements to yield brought about by traditional plant breeding and existing biotech traits. Current biotech traits deployed in crops by the seed industry are based primarily on using microbial-sourced genes to impart yield protection through herbicide, pest, disease and even drought resistance, whereas Yield10 is focused on increasing fundamental crop yield through enhanced carbon capture and utilization.

Yield10 is focused on "building better plants" using the Trait Factory to optimize photosynthesis and carbon efficiency in crops to increase grain or biomass yield targeting step-change increases in the range of 10-20 percent in crop yield.

Our History

We have a significant track record and expertise in the metabolic engineering of microbes and have made significant progress translating this capability to plants.

As part of the legacy biopolymers and biobased chemicals business of our predecessor company Metabolix, our research team developed an advanced metabolic engineering capability to alter key biochemical pathways and redirect the flow of carbon metabolic intermediates in microbes resulting in the production of PHA, a natural biomaterial, at a level of more than 80 to 90 percent by weight of microbial cells that normally did not produce any PHA. In 1997, Metabolix initiated a crop science research program to produce PHA biomaterials in crops as a low cost production system. Historically, these efforts were focused on producing PHB, a microbial carbon storage biopolymer, in high concentration in the seeds of oilseed crops or in the leaves of biomass crops such as switchgrass. The PHB biomaterial is useful as a natural water treatment product and as a replacement for petroleum-based plastics.

As we made progress on producing PHB in plants, we learned that basic carbon supply from photosynthesis was a bottleneck. To address this carbon shortfall, in 2012 we began developing new metabolic engineering and bioinformatics approaches to enhancing basic crop photosynthetic carbon capture. Discoveries from these two approaches became the foundation of our GRAIN crop trait discovery platform. We also began building intellectual property on novel yield trait

gene technologies discovered in these programs and realized that our experience in re-engineering the flow of carbon in microorganisms could be applied to building better plants. Photosynthesis is the most important biological process responsible for global food production. Improving the photosynthetic capacity of plants is an essential first step to increase seed and/or biomass yield and, therefore, food production. We must develop plants which on a per acre basis during the growing season fix more carbon and ultimately target that additional fixed carbon to seed or biomass.

Our Approach

We have assembled a pipeline of crop yield traits for development that are applicable to major commercial crops.

Our unique approach to crop yield trait discovery utilizing our GRAIN platform, which integrates advanced metabolic engineering concepts to address critical bottlenecks in carbon metabolism, has enabled us to discover a series of yield genes with potential use for producing step-change improvements in crop yield. Through our research and early development efforts we have identified and begun characterizing our C3000 and C4000 series of traits. To initially characterize the potential yield trait genes, we test many of our yield trait candidates using our Camelina platform. As a yield trait innovator, our objective is to identify novel yield traits that act at a fundamental level in crop metabolism to provide the potential for broad deployment of our traits across multiple crop types. Following our early work with these trait genes, we focus on deploying the traits for evaluation across a range of crops including canola, soybean, corn, rice, wheat, each of which are crops of high commercial interest in North America. For crops where Yield10 is not directly conducting research and development activities, we are open to licensing arrangements like the agreement we have in place with Forage Genetics for evaluation of five of our traits in forage sorghum. Our goal is to generate greenhouse and field test data that will support commercial development of the trait and enable us to form collaborations or enter into license agreements with major agricultural companies in order to incorporate our novel yield traits into their seed products. We believe that successfully launching new, high yielding seed to the market would result in higher economic benefit to growers, seed companies, and Yield10.

We believe our business model will allow us to capture value for our yield trait discoveries and provide a path to commercialization for important new yield traits for major crops.

Yield10 is working to advance our own developments as well as form business alliances to progress our traits through development, launch and commercialization. Our goal is to capture an attractive share of the added economic value resulting from the deployment of our trait genes and technologies in key crops. We are currently working on the development and deployment of our trait genes into several crops, an approach facilitated by the expiration of much of the early foundation patents in the agricultural biotechnology sector, and one of our key objectives in that regard is to demonstrate commercial proof points through field tests and multi-site field trials. Yield10 opportunities and business models for value capture including partnering or licensing with established agricultural industry companies. Key to our strategy is to retain, where practical, control of timelines and maximize, where possible, the opportunity for value creation and optionality around future value realization strategies. In 2019, we are focused on identifying and signing additional research and development collaborations to accelerate commercial development of our promising yield traits.

We have signed non-exclusive research licenses for our novel yield traits with agriculture industry leaders.

In 2017 we granted a non-exclusive global research license to Bayer to evaluate our novel yield traits C3003 and C3004 in soybean. The license was expanded in 2019 to include a new discovery and intellectual property for C3004. Bayer is a leader in the development and commercialization of biotech-derived soybean seed. In 2018, we granted a research license with a similar structure to Forage Genetics, a leader in forage crops used for animal feed, to evaluate five traits in forage sorghum.

These licenses are intended to provide market leaders in their respective crops with an attractive opportunity to test our traits and develop data at their own expense. At any time during the term, they have the option to negotiate a broader agreement with us. At the same time, we have the right to sign licenses with other companies for these traits. This structure allows us the flexibility to expand the testing of our traits with investment by other companies and to potentially enter negotiations for development and commercial licenses when the value of our traits is better understood. In 2019, we plan to explore additional opportunities to expand the testing of our traits through similar arrangements with other companies.

We are focused on developing yield traits for use in canola, soybean and corn, major North American commercial crops.

Canola, soybean and corn represent the largest North American commercial crops with approximately 195 million combined acres. The majority of the crop acreage incorporates biotechnology traits for herbicide or pesticide resistance that are deployed in elite germplasm controlled by seed companies. Recent advances in crop yield have been based primarily on the use of biotechnology traits to protect yield by managing and/or allowing the plants to outcompete weeds. We are developing our traits to complement the biotechnology traits currently utilized in these major crops by focusing on our traits to increase the inherent seed yield of the plant. In 2018, we obtained promising field test results for second generation C3003 in canola and advanced work with the trait into the early commercial development phase where we will make and test additional elite events of the C3003 trait. Our development work with C3003 and other traits in the C3000 and C4000 series, some of which may be accessible using genome editing, is progressing in canola, soybean and corn. Canola is important as an edible oil for human consumption, while soybean and corn are grown in North America mainly as animal feed.

We are testing our yield traits in wheat and rice, important staple crops for human consumption.

Wheat and rice are important staple crops used primarily for human consumption. It is estimated that more than 900 million acres of rice and wheat are grown annually worldwide. Advances in seed yield for rice and wheat have occurred primarily through plant breeding for rice and hybridization and breeding for wheat. Genetically modified, or GM, traits based on biotechnology have not been broadly introduced into these crops. Seed sales to growers for these crops typically rely on regional, local organizations to distribute and sell seed and the market is extremely fragmented. To enable production of wheat and rice to meet future global demand, increases in yields will be required. The application of genome editing to precisely incorporate yield traits into these crops may represent a way to increase yield and establish consumer acceptance of the technology and seed product. We recently published promising results with members of our C4000 series of traits showing that deployment of these traits in switchgrass as a model crop resulted in significant increases in photosynthesis and biomass yield. We are testing C4000 series traits that may be accessible through genome editing as a strategy to produce increases in seed yield in wheat and rice. If we are successful identifying yield traits accessible through genome-editing that have potential to boost seed yield in rice and/or wheat, we are likely to seek partners for further development and commercialization in these food crops.

Our GRAIN platform provides us with a unique approach for discovering novel yield trait genes.

We have integrated advanced metabolic flux modeling capabilities with transcriptome network analysis to form the foundation of our GRAIN bioinformatics gene discovery platform. This discovery platform is the core of our Trait Factory. GRAIN takes both a bottom up approach based on the flow of electrons and carbon through essential metabolic processes and a top down approach based on transcriptome network analysis. In the case of crops, the levers to increase seed yield are the metabolic infrastructure through which carbon flows from photosynthesis to seed production and the gene regulators or transcription factors which control the various pathways. Over the last 20 years, the agricultural sector has generated vast numbers of data points. During this same period, there have been very few new crop traits produced. The purpose of GRAIN is to develop a system which can convert data sets into actionable gene targets to improve crop productivity. We have employed this approach to discover a range of potential yield trait genes.

We have identified promising potential yield targets which can be modified using genome editing. We believe that such targets may be subject to less regulatory complexity in the U.S. during development and along the path to commercialization and may provide opportunities for licensing.

Genome editing techniques, including CRISPR, which involve making small targeted changes to the DNA of a target organism, have been of interest to the agricultural biotechnology industry because this approach is believed to have the potential to significantly reduce development costs and regulatory timelines for crop trait development and market introduction. In 2018, we signed a non-exclusive research license for CRISPR/Cas-9 technology with the Broad Institute of MIT and Harvard and Pioneer, part of the Corteva Agriscience Agriculture Division of DowDuPont Inc.

Announcements from USDA-APHIS, including those made in 2018, indicate that the regulatory path for genome edited plants lines that do not contain any remaining foreign DNA (i.e. DNA sequences not from the plant being engineered) from the procedure used to edit the plant may not be subject to certain USDA-APHIS crop regulations in the U.S. See “Regulatory Requirements” section below. One of the potential implications of this regulatory approach in which edited plants are subject to fewer regulatory controls than traditional genetically modified plants may be to significantly decrease the timeline and cost of developing and bringing new traits to commercialization in the U.S. The challenge now

for the agricultural biotechnology sector will be to identify gene targets for genome editing that can generate economic value. This has opened the potential for Yield10 to exploit a second tier of novel traits addressable with genome editing.

Yield10 has identified, from its internal discovery platforms and in-licensed through academic collaborations, gene targets suitable for deployment in crops through genome editing. In the course of our work, we have introduced genes coding for new metabolic pathway enzymes or global transcription factors producing high yield lines with higher rates of photosynthetic carbon fixation. Analysis of these high yielding plants has allowed identification of novel genome editing targets.

We have deployed genome editing technology based on our C3008a trait in Camelina as well as our triple edited-line based on our C3008a, C3008b and C3009 traits in Camelina, which were deemed non-regulated by USDA-APHIS in 2017 and 2018, respectively. Plants that are not regulated by USDA-APHIS may still be subject to regulation by the FDA or the EPA depending on certain characteristics and the plant's intended uses. We expect to increase our level of effort in this area in other crops, particularly canola, over the course of 2019 and are implementing a plan to deploy our genome edited traits into soybean, rice and corn. We have successfully edited the C4004 gene in rice and are currently developing performance data on the edited rice lines. We believe our genome editing targets as well as the improved crops we could develop using this approach may enable us to form collaborations or enter into license arrangements with a broader set of potential commercial partners in order to bring these genome edited traits forward into development in the near-term.

We plan to use any revenues we generate from license agreements around our genome editing targets to support our ongoing research and development efforts to enable step-changes in crop yield.

We developed the Camelina Fast Field Test model system to characterize, evaluate and de-risk novel yield trait genes.

One of the challenges the agricultural industry has faced over the years is translating early crop science discovery into value generating traits. In part this is because results from greenhouse studies in model plants have not translated well into field results in major crops. This is also in part because the plants used for discovery research have not been suitable for studies in the field and are not representative of the advanced seed or crop varieties (germplasm) used in commercial production, which have been subject to decades of intensive breeding to improve yield. Translating success when introducing non-plant genes into major crops has been very successful and the current biotechnology seed sector, which accounted for 457 million acres of crops worldwide in 2016, is based on using microbial genes in plants. The long timelines to progress early discoveries successfully into major crops and generate field data adds to the challenge.

For these reasons, Yield10 has put in place a process we call "Fast Field Testing" based on our Camelina oilseed platform. We believe that over time this will become a valuable tool in the trait discovery to translation effort. Camelina is an industrial oilseed well-suited to field trials, and we believe it is a good model for identifying promising new yield traits for canola and soybean. It is also very fast to modify and develop genetically stable seed for field planting. Ideally, we hope to be able to progress from trait identification to field planting in about 12 months. Our process is to identify trait genes of interest in Camelina and immediately begin putting them into canola and soybean, where the timelines to transform plants and generate field data are much longer. We can then progress the Fast Field Testing in Camelina and generate field data and a complete molecular analysis of plant material from the field. These results and data can then be used to inform how we progress the previously transformed canola and soybean.

We believe that this will provide the opportunity for go-no-go decisions in some cases and in other cases allow us to update our approach based on the results of our Fast Field Testing in Camelina. For example, with the longer development timelines needed to get canola and soybean ready for field testing, we expect to initiate additional modifications earlier in these crops, having identified the potential to further improve the outcome based on the results of our Fast Field Testing in Camelina.

In our 2017 and 2018 field test programs, we tested both first and second generation versions of C3003 in Camelina and in canola, an important North American oilseed crop. Overall, our findings in canola for first generation and second generation C3003 mirror closely our observations of the effect of the trait in Camelina, underscoring the value of Camelina as a predictive system for understanding the performance of our novel yield traits in development.

We are using our Camelina Field Test model system to de-risk and accelerate the demonstration of the trait gene value in major crops. As a particular trait is de-risked there is the potential for inflection points in value. If we can establish a strong correlation between the results from the Camelina system with future field data first from canola and then with soybean, then we may be able to leverage this to enter partnership and licensing discussions earlier while preserving the opportunity to capture a meaningful share of the upside value.

Through our investment in the Camelina platform Yield10 established the foundation for potential niche crop product opportunities such as nutritional oils and PHA biomaterials.

Our Oilseed Operation based in Canada provides us with unique capabilities in the development of oilseed crops.

We established our oilseeds subsidiary in Canada in 2010 to produce robust oilseed germplasm with engineered value-added traits for commercial crop production in western North America. Our oilseeds team is based in Saskatoon, Saskatchewan, with laboratories in the National Research Council (NRC) - Saskatoon facility and commercial greenhouse and laboratory facilities at nearby Innovation Place. Our team has developed and implemented technology to improve and accelerate engineering and trait evaluation of Camelina and canola. The team also plays a key role in designing and conducting greenhouse and field tests required to effectively evaluate novel yield traits.

We are establishing a network of commercial and science advisors to provide us with insight and opportunities to advance our industry alliances, crop research and development, and key intellectual property.

Yield10 named Sherri Brown, Ph.D., a former Monsanto Company executive, as a special commercial and technical advisor to the Company in 2018. Dr. Brown, who is currently a Managing Director at The Yield Lab, served from 1999-2017 in leadership positions at Monsanto, most involving the development and commercialization of new traits for corn and oilseed crops including soybean and canola.

Yield10 has pursued academic collaborations that have led to the discovery of novel yield trait genes. Researcher Danny Schnell, Ph.D. discovered the C3003 trait in an ARPA-e (a division of the U.S. Department of Energy ("DOE")) funded collaborative project at the University of Massachusetts in which Yield10 was a partner. In 2015, Prof. Schnell moved to Michigan State University where he is Chairperson, Department of Plant Biology and remains a collaborator on C3003. Heike Sederoff, Ph.D., Professor, Department of Plant and Microbial Biology at North Carolina State University, developed the C3004 and C3005 traits with ARPA-e funding which Yield10 is now progressing under a license agreement. In 2018, Yield10 announced signing a global license agreement with the University of Missouri for advanced technology to boost oil content in oilseed crops, including C3007 and C3010, which are based on the discovery of a key regulatory mechanism controlling oil production in oilseed crops which can be used to increase oil content. Jay J. Thelen, Ph.D., Professor of Biochemistry at the University of Missouri, who discovered this mechanism, joined Dr. Schnell and Dr. Sederoff as a member of our Scientific Advisory Board in 2018.

We plan to seek U.S. and Canadian government grants to support our research and development goals.

Yield10 has been awarded grants over the last several years supporting research on strategies to improve the efficiency of photosynthesis, increase seed oil content, identify novel yield traits and test these novel traits in Camelina. This work is valuable because traits developed in Camelina have the potential to be developed and deployed in other oilseed crops. For example, in 2017, we were selected as a sub-awardee on a new DOE grant led by Michigan State University that commenced during the first quarter of 2018 to conduct research aimed at boosting oilseed yield in Camelina. We plan to continue to pursue government grants to defray research costs associated with our research and development activities.

We are operating with a lean organizational footprint which is evaluating our novel yield traits in greenhouse and field tests while maintaining efficient use of cash resources.

As of June 30, 2019, we had 25 full-time employees, with the majority directly involved with our research and development activities. We believe that our organizational capabilities are aligned with our research priorities and are complemented by our use of third-party infrastructure and certain service providers. With this approach we can leverage third-party infrastructure and capability without having to spend the time and capital needed to recreate them in-house. This is allowing us to focus our limited resources on deploying our core strengths against our key development goals. We expect to grow our research and development operations over time commensurate with building value in our business and advancing our traits through development while at the same time tightly managing overhead costs.

Our “GRAIN” Technology Platform

In the last decade there has been a dramatic expansion of new genetic engineering and systems biology tools: genomics data, metabolic engineering, high-throughput analytical tools, including whole organism gene expression analysis and metabolomics, and powerful genome editing technologies. At Yield10 we plan to build value by leveraging genome editing targets for revenue generation in the near-term while we independently work to demonstrate the economic value of our transformative genetic engineering-based yield breakthroughs in the longer term. The recent expiration of

blocking patents on early inventions in the plant genetic engineering space means that we can now be more effective in research and development, leverage third-party service providers and independently drive key proof points in major commercial crops such as canola, soybean and corn while focusing our resources on our core strengths. Yield10 is focused on increasing the inherent yield of major food and feed crops. Our goal is to “build better plants” which requires new approaches and innovation and, in our view, will most likely involve gene combinations and/or multi-gene systems.

At a fundamental level, increasing crop yield is a complex two-step carbon optimization problem. Harvested seed is mostly carbon fixed from carbon dioxide in the air by photosynthesis with oxygen coming from water in the soil and smaller amounts of nitrogen and phosphate both of which are applied as fertilizer. To achieve increased yield, the rate at which crops can fix carbon has to be increased. Based on our experience optimizing carbon flow in living systems, we know that increasing seed yield will likely require multiple trait genes to increase carbon fixation by photosynthesis at the front-end and direct the increased fixed carbon to the seed.

We have integrated advanced metabolic flux modeling capabilities with transcriptome network analysis to form the foundation of the GRAIN bioinformatics gene discovery platform. This discovery platform is the core of our Trait Factory. GRAIN takes a bottom up approach based on the flow of electrons and carbon through essential metabolic processes and a top down approach based on transcriptome network analysis. Plant growth at its core is a series of chemical reactions and these can be modeled to determine the best ways to optimize the yield of the targeted product. Advanced metabolic modeling based on flux-balance analysis and enzyme reaction thermodynamics and kinetics enables us to make predictions about which reaction modifications are most likely to achieve targeted performance improvements. However, as with all modeling approaches, the tool is only useful alongside the means and the data to test it in real plants. Here, Yield10 makes use of metabolic and transcriptome data generated from its high-photosynthesis, high-yield engineered plants as well as from academic publications and other public data to project optimal gene targets for modifications. By integrating the transcriptome network capabilities of our technology platform, we expect to be able to identify transcription factor genes whose activity profiles can be altered to optimize multiple steps in metabolic pathways or the flow of carbon in plant tissues of interest. In a crop like modern hybrid corn, which already produces vastly more seed than it needs to reproduce, our initial objective is to reduce or even eliminate the activity of the transcription factors that restrict further seed production.

We are excited about the prospects of C3003 in reducing the well-known yield losses that occur through photorespiration in C3 crops. C3 photosynthesis, the simplest type of plant photosynthetic system, exists in most agricultural crops used for human consumption, including canola, soybean, rice wheat and potato. We know C3003 has increased the rate of photosynthetic carbon fixation in our Camelina plants and we have been able to study these plants at the molecular level. Consistent with our initial hypothesis that downstream bottlenecks can be identified, we have found that in high yielding plants expressing C3003, the expression of other genes, including our C3004 trait gene is changed. We have carried out experiments to increase the activity of the C3004 trait gene in Camelina and have shown in growth chamber studies that this results in increased plant vigor, branching and up to a 65% increase in seed yield. We believe the C3004 gene, which may be engineered into crops using genome editing, has the potential to be used alone or be combined with the C3003 trait gene to further increase yield beyond what can be achieved with C3003 alone. We have work ongoing to evaluate the Camelina C3004 gene in canola, soybean and corn.

In crops having the evolutionarily advanced, more efficient C4 photosynthetic system, including corn, sugarcane and sorghum, the yield is already several-fold higher than in C3 crops. In this case, the hurdle to accomplish step-change increases in seed yield is higher as these crops are already more metabolically efficient. We validated our approach by verifying with experimental results the positive yield impact of three gene targets we identified computationally, which we believe to be an exceptional hit rate. These three yield genes, C4001, C4002 and C4003, significantly increased photosynthetic carbon capture and biomass production in switchgrass, an already high biomass yielding C4 crop. In this case our early experiments have been successful in demonstrating the potential to increase the rate of carbon fixation even in a high yielding C4 crop.

Plant scientists now have powerful genome editing tools, such as the CRISPR/Cas9 system, that enable single and multi-gene changes to be made in major crops; the challenge is knowing what combinations of genes to edit. We believe Yield10 is in a unique position to expand our learning and discover additional gene targets, or genes that need to be modulated, to optimize the flow of carbon to seed in these plants, and we have made considerable progress on this front.

Molecular analysis of high yielding plants expressing the global transcription factors has allowed the identification of 71 downstream transcription factors that are differentially expressed in the high yielding lines and are themselves targets for genetic manipulation. The expression of some of these genes is down regulated in the high yielding plants making them potentially promising targets for genome editing through well-known approaches such as CRISPR.

We began by validating the predictive impact of three of these trait gene targets in switchgrass and confirmed their function and recently completed the genome editing of the first of these, C4004 in rice. We know the industry has struggled to deploy transcription factors using traditional biotech approaches to improve crops particularly in hybrid corn. However, we are optimistic that we will be more successful introducing our global regulator genes using genome editing and believe that simple gene deletions to eliminate their function, will be significantly easier to implement and translate across crop varieties.

We are building significant capabilities and intellectual property around key oil biosynthesis pathways in plants based on technologies for increasing oil content in plants. In this area, we have focused on Acetyl-CoA Carboxylase (ACCase) as a key metabolic control point for oil production in plants and have assembled a portfolio of gene targets accessible through genome editing. ACCase gives rise to metabolic pre-cursors common to PHA biomaterials and edible oils, as well as cannabinoid oils found in industrial hemp and other plants. Given the central role of ACCase, we have been establishing a strong intellectual property position around controlling the flow of carbon at this key branch point and are advancing a number of gene targets including C3007, C3010 and C3012.

We believe our integrated GRAIN platform can be used to successfully identify new targets for improving crop yield and are working to leverage the platform in the near-term to secure research and development funding from industry partners.

Fast Field Testing System in Camelina

One of the challenges the agricultural industry has faced over the years is translating early crop science discoveries into value generating traits. This is in part because most of the plants used for discovery research have not been suitable for studies in the field. In addition, the plant systems used for discovery are not representative of the advanced seed or germplasm used in commercial production which have been subject to decades of intensive breeding to improve yield. The long timelines to progress early discoveries successfully into major crops and generate field data adds to the challenge.

In 2010, we established a research and development operation in Saskatoon, Canada staffed with leading oilseed researchers. Our team established a model for testing novel trait genes called the “Fast Field Testing” system based on our Camelina oilseed platform. We believe that this system has become a valuable tool for our yield trait discovery and translation effort. Camelina is an industrial oilseed with reasonable field performance providing a robust model for canola and soybean and it is well suited to multi-site field tests and larger scale trials. Camelina is a plant that can be readily genetically modified and bred through the efforts of our skilled staff to deliver genetically stable seed sufficient for planting in field tests. We have shown that we can go from the identification of a potential yield trait gene or combinations of genes to field planting in about 12 months. In our Fast Field Tests, we typically collect and analyze a broad set of data on our transgenic or genome edited plants including parameters such as stand establishment, flowering, maturity, seed weight, seed size, oil content and oil composition. We also perform molecular analysis on plants of interest. We are using our Camelina Fast Field Test system to identify and screen trait genes of interest while deploying them in parallel into crops of commercial interest including canola, soybean, rice, corn and wheat where the timelines to obtain stable plant lines and field data are longer.

Traits in Development

Yield10 Bioscience has ownership or licensed rights to several crop trait genes and our lead yield trait gene C3003 is currently well-positioned in terms of translation and demonstration in key crops. Yield10 has exclusive rights through ownership or licensing of patent applications, or is preparing patent applications, covering the trait genes listed in the accompanying table.

We identified the C3000 series of novel yield traits based on establishing new metabolic pathways in crops. We have tested our lead yield trait gene C3003 in Camelina in both greenhouse and field tests and have previously reported results from these studies. We are moving this promising trait forward in additional crops including canola, soybean, corn, sorghum and rice. Our other C3000 series traits may be accessible through genome editing and are being tested in various target crops as well.

We have also identified the C4000 series of novel yield traits and gene editing targets addressing increases in seed yield and biomass. We have shown that our C4000 series traits, which comprise global regulatory genes discovered through our GRAIN technology platform, may have the potential to significantly enhance photosynthesis and carbon capture in key crops. We are moving members of the C4000 series of traits forward in several crops including wheat, rice,

corn and forage sorghum using mainly third party resources and capabilities while retaining control of intellectual property.

Novel Yield Trait Gene C3003

C3003 represents the lead novel yield trait gene in our trait pipeline. C3003 is a scientific discovery made in one of our academic collaborations funded by ARPA-e, a division of the DOE. Our academic collaborator is continuing work to characterize C3003 and some of this work is funded by a DOE grant under which Yield10 is a sub-awardee conducting research supported by the grant.

C3003 appears to be a unique gene that impacts photorespiration, a biochemical pathway in C3 plants that is responsible for significant losses in yield. Yield10 is progressing the introduction of the C3003 trait gene as well as improvements to the C3003 trait in Camelina, canola, soybean, corn and rice. In 2019, we are conducting additional greenhouse and field test activities to continue generating yield and agronomic data on C3003 in a variety of important crops.

Camelina

We have extensively utilized our Camelina Fast Field Testing Platform to evaluate the mechanism and effect of C3003 in crops. Over the past three growing seasons, 2016-2018, we have produced field-grown seed and field tested numerous stable Camelina seed lines containing first generation C3003, second generation C3003 and certain prototypes of traits related to C3003. Through this work, we have collected important molecular, agronomic and seed yield data that has enabled us to characterize these traits as well as understand important differences in the effects they produce in field-grown plants.

Our greenhouse and field work with C3003 in Camelina have allowed us to capture data on the performance of the trait. The results from our field tests show that first generation C3003 produces significant improvements in seed yield although the individual seed weight in these lines is decreased as compared to controls, likely due to a change in carbon partitioning in the plant. Field test results for second generation C3003 (seed specific expression of the trait), show improvements in seed yield, harvest index and overall agronomic performance, while also maintaining typical seed size as compared to control plants. There were no significant changes to oil content or oil composition with either version of the trait as compared to control plants. In our 2019 field tests, we saw some indications of drought resistance with C3003, an observation we plan to follow up on in subsequent field tests of this trait.

Underscoring the value of our Camelina Platform in the evaluation of C3003, our observations around the increases in seed yield along with differences in seed weight have been observed in some of our recent studies with canola and soybean lines. Based on encouraging data obtained in Camelina with first and second generation C3003, we are continuing to progress the evaluation of the C3003 yield trait gene in parallel in various commercial crops including canola, soybean, corn and rice, where we believe step-change increases in seed yield could improve the prospects for global food security and create considerable economic value.

Canola

Canola is an important North American oilseed crop harvested for its oil. We are targeting step-changes of 10-20% in the evaluation and development of novel traits to increase seed yield in canola. In our field tests of canola in 2018, we achieved seed yield improvements in some events at the low end of this range (11%), and based on these results, we will progress C3003 into the preliminary commercial development phase in canola in 2019. The key activities to be completed during this phase include development of commercial quality events in elite canola germplasm, execution of multi-site, multi-year field studies and development of regulatory data as appropriate.

In 2019, we are conducting additional field tests in Canada with second generation C3003 in canola. Harvest of the test fields is expected in third quarter 2019, which will enable the collection and evaluation of agronomic, seed yield, oil content and other data from the studies.

We evaluated our second generation C3003 yield trait in canola for the first time in canola in 2018. In these field tests, we monitored key agronomic and growth parameters of the plants throughout the field test and collected yield data including total weight of harvested seed, individual seed weight and oil content in our transformed plants as compared to control plants. The best second generation C3003 canola lines showed an increase in seed yield of 11 percent as compared to control plants, a statistically significant outcome. In second generation C3003 canola plants, the weight of an individual seed (measured using 1,000 seeds) was similar to control plants, an expected outcome using the second generation version of the C3003 trait.

The results we obtained in canola were similar to results obtained in prior studies with Camelina, illustrating that our Fast Field Testing system in Camelina is a valuable tool for effectively screening novel yield trait genes and dynamically adapting our approach to trait development as we work to translate these improvements into commercially important crops.

Soybean

Yield10 has limited capabilities related to engineering soybean. However, because soybean is the leading North American oilseed crop, we initiated deployment of both first and second generation C3003 into soybean in 2016 through an academic collaborator. We recognize that the scale of this program is limited and that it will serve mainly to generate research data. Yield10 is currently exploring additional third-party options for conducting soybean transformations to increase the scope of our internal program. In 2017 we generated early greenhouse data and in 2018 we grew C3003 soybean plants at sites in Canada to produce field-grown seed. We expect that additional development work including the generation of more C3003 lines will continue in soybean with our academic collaborator in 2019.

Preliminary observations based on a small number of events from our greenhouse studies suggest that results for C3003 obtained in Camelina and canola are translating into soybean. First generation C3003 produced seeds with lower individual seed weight while typical individual seed weight was observed with second generation C3003 in soybean. Further, our greenhouse results show that there is an increase in branching in the plants for some of the events tested. This is significant because more branching provides more sites on the soybean plant for seed pods to develop which can be associated with obtaining higher yielding plants.

In December 2017, we granted a non-exclusive research license to Bayer to evaluate our novel C3003 and C3004 yield traits in soybean. Under the license, Bayer is working with C3003 in its soybean program as a strategy to improve seed yield. We anticipate that Monsanto will generate field test data with C3003 pursuant to the research license. The Bayer license was expanded to include a new discovery relating to C3004 that will enable them to begin work deploying and testing the trait in their soybean program.

Corn

Corn is the highest value commercial row crop grown in the United States. We initiated an early development program in corn in late 2018 with the objective of evaluating novel seed yield and drought tolerance traits in this crop. Under this program, novel traits discovered by Yield10 are being deployed in corn by a third-party agriculture company with proven expertise introducing new traits into corn. The yield traits included in the corn development program are C3003, C3004, and C3011, as well as the transcription factors C4001, C4002, and C4003. This aspect of the development activity is expected to be completed in early 2020. We plan to engage an additional third party to conduct field testing of the novel traits in corn to evaluate the impact on seed yield.

Novel Yield Trait Gene C3004

The plant gene C3004 is over-expressed in Camelina plants engineered to express C3003. While the role of C3004 is currently not well understood and we continue to investigate the role of the gene in plant metabolism, we believe that it may have an effect on carbon partitioning in plants. We also believe that, under certain conditions, this effect may potentially be additive with the activity of C3003. Our ongoing research will continue to investigate the activity of C3004 alone and in combination with C3003 to produce increases in seed yield in crops.

We began our investigation of C3004 in Camelina. We constructed C3004 to increase expression of the gene in Camelina. Stable plant lines were developed and we performed yield studies in a controlled environment growth chamber. In these studies, increased expression of C3004 in Camelina results in a significant increase in plant growth and vigor, increased seed yield, and in some cases increased individual seed weight. In these limited studies, six Camelina plant lines containing C3004, average seed yield (grams/plant) increased by 26 to 65 percent over control plants. We also measured tertiary branching in a subset of plants and found that the increase in seed yield seen in the plants was also accompanied by an increase in tertiary branching. While early stage and based on a small sample of events, the data suggest that C3004 may hold significant promise as a novel yield trait.

In 2019 we are conducting greenhouse and field tests in Camelina to continue to generate additional seed yield and agronomic data on C3004. We also plan to test C3004 in combination with C3003 in Camelina to investigate whether the traits could be additive or synergistic. We have also fast-tracked the deployment of C3004 into canola and corn where we will engineer lines and begin testing to determine if this trait produces improvements in seed yield in other crops. The version of the C3004 trait we tested in our Camelina studies was genetically engineered using recombinant DNA;

however, we believe that it may be possible to develop versions of the trait that are genome edited, potentially enabling a path to non-regulated status for C3004 plants under current USDA-APHIS rules.

Oil Enhancing Traits

With increasing focus on health and wellness, food safety and sustainability in developed countries, we anticipate a rise in demand for new varieties of food and food ingredients with improved nutritional properties. This concept is currently being implemented in agricultural biotechnology, in both canola and soybean that have been modified to alter the composition of the oil produced. High oleic canola and soybean oils are being marketed as "healthier" than other oils; we believe the ability to make similar marketing claims directly to the consumer will be a feature of newly developed products in this space. We expect consumer demand for identity preserved specialty ingredients will rise, and we believe that Yield10's crop yield technologies and crop gene editing targets could be useful in this emerging field.

Based on our study of metabolic pathways in oilseed crops, we believe there is an opportunity to apply genome editing to significantly increase oil content in oilseed crops including canola, soybean, sunflower and safflower. In cases where the edible oil is the primary economic value driver for the crop or in cases such as high oleic soybean where the crop has been modified to improve the fatty acid profile, increasing oil content is a valuable trait. This potential also extends to Camelina where recent clinical studies have shown that Camelina sativa oil, but not fatty fish or lean fish, improved serum lipid profile in subjects with impaired glucose metabolism. This randomized, controlled study was recently published in the journal Molecular Nutrition and Food Research, U. Schwab, et. al. (2018). Improving the oil content and yield of Camelina seed could make this an attractive crop for producing nutritional oils. In 2017 and 2018, we received confirmation from USDA-APHIS's Biotechnology Regulatory Services (BRS) that two types of our genome-edited Camelina plant lines developed using CRISPR/Cas-9 genome editing technology for increased oil content were not considered to be regulated under 7 CFR part 340, clearing the way for field testing in the U.S. The first type is based on the inactivation of an enzyme expected to increase seed oil content in Camelina, a trait we have designated as C3008a. The other type is based on the inactivation of three enzymes to enhance the production of oil and is designated as our triple edit, or C3008a, C3008b and C3009 trait containing line. We are currently evaluating combinations of the genome editing targets to optimize oil content in Camelina and canola, and plan to do so in soybean with the objective of obtaining plant lines that are not considered to be regulated by USDA-APHIS under the current regulatory framework of 7 CFR part 340.

In 2018 we signed an exclusive global license agreement with the University of Missouri for advanced oilseed technology including C3007 and C3010, which are promising targets involved in oil biosynthesis. We are working to deploy C3007 in oilseed crops with the objective of increasing oil content through methods that could result in a plant line that is not regulated by USDA-APHIS under 7 CFR part 340. We have produced a genome edited version of C3007 in canola and further development and evaluation of the trait is underway. In 2019 we signed an additional exclusive global license with University of Missouri for additional oilseed technology we named C3012.

C4000 Series Traits

We have used our GRAIN platform to study global transcription factors and identify novel yield traits in the C4000 series. These traits may be powerful regulators of plant growth and represent a potentially valuable resource for identifying genome editing traits for crops. We have recently shown that traits from the C4000 series can significantly increase photosynthetic efficiency as well as aboveground and below ground biomass production in our switchgrass plants.

In 2018 in the journal *Plant Science*, we reported that our novel C4001 and C4003 traits have been shown to significantly increase plant biomass yield in switchgrass. Switchgrass plants expressing C4001 resulted in a total increase in biomass of 75-100 percent in leaves and stems as compared to controls. Expression of C4003 in switchgrass resulted in a total increase in biomass of 100-160 percent in leaves and stems as compared to control plants. Increasing biomass yield is important for forage crops such as sorghum, silage corn, and alfalfa.

We are testing certain of our C4000 series of traits to increase seed yield in wheat, rice, and corn, as well as to increase biomass in forage sorghum. Using internal resources, we have been able to progress the C4001 trait gene in rice. In a collaboration with the National Research Council of Canada we have introduced the C4001 and C4003 traits into wheat and expect to generate performance data from wheat lines in the coming year. With rice and wheat, we do not plan to evaluate traditional biotechnology traits in the field or develop them as products but to use them as a source of new genome editing trait leads. We have completed the editing of the first of the C4004 trait in rice and are currently growing these plants in the greenhouse. Forage Genetics began work with certain of our C4000 series traits through a research license signed in 2018 to assess the potential of our traits to increase biomass in forage sorghum. We also began early development work in late 2018 to assess certain C3000 and C4000 series traits in corn through a third-party agricultural company. We expect the first phase of this work to be completed by early 2020.

We expect evaluation of C4000 series traits in these target crops will continue to advance in 2019. Traits in this series and the proof points we expect to generate may provide us with an opportunity to selectively partner with others for the development of these traits in major commercial food, feed, and forage crops.

PHA Trait

While maintaining our focus on the development of novel yield traits for key crops based on a licensing model, as part of our business development activities we have been working to develop independent business opportunities for Yield10 in the specialty oils and niche crop product space. The target of this effort is sustainable business solutions to support global food production and other specialty applications. Yield10 is a pioneer in the development of technology for producing PHA/PHB biomaterials in crops. Seed-based PHA/PHB production provides an opportunity to sustainably produce these natural biodegradable materials at low cost, disrupting the cost advantage of the petroleum plastics they can functionally replace. Based on our engineering projections, we believe the costs achievable in Camelina will also enable broad use of this material for water treatment applications where it acts as a maintenance-free growth substrate for bacteria that convert nitrate to nitrogen gas thereby reducing pollution and algal growth. Scientific data has clearly shown that fertilizer (NPK) is essential for global food security, however its use is also a major source of nutrient pollution in our waterways. We need to develop sustainable economically attractive ways to reduce fertilizer run-off and simple cost-effective ways to remove it from water where it comes from multiple sources including natural processes and septic systems. This market application has been known since the 1980’s but has been constrained by the high costs of fermentation-based production technologies. We believe the potential exists to use our Camelina platform as a sustainable low-cost source of PHA biomaterials to improve the overall sustainability of food production and to reduce nutrient pollution of our waterways.

A recent patent application was filed by Yield10 describing a discovery around maintaining the viability and vigor of Camelina seed containing high levels of PHA polymer. This is an important step toward the development and commercialization of a seed-based production platform for PHB using Camelina. Yield10 is in the early stages of developing a commercial business model focused on PHA produced in Camelina for water treatment applications.

We believe by developing the PHA Camelina platform as a cash cover crop we can create new sources of revenue for farmers, independent of export markets, reduce run-off from fertilizers and produce a natural biodegradable product that can be used to mitigate the impact of fertilizer run-off when it occurs as well as reduce nitrate pollution from aquaculture and septic systems. By focusing on North America we believe we can avoid the high costs and time delays associated with global deregulation of a biotech crop and potentially benefit from the ongoing modernization of the USDA-APHIS regulatory process.

PHA biomaterials are widely useful for functionally replacing petroleum-based plastics in a wide range of packaging applications. The plastics industry, which produces more than 350 million tons of material per year globally, is facing intensive scrutiny due to the failures in plastics recycling and increasing plastic waste in the environment. As natural biomaterials, PHAs fully degrade over time in the environment yet have excellent shelf life in use. We estimate that PHA biomaterials can be produced at very low cost in oilseeds based on our newly patented technology. When we made the transition to the Yield10 business we divested our PHA bioplastics (biomaterials) assets based on the microbial fermentation platform but retained the patents and field of PHA production in engineered crops. Our current approach to this market is to execute agreements with petroleum, chemical or plastics companies to commercialize this opportunity. These companies are also potential sources of funding to support the development of the PHA Camelina crop.

Target Crops

Our research and early development work in our C3000 and C4000 series traits suggests that our technology may be applicable to a wide range of crops harvested for food and animal feed uses. We believe that if novel yield traits could be successfully developed and commercialized in any of these crops, farmers would be able to improve the productivity of their land to meet rising demand for food and feed, thereby creating significant economic value.

In considering our strategy to develop our technologies we segregate our trait genes into two classes: trait genes based on using non-plant genes to add new functionality to crops which are by definition GM due to the insertion of foreign recombinant DNA; and trait genes that we may be able to deploy in lines that are not considered regulated by USDA-APHIS, which encompass our trait genes that are based exclusively on plant genes. We see the opportunity to deploy our trait technology in a broader set of food and feed crops many of which are not currently GM. We plan to pursue our GM trait genes in crops which are currently GM and where the economics can sustain the cost and timelines for deregulation. We are aware of the current USDA-APHIS GM crop regulation review and the reality that GM likely will remain an issue for some NGO groups regardless of the science. For our GM yield trait genes, we are targeting seed yield increases on the order of 10 to 20 percent over the current elite seed lines, increases which reflect the order of magnitude step-changes necessary to address global food security.

The crops we are targeting for development are described below.

Camelina or *Camelina sativa* is an oilseed crop in limited cultivation in North America and Europe. Camelina has received recent attention as an industrial oilseed for the production of biofuels, novel industrial lipids, and oleochemicals. In addition, its meal has been identified for development as an animal feed supplement and its oil as a fish feed supplement. Recent clinical studies have shown that Camelina sativa oil, but not fatty fish or lean fish improved serum lipid profile in subjects with impaired glucose metabolism-a randomized controlled study published in the journal *Molecular Nutrition and Food Research*, U. Schwab, et. al. (2018). Improving the oil content and yield of Camelina seed could make this an attractive crop for producing nutritional oils. While it is not currently a commercially significant crop, research suggests that efforts to improve seed yield, oil content and fatty acid composition, and tolerance to heat stress may expand the commercial adoption and cultivation of Camelina. We believe that the production of PHA biomaterials in Camelina could provide economic returns for farmers to justify large acreage adoption and enable the low-cost production of this product for new markets including water treatment and plastics replacement applications. We believe crop-based production will enable an advantageous cost structure thereby eliminating one of the significant remaining barriers to entry for broad adoption of these materials.

Canola or *Brassica napus* is a cultivar of rapeseed which produces a higher value edible oil favored by consumers because it has a healthier fatty acid profile than corn or soybean oil. The canola crop was developed in Canada where it is primarily grown today with additional acreage grown in the U.S. Currently the vast majority of the canola grown in North America contains two seed enhancement technologies, herbicide tolerance and hybrid seed. Both Roundup Ready (Monsanto, now Bayer) and Liberty-Link (Bayer) varieties of canola are grown and were introduced to the market in 1990s. Approximately 24.7 million acres were planted in Canada and the U.S. in the 2018 growing season. The Canola Council of Canada has set yield goals of 52 bushels/acre for 26 million metric tons of production to meet global market demand for canola by 2025. Yield10 is targeting a 10-20 percent or greater increase in canola seed yield. With a 2017 harvest of 939 million bushels of canola (Statistics Canada) and assuming an average farm gate price of $10.00 per bushel, a 20 percent yield increase in canola represents a total potential added annual value of $1.9 billion that could be shared among the companies in the canola value chain.

Soybean or *Glycine max* is an oilseed crop used for food, food ingredients, food additives and animal feed. The soybean can be harvested for oil used in food and industrial applications, and soybean meal is a significant source of protein for use mostly in animal feed but also for direct human consumption. Fermented soy foods include soy sauce and tempeh, and non-fermented food uses include soy milk and tofu. Soybeans are widely cultivated in North and South America, where a majority of the seed planted is genetically modified. An estimated 94.4 million acres of soybean will be planted in the U.S. and Canada in the 2018/2019 growing season. According to the USDA, the U.S., Brazil and Argentina together represent approximately 80 percent of global soybean production. Yield10 is targeting a 20 percent or greater increase in soybean seed yield. Assuming a 2018/2019 U.S. harvest of 4.5 billion bushels (USDA) and an average farm gate price of $10.00 per bushel, a 20 percent yield increase in soybean represents a total potential added annual value of $8.8 billion that could be shared among the companies in the soybean value chain.

Corn is a crop grown globally and used for animal feed and for producing starch which can be used as a raw material for producing food ingredients and food additives, as well as for use in the production of paper, packaging materials and other items. GM maize was grown for the first time in the U.S. and Canada in 1997. Currently, about 80

percent of maize/corn production in the U.S. is genetically modified. It was estimated that more than 83 million acres of corn were planted in North America in the 2018 growing season. The traits commonly used in today's corn cultivars provide insect resistance and herbicide tolerance. In many GM seeds sold today, these traits are stacked ("stacked" refers to the practice of adding multiple traits to an elite plant line). Europe has limited production of GM corn, where Spain is a leading producer. In this case, the most widely used GM trait (Bt) protects against the corn borer insect. Special protocols must be followed in Europe to avoid mixing of GM corn with conventional corn. Corn has the more efficient C4 photosynthesis system and Yield10 is targeting a 10 percent yield increase in corn. With a projected 2018/2019 U.S. harvest of 14.4 billion bushels and an average per bushel price of $3.50, a 10 percent yield increase in corn represents a total potential added annual value of $5.1 billion that could be shared among the companies in the corn value chain.

Rice is the staple food for over 50 percent of the global population. World crop production of rice for 2018/2019 is estimated at approximately 495 million metric tons. Rice is grown in tropical and subtropical regions around the world. Rice cultivation takes place primarily in China, India and Southeast Asia. Typically, improvements to rice yield have been achieved through traditional plant breeding approaches. Genetic engineering approaches are being investigated to develop rice hybrids and to protect rice from weeds and insect pests. Additional biotechnology approaches are being taken to improve the nutritional value of rice. While Yield10 has not established a target for yield improvement in rice, early work is underway to evaluate the potential of our technologies in this globally important food crop.

Wheat is a species of grass cultivated broadly worldwide as a staple cereal crop. Wheat requires processing to be used as food, mainly in the form of flour for bread, baked goods and pasta. Wheat may also be used as an industrial starch, as a food additive or as a production component in the textile and paper industries. Improvements to wheat yield have typically been achieved through plant breeding approaches. Wheat production ranks third among U.S. field crops in planted acreage, production and gross farm receipts behind corn and soybeans. The planted area for wheat (winter and spring varieties) in the U.S. and Canada combined for 2018 was estimated at 72 million acres.

Forage crops are grown expressly for biomass used for feeding livestock. Typical forage crops include both annual and perennial crops such as various grasses, silage corn, alfalfa and sorghum. Biotechnology traits have been previously introduced into silage corn and alfalfa. Other forage crops could be amenable to gene editing strategies to increase biomass yield per acre. We believe that our technology and traits that increase biomass may have application to forage crops.

Regulatory Requirements

Since the first successful commercialization of a biotechnology-derived agricultural crop in the 1990s, many new crop varieties have been developed and made available to farmers in the U.S. and worldwide. U.S. farmers have rapidly adopted many of these new biotechnology-derived varieties, so that in 2016, 92 percent of the corn, 93 percent of the cotton and 94 percent of the soybeans planted in the U.S. were varieties produced through traditional forms of genetic engineering. A significant percentage of the production of other crops planted and harvested in the U.S., such as alfalfa, papaya and sugar beet, are also biotechnology-derived.

Biotechnology-derived or genetically engineered crops are subject to a significant amount of regulation in the U.S. and around the world. Field tests and field trials of such crops need to ensure that traits in development do not escape or mix with native plants, and crops that may be used as human food or animal feed must meet certain safety standards, but government regulations, regulatory systems and the politics that influence them vary significantly among jurisdictions.

For purposes of this discussion, the term "GE" includes both biotechnology-derived or genetically engineered plants that are modified by the insertion of recombinant DNA ("Traditional Genome Modification") and biotechnology-derived or genetically engineered plants that are modified through the application of more modern techniques of genome editing. We have seed traits that fall within each of these two generalized categories of GE plants, as summarized above under the subheading "*Traits in Development*."

United States Regulation

The U.S. Government agencies primarily responsible for overseeing the products of modern agricultural biotechnology are the U.S. Department of Agriculture (USDA), the U.S. Food and Drug Administration (FDA) and the U.S. Environmental Protection Agency (EPA). Depending on its characteristics, a product may be subject to the jurisdiction of one or more of these agencies under the federal government's 1986 Coordinated Framework for the Regulation of Biotechnology, as updated. Regulatory officials from the three agencies regularly communicate and exchange information to ensure that any safety or regulatory issues that may arise are appropriately resolved within the scope of authority afforded to each agency under their respective statutes. Other environmental laws or regulations also

may be implicated, depending on the specific product and its potential applications or intended uses. EPA's principal oversight role is for biotechnology-derived products that are intended for use as pesticides or herbicides, under the authorities granted to the agency under the Federal Insecticide, Fungicide, and Rodenticide Act and the Toxic Substances Control Act. Our business strategy for major grain crops is to develop yield and performance traits for licensing to the major seed companies. We have no current plans for the development of pesticide or herbicide GE traits that would be subject to the procedures and requirements of the EPA under these statutes.

Our seed traits and any future products that are successfully developed containing our seed traits, however, are or will be subject to USDA and FDA regulatory requirements. Those requirements will vary depending on the particular seed trait and the type and intended use of any product that will be commercialized. Future products which we plan to produce and sell for example for use in water treatment may potentially have EPA regulatory requirements and the regulations relating to manufacturing and consumer protection will need to be addressed.

First, within USDA, the Animal and Plant Health Inspection Service (APHIS) is responsible for protecting agricultural plants from pests, diseases and noxious weeds. Under the Plant Protection Act ("PPA"), USDA-APHIS has regulatory oversight over products of modern biotechnology that could pose such a risk to domestic agriculture and native plants. Accordingly, USDA-APHIS regulates organisms and products that are known or are suspected to be plant pests or to pose a plant pest risk, including those that have been altered or produced through various genetic engineering techniques. These GE plants are called "regulated articles" in the relevant USDA-APHIS regulations, which are codified at 7 CFR part 340 ("Part 340"). The PPA and the implementing regulations in 7 CFR part 340 empower USDA-APHIS to regulate the import, handling, interstate movement and release into the environment of regulated articles, including certain GE organisms undergoing confined experimental use or field trials. Regulated articles are reviewed to ensure that, under the proposed conditions of use, they do not present a plant pest risk by ensuring appropriate handling, confinement and disposal.

Seed traits developed using Traditional Genome Modification, such as our C3003 yield trait that leverages the biological functions of an algal gene, are regulated under 7 CFR part 340. Regulated articles are subject to extensive USDA-APHIS oversight, including but not limited to permitting requirements for import, handling, interstate movement and release into the environment.

If, however, USDA-APHIS determines that a GE plant is unlikely to present a greater plant pest risk than its unmodified counterpart, the newly developed crop will no longer be subject to the permitting and other regulatory processes that are overseen by the agency (*i.e.*, it will no longer be treated as a potential plant pest). Such a determination by the USDA-APHIS is called not regulated under the 7 CFR part 340 regulatory framework. The regulations establish detailed procedures for how a developer of a new GE plant may petition USDA-APHIS to determine if modified plant lines are not regulated under the 7 CFR part 340 framework, which is an official agency finding that the particular article is unlikely to pose a plant pest risk and therefore no longer needs to be regulated under 7 CFR part 340 and the PPA.

USDA-APHIS conducts a comprehensive science-based review of the petition to assess, among other things, plant pest risk, environmental considerations pursuant to the National Environmental Policy Act, and any potential impacts on endangered species. The duration of the petition process varies based on a number of factors, including the agency's familiarity with similar GE products, the type and scope of the environmental review conducted, and the number and types of public comments received. If, upon the completion of the review, USDA-APHIS approves the petition and the product is no longer deemed a "regulated article," the developer may commercialize the product, subject to any conditions set forth in the USDA-APHIS written decision issued in response to the petition for determination of non-regulated status.

As previously described, our seed traits developed using Traditional Genome Modification are regulated under 7 CFR part 340 and are subject to USDA-APHIS permitting requirements. In recent years, however, we and others have submitted various petitions to USDA-APHIS to determine whether particular GE plants developed through the use of different genome editing techniques meet the not regulated status under the 7 CFR part 340 framework administered by the agency. In general, lines developed using genome editing approaches have been deemed not to be regulated by USDA-APHIS under 7 CFR part 340. The USDA also announced in March 2018 that it would not require an assessment on products that used modern forms of mutagenesis if it was clear these outcomes could occur in nature. The USDA stated at that time that it did not "have any plans to regulate plants that could otherwise have been developed through traditional breeding techniques as long as they are developed without the use of a plant pest as the donor or vector and they are not themselves plant pests." This USDA policy statement applies to genetic deletions of any size, which would include genome editing through CRISPR-Cas9 and other emerging technologies, although it remains to be seen how this policy announcement will be implemented by USDA-APHIS and what practical effect that may have on seed trait developers like us and our competitors.

Historically, changes to the U.S. regulatory paradigm for agricultural biotechnology have been infrequent, are typically preceded by notice, and are most often subject to public comment, but there can be no guarantee that the USDA-APHIS governing regulations and policies will not change.

We have submitted two petitions under 7 CFR part 340 for a determination of the regulatory status (also known as the "Am I Regulated?" letter) to USDA-APHIS's Biotechnology Regulatory Services in order to confirm that the following two traits designed to increase oil content are not going to be regulated by the agency: (i) the single trait C3008 Camelina plant line, developed using CRISPR genome editing technology for increased oil content; and (ii) the triple-edited Camelina line that combines three gene traits, C3008a, C3008b and C3009, to increase oil production. In both cases, USDA-APHIS's Biotechnology Regulatory Services approved our petitions and confirmed that each of these novel plant lines would not be treated as a regulated article.

To our knowledge, our triple-edited Camelina line which was determined to not be regulated under 7 CFR part 340 in September 2018, is the first CRISPR-edited triple-trait plant determined by the agency to be not to be regulated. Given our business strategy to develop certain multi-trait genome edited plant lines, this achievement should facilitate our ability to put more of our novel yield traits through the petitioning process and the agency's scientifically driven decision-making process, with the expected end result of having lines containing more of our traits treated as not to be regulated under 7 CFR part 340 (as compared to our seed traits developed using Traditional Genome Modification, which are regulated articles). We expect to continue to make appropriate use of the "Am I Regulated" letter procedures to clarify the regulatory status of our new GE seed traits as they are developed.

Also, we tested the C3008 single-trait Camelina line in a 2018 field evaluation that took place in the United States following a notification in 2017 that the line would not be regulated under 7 CFR part 340.

Separate from the plant breeding and planting issues and USDA-APHIS regulation under 7 CFR part 340, a GE plant also will be regulated by the FDA if it is intended to be used as human food or animal feed. The FDA regulates the safety of food for humans and animals, and foods derived from GE plants must meet the same food safety requirements as foods derived from traditionally bred plants (also called conventional foods).

Since 1992, the FDA has had in place a voluntary consultation process for developers of bioengineered food ("Biotechnology Consultations"). Final agency decisions and other information from these Biotechnology Consultations are made publicly available by the FDA. Biotechnology Consultations are data-intensive and examine the new food product's safety and nutritional profile, among other issues. Generally, the FDA has found that such food products do not pose unique health risks to humans or animals, but if a novel allergen or other distinction from the conventional food is present in the new plant variety, the agency may require specific label statements on the product to ensure that consumers are made aware of material differences between GE and conventional versions. The FDA primarily derives its regulatory power from the Federal Food, Drug, and Cosmetic Act, which has been amended over time by several subsequent laws. Among other oversight and inspection responsibilities, the FDA regulates ingredients, packaging, and labeling of foods, including nutrition and health claims and the nutrition facts panel. Foods are typically not subject to premarket review and approval requirements, with limited exceptions.

As part of a broader effort to modernize its regulatory approach to all biotechnology-derived products, the FDA is currently re-evaluating its regulatory approach in light of the increasing prevalence of certain genome edited plants. In January 2017, the FDA asked for public input to help inform its thinking about human and animal foods derived from new plant varieties produced using genome editing techniques. Among other things, the FDA's request for comments asked for data and information in response to questions about the safety of foods from genome edited plants, such as whether certain categories of genome edited plants present food safety risks different from other plants produced through traditional plant breeding.

In October 2018, FDA leadership issued a document entitled the "Plant and Animal Biotechnology Innovation Action Plan" ("Action Plan") that identified three key priorities for the agency in this area: 1) advancing human and animal health by promoting product innovation and applying modern, efficient and risk-based regulatory pathways; 2) strengthening public outreach and communication regarding the FDA's approach to innovative plant and animal biotechnology; and 3) increasing engagement with domestic and international partners on biotechnology issues. The Action Plan also stated that the FDA has reviewed the comments and other information it received in response to the January 2017 request for comments, and that it intends to develop guidance for the industry explaining how the FDA's existing regulatory policy for foods derived from new plant varieties applies to foods produced using genome editing. The forthcoming draft guidance is expected to be released for public comment in 2019. The FDA also stated in the Action Plan that it intends to begin updating the existing procedures for voluntary Biotechnology Consultations to reflect the agency's 25 years of experience with foods derived from biotechnology plants and to incorporate any additional issues

related to genome editing of food crops. Such procedural updates are expected to be developed and implemented over the next two years.

Canadian Regulation

In Canada, GE crops and the food products into which they are incorporated are regulated by multiple government agencies under a federal framework for the regulation of biotechnology products that is similar to the U.S. system. First, the CFIA is the lead agency for ensuring that a new agricultural biotechnology crop will not pose new risks to Canadian plants, animals and other agricultural commodities. The PBO is responsible for conducting environmental assessments of PNTs. Authority for the PBO includes both approving confined field trials with the PNT through permits and authorizing their "unconfined release" as a first step towards commercialization. PNTs are defined in the Canadian Seeds Regulations as (i) plants into which a trait or traits have been intentionally introduced, and (ii) where the trait is new in Canada and has the potential to impact the environment. The CFIA also has in place a remutation policy, whereby plants containing the same mutation as a previously authorized plant of the same species are included in the authorization of the original PNT and are therefore subject to the same conditions.

Second, under the Food and Drugs Act and related regulations, Health Canada is responsible for reviewing a pre-market safety assessment that must be submitted by the manufacturer or importer of a "novel food," a term of art that includes any PNT or other or biotechnology-derived foods. The safety assessment should provide assurances that the novel food is safe when prepared or consumed according to its intended use before it enters the Canadian market and food system. A multi-disciplinary team of experts from Health Canada will evaluate the data and information about the novel food and make a determination regarding whether it is safe and nutritious before it can be sold in Canada, as well as whether any restrictions are warranted under applicable law or the product's safety profile. Health Canada's final decision documents regarding the safety of these novel foods are made available to the public by the government. As in the United States, approval of a PNT or a novel food product does not take into account the method with which such product was produced. Rather, Health Canada employs a product-based (as opposed to a process-based) approach to its regulatory oversight of such emerging foods and food ingredients.

As the lead agency for public health and safety, Health Canada also works in conjunction with the CFIA on food labeling oversight when it has identified a potential health or safety issues with a food that could be mitigated through labeling or other disclosures. For example, if the biotechnology-derived food contains a new allergen that is otherwise not present in the conventional version of the food, then specific label statements will be required to alert consumers to that important health information. However, the CFIA has primary oversight over non-health issues related to food labeling, packaging, and advertising. Accordingly, the CFIA is the lead agency for ensuring that food labeling, and advertising meet the legal requirements of the Food and Drugs Act, and that labeling representations do not create a potential risk of fraud or consumer confusion and are compliant with Canada's voluntary disclosure standard for GE food ingredients.

Environment Canada is also available to serve as a regulatory "safety net" if a novel product does not naturally fall within the jurisdiction of the CFIA, Health Canada, or the Pest Management Regulatory Agency that oversees pesticide products.

Our work involving the development, greenhouse testing and field testing of novel yield trait genes in crop plants requires certain government and municipal permits and we must ensure compliance with all applicable regulations including regulations relating to GE crops. With laboratories and greenhouses in both the U.S. and Canada, we are also subject to regulations governing the shipment of seeds and other plant material (including GE seeds and GE plant material) between our facilities in the U.S. and Canada, including USDA-APHIS and CFIA permits for the import and phytosanitary certificates for the export of plant materials that could pose a risk to domestic agriculture.

Having deployed our own research and development operations in Saskatoon, Canada in 2010, we have been conducting field studies of various yield traits in that country since 2016 under PNT permits issued by Canadian regulators. During 2018, we conducted field studies of C3003 in canola, Camelina and soybean at field sites in Canada.

Finally, as one of Canada's major field crops, canola in particular is subject to variety registration, which is a regulatory requirement of the Seeds Act and is also administered by the CFIA. Any future sales of our seed traits or products in Canada would be done by a third-party collaborator or other partner, and that third party would be responsible for complying with registration requirements for the canola varieties, if applicable.

Regulation in Other Jurisdictions

Other jurisdictions and governmental authorities, including in South America and Asia, are increasingly taking an interest in regulating agricultural products of biotechnology. Regulatory approaches vary by jurisdiction, the existing public health framework and phytosanitary laws in the country, and other less tangible factors such as cultural and religious norms that may have an impact on individual country risk assessments and decision-making. We cannot predict future changes in the global regulatory landscape regarding GE plants subjected to Traditional Genome Modification or GE plants subjected to genome editing.

Further, although U.S. and Canadian regulatory authorities have taken similar approaches to overseeing both traditional biotechnology-derived plants and genome edited plants under their national plant health and biosafety laws, regulation of all GE plants in the EU is significantly more stringent than in North America. U.S. and Canadian regulators have also determined that genome edited GE plants pose fewer risks that those subjected to Traditional Genome Modification, while a recent EU legal ruling indicates that the existing European regulations for GE plants modified by the insertion of recombinant DNA should be strictly applied to genome edited plants at well. There is thus a sharp distinction between how European and North American regulatory agencies oversee novel seed traits, including those that are generated using the more modern techniques of genome editing. It is possible that emerging oversight regimes for GE products in other jurisdictions could follow the EU approach and impose similar strict requirements for the release of such products into the environment and their incorporation into human food or other consumer products.

Regulation of biotechnology-derived products in the EU is primarily based on Directive 2001/18/EC (the “2001 EC Directive”). The 2001 EC Directive defines “genetically modified organisms” ("GMOs") broadly as “organism[s], with the exception of human beings, in which the genetic material has been altered in a way that does not occur naturally by mating and/or natural recombination.” In July 2018, the Court of Justice of the European Union (CJEU) issued an important ruling clarifying that the 2001 EC Directive and its pre-market authorization and associated risk assessment requirements required for such “GMOs” should also apply in full to organisms developed using more modern “directed” mutagenesis techniques.

The July 2018 CJEU decision is being interpreted to cover all modern genome editing tools such as CRISPR-Cas9, TALEN and oligonucleotide-directed mutagenesis. This recent clarification by the CJEU regarding the scope of EU regulations suggests that novel seed trait developers who are seeking to bring genome edited seed traits to commercial markets in the EU will face hurdles comparable to what has historically been required in Europe for introducing and commercializing Traditional Genome Modification traits.

Although we are not currently targeting European markets for the development or commercialization of our products, the EU approach to regulating GE plants without regard to the scientific distinctions between Traditional Genome Modification and directed genome editing could be adopted by emerging oversight regimes for GE products in other jurisdictions. There is no guarantee that countries for which we may have or may develop future marketing plans would not take a stricter legal and regulatory approach to controlling GE plants similar to that of the EU.

License Agreement with the University of Massachusetts

Pursuant to a license agreement with the University of Massachusetts ("UMASS") dated as of June 30, 2015, we have an exclusive, worldwide license under certain patents and patent applications, including issued patents covering our yield trait gene C3003, relating to the manufacture of plants with enhanced photosynthesis. The agreement provides an exclusive, worldwide license to make, have made, use, offer for sale, sell, have sold and import any transgenic plant seed or plant grown therefrom or transgenic plant material developed for sale to a farmer or grower for planting in the field, which transgenic plant seed or plant grown therefrom or transgenic plant material is covered by, embodies or is derived from (in whole or in part) one or more issued or pending claims of the licensed patents or patent applications.

We are required to use diligent efforts to develop licensed products throughout the field of use and to introduce licensed products into the commercial market. In that regard, we are obligated to fulfill certain development and regulatory milestones relating to C3003, including completion of multi-site field demonstrations of a crop species in which C3003 has been introduced, and filing for regulatory approval of a crop species in which C3003 has been introduced within a specified period. Our failure to achieve any milestone provided for under the agreement would, if we are unable to reach agreement with UMASS as to a potential adjustment of the applicable milestone, give UMASS the right to terminate the agreement, following a notice period.

We are obligated to pay UMASS milestone payments relating to any regulatory filings and approvals covered by the agreement, royalties on any sales of licensed products following regulatory approval, as well as a percentage of any sublicense income related to the licensed products.

We may terminate the agreement at any time upon 90 days prior written notice to UMASS. Either party may terminate for material breach immediately upon written notice for a breach that is not cured within 60 days after receiving written notice of the breach. In addition, UMASS may terminate this agreement with respect to certain patent rights immediately upon written notice in the event we contest the validity or enforceability of such patent rights.

License Agreement with the University of Missouri

Pursuant to a license agreement with the University of Missouri ("UM") dated as of May 17, 2018, we have an exclusive, worldwide license to two novel gene technologies to boost oil content in crops. Both technologies are based on significant new discoveries around the function and regulation of Acetyl-CoA carboxylase ("ACCase"), a key rate-limiting enzyme involved in oil production. The first technology, named C3007, is a gene for a negative controller that inhibits the enzyme activity of ACCase. The second technology, named C3010, is a gene which, if over-expressed, results in increased activity of ACCase. The UM license was expanded during May 2019 to include an exclusive worldwide license to a third gene in the ACCase complex, that we have designated C3012, that may complement the activity of C3007 to boost oil content in crops.

We are required to use diligent efforts to develop licensed products throughout the licensed field and to introduce licensed products into the commercial market. In that regard, we are obligated to fulfill certain research, development and regulatory milestones relating to C3007, C3010 and C3012, including completion of multi-site field demonstrations of a crop species in which C3007, C3010 and C3012 have been introduced, and filing for regulatory approval of a crop species in which C3007, C3010 and C3012 have been introduced within a specified period. Our failure to achieve any milestone provided for under the license agreement would, if we are unable to reach agreement with UM as to a potential adjustment of the applicable milestone, give UM the right to terminate the license agreement or render it nonexclusive.

We are obligated to pay UM a license execution payment, milestone payments relating to any regulatory filings and approvals covered by the license agreement, royalties on any sales of licensed products following regulatory approval, as well as a percentage of any sublicense royalties related to the licensed products.

We may terminate the license agreement at any time upon 90 days' prior written notice to UM. Either party may terminate the license agreement upon written notice for a breach that is not cured within 30 days after receiving written notice of the breach. In addition, UM may terminate the license agreement with respect to certain patent rights immediately upon written notice in the event we contest the validity or enforceability of such patent rights.

Agricultural Industry Landscape

Following advances in biotechnology in the 1970s through early 1990s, the first genetically modified ("GM") crops were commercially introduced in the U.S. in the years 1994 and 1995. Today, the U.S. leads the world in the adoption of GM crops in terms of crop value and acreage planted. GM crops have had both their supporters and their detractors over the years. Consumer sentiment including concerns about the safety of GM crops have limited the introduction and adoption of GM crops in Europe. However, recent studies by the National Academy of Science continue to support the 20 year history of safe use of GM crops.

The International Service for the Acquisition of Agri-Biotech Applications (ISAAA), an industry research group, reported that 457 million acres worldwide were planted with GM crops in 2016, the most recent year where data is available. The planting of GM crops is centered in the Americas with North America at approximately 45 percent of the acres and South America at approximately 43 percent. China and India follow with approximately 8 percent and the balance of the total worldwide GM crop acreage in 2016 was planted in the EU and the rest of world. The primary GM crops in the U.S. are corn, soybean, cotton and sugar beet. In Canada, the oilseed crop canola is the primary GM crop. Cotton is the primary GM crop grown in India and China.

In contrast to the Americas, the EU has been resistant to the adoption of GM crops and has relied heavily on plant breeding programs for capturing crop yield improvements over the last 20 years. In 2016, Spain was the largest producer of GM crops in Europe, based on cultivation of GM corn representing approximately 20 percent of the country's crop that year. Certain GM crops have been approved for cultivation in some European countries, while other countries have imposed outright bans on cultivation of GM crops.

According to the market research firm, Research and Markets, the total global seed business was estimated at $68 billion in 2017 and is projected to grow to more than $100 billion by 2022. According to an ISAAA report, the global GM seed business represented a $17.2 billion market in 2017 and biotech crops were grown on approximately 469 million acres that year. The traits being commercialized today by the agricultural industry mainly address crop protection, which involves preventing crop damage by weeds, insects and other pests that lower expected crop yield. As technology has

advanced, “trait stacking,” or the practice of adding multiple traits to an elite plant line, has become commonplace as a strategy to protect yield. As the industry has developed, the practice of inter-licensing traits between research and development driven seed companies has led to a proliferation of branded seed products on the market today.

The GM seed business is dominated by large multinational companies and their subsidiaries including BASF, Bayer, DowDuPont, Syngenta and AgReliant. These companies have significant resources, experience and track records of successfully developing, testing and commercializing high performing seed lines as well as new traits for GM crops. They offer farmers conventional and biotechnology seeds as well as crop protection chemicals, biologicals, fertilizers and other products and technologies aimed at supporting the on-farm efficiency of managing crops in the field as well as managing the overall cost of crop production to successful harvest. Many of these companies were recently involved in consolidation of the sector with the DowDuPont merger, the acquisition of Syngenta by ChemChina, and the acquisition of Monsanto by Bayer in 2018.

Privately owned, U.S. retail seed companies play a key role in the industry by developing, marketing and selling high performing seed to U.S. farmers. These companies include Beck’s Hybrids and Stine Seed. These companies have capabilities in both biotechnology and plant breeding. They source traits from the multinational companies and input these traits into elite plant germplasm to produce seeds optimized for a variety of soil, climate and field conditions. Both companies offer a broad arrange of GM corn and soybean products to their customers.

Recent advances in biotechnology including gene editing have led to the formation of companies focusing on yield trait discovery, biologicals for pest control, agbiome strategies and precision agriculture. There are startups, privately held and publicly traded companies involved in this space. Such companies include AgBiome, Arcadia Biosciences, Benson Hill Biosystems, BioCeres, Calyxt, Cibus, Evogene, Inari, Indigo, Kaiima, Marrone Bio Innovation, and Pairwise Plants, many of which have greater resources and experience than we have.

Intellectual Property

Our continued success depends in large part on our proprietary technology. As of June 30, 2019, we owned or held exclusive rights to 20 patents and pending patent applications worldwide related to advanced technologies for increasing yield in crops. Our portfolio of patent applications includes plant science technologies we have in-licensed globally and exclusively from the University of Massachusetts and North Carolina State University related to the yield trait gene C3003 and other advanced technologies based on advanced metabolic engineering methods to improve carbon capture and selectively control carbon partitioning in plants. Our portfolio of patent applications also includes advanced technologies for oilseed crops we in-licensed globally and exclusively from the University of Missouri in 2018 and 2019 related to the yield trait genes C3007, C3010 and C3012.

We continue to seek, develop and evaluate new technologies and related intellectual property that might enhance our Company's business strategy, industry position or deployment options.

Employees

As of June 30, 2019, we had 25 full-time employees. Of those employees, 21 were in research and development. Among our staff, 11 hold Ph.D.’s and 12 hold masters’ or bachelors’ degrees in their respective disciplines. Our technical staff has expertise in the following areas: plant genetics, plant biology, microbial genetics, bioinformatics, metabolic engineering and systems biology. Our headquarters are located in Massachusetts, and we maintain a research and development facility, including greenhouse facilities, in Saskatoon, Canada. None of our employees are subject to a collective bargaining agreement. We consider our relationship with our employees to be good.

Corporate History and Investor Information

We changed our name to Yield10 Bioscience, Inc. in January 2017 to reflect our change in mission around innovations in agricultural biotechnology focused on developing disruptive technologies for step-change improvements in crop yield. In 1992, our Company was incorporated in Massachusetts under the name Metabolix, Inc. In September 1998, we reincorporated in Delaware. Financial and other information about our Company is available on our website at www.yield10bio.com.

PRINCIPAL STOCKHOLDERS

The following table sets forth certain information with respect to the beneficial ownership of our common stock as of August 16, 2019 for (a) our named executive officers, (b) our directors, (c) our executive officers and directors as a group, and (d) each stockholder known to us to beneficially own more than five percent of our

common stock. Beneficial ownership is determined in accordance with the rules of the SEC and includes voting or investment power with respect to the securities. We deem shares that may be acquired by an individual or group within 60 days following August 16, 2019 pursuant to the exercise of options or warrants to be outstanding for the purpose of computing the percentage ownership of such individual or group, but are not deemed to be outstanding for the purpose of computing the percentage ownership of any other person shown in the table. Except as otherwise indicated, we believe that the stockholders named in the table have sole voting and investment power with respect to all shares shown to be beneficially owned by them based on information provided to us by these stockholders. Percentage ownership is based on a total of 12,519,017 shares of our common stock issued and outstanding on August 16, 2019. Unless otherwise noted below, the address of each person listed on the table is c/o Yield10 Bioscience, Inc., 19 Presidential Way, Woburn, MA 01801.

Category	Beneficial Owner	Shares of Common Stock (1)	Options Exercisable Within 60 Days (2)	Warrants Exercisable Within 60 Days (2)	RSUs Vesting Within 60 Days (2)	Total Shares Beneficially Owned	Percentage of Outstanding Shares (3)
5% Stockholders	Jack W. Schuler (4) 100 N. Field Drive Suite 360 Lake Forest, IL 60045	3,804,885	—	2,067,136	—	5,872,021	40.3%
Directors and Named Executive Officers	Lynne H. Brum (5)	26,513	86,583	—	—	113,096	0.9%
	Oliver P. Peoples (6)	65,874	290,937	—	—	356,811	2.8%
	Kristi Snell (7)	23,014	163,842	—	—	186,856	1.5%
	Richard Hamilton	3,041	25,181	—	—	28,222	0.2%
	Peter Kellogg	5,302	36,083	—	—	41,385	0.3%
	Joseph Shaulson (8)	35,295	151,483	—	—	186,778	1.5%
	Anthony J. Sinskey (9)	12,372	39,517	—	—	51,889	0.4%
	Robert L Van Nostrand	11,293	56,397	—	—	67,690	0.5%
All directors and executive officers as a group (9 persons) (10)		**203,031**	**937,342**	—	—	**1,140,373**	**8.5%**

(1) Beneficial ownership, as such term is used herein, is determined in accordance with Rule 13d-3(d)(1) promulgated under the Securities Exchange Act of 1934, as amended, and includes voting and/or investment power with respect to shares of our common stock. Unless otherwise indicated, the named person possesses sole voting and investment power with respect to the shares.

(2) Consists of shares of common stock subject to stock options and warrants held by the person that are currently vested or will vest within 60 days after August 16, 2019.

(3) Percentages of ownership are based upon 12,519,017 shares of common stock issued and outstanding as of August 16, 2019. Shares of common stock that may be acquired pursuant to options and warrants that are vested and exercisable within 60 days after August 16, 2019, are deemed outstanding for computing the percentage ownership of the person holding such options, but are not deemed outstanding for the percentage ownership of any other person.

(4) The reported securities consist of 2,838,128 shares of common stock and 2,067,136 shares of common stock underlying the warrants owned by the JWS Living Trust, 965,914 shares of common stock owned by the Schuler Family Foundation, and 843 shares of common stock owned by the Renate Schuler Trust. Mr. Schuler has sole voting and investment power over the shares issued to the JWS Living Trust, the Schuler Family Foundation and Renate Schuler Trust. Beneficial ownership information for Mr. Schuler has been derived from his historical SEC filings.

(5) Includes 18,984 shares held for Ms. Brum in the Company's 401(k) plan.

(6) Includes 18,246 shares held for Dr. Peoples in the Company's 401(k) plan.

(7) Includes 18,425 shares held for Dr. Snell in the Company's 401(k) plan.

(8) Includes 1,470 shares held for Mr. Shaulson in the Company's 401(k) plan.

(9) Includes 822 shares owned by Dr. Sinskey's spouse and 166 shares owned by a trust over which Dr. Sinskey may be deemed to share voting and investment power. Dr. Sinskey disclaims beneficial ownership of such shares.

(10) Includes a total of 75,176 shares held for current executive officers and Mr. Shaulson, our former President and Chief Executive Officer, in the Company's 401(k) plan.

CAPITALIZATION

The following table sets forth our cash and cash equivalents and our capitalization as of June 30, 2019:

- on an actual basis; and
- on an as adjusted basis to give effect to the sale of [●] shares in this offering, at an assumed public offering price of $[●], the application of the net proceeds of this offering and after deducting the underwriting discounts and commissions and estimated offering expenses payable by us.

		(unaudited) As of June 30, 2019	
in thousands		**Actual**	**As Adjusted**
Cash, cash equivalents and short-term investments	$	4,250	
Stockholders' Equity			
Preferred stock ($0.01 par value per share); 5,000,000 shares authorized; no shares issued or outstanding		–	—
Common stock ($0.01 par value per share); 60,000,000 shares authorized; 12,494,731 shares issued and outstanding, actual and [●] shares issued and outstanding, on an adjusted basis		125	
Additional paid-in capital		360,516	
Accumulated other comprehensive loss		(118)	
Accumulated deficit		(356,069)	
Total stockholders' equity	$	4,454	$ —
Total capitalization	$	4,454	$ —

You should read this table together with “Item 2-Management’s Discussion and Analysis of Financial Condition and Results of Operations” in our Quarterly Report on Form 10-Q filed on August 12, 2019 and with our consolidated financial statements and the accompanying notes contained therein.

DILUTION

If you acquire shares of our common stock in this offering, your ownership interest will be diluted to the extent of the difference between the public offering price per share of our common stock and the pro forma net tangible book value per share of our common stock after this offering. Our historical net tangible book value of common stock as of June 30, 2019 was $4.5 million, or $0.36 per share of common stock. Historical net tangible book value per share represents the amount of our total tangible assets less total liabilities, divided by the total number of shares of common stock outstanding.

After giving effect to the sale of [●] shares of common stock at an assumed public offering price of $[●] per share, and after deducting estimated offering expenses payable by us, our pro forma net tangible book value as of June 30, 2019 would have been $[●] million, or $[●] per share of common stock. This represents an immediate decrease in pro forma net tangible book value of $[●] per share to our existing stockholders and an immediate dilution in pro forma net tangible book value of $[●] per share to investors participating in this offering. The

following table illustrates this per share dilution:

Assumed public offering price per share	$
Historical net tangible book value per share as of June 30, 2019	$0.36
Increase in net tangible book value per share attributable to this offering	$
Pro forma net tangible book value per share after this offering	$
Dilution per share to new investors in the offering	$

The information discussed above is based on an assumed public offering price of $[●], is illustrative only and will change based on actual pricing and other terms in this offering determined at pricing. The table and calculations set forth above are based on the number of shares of common stock outstanding as of June 30, 2019 and exclude:

- 2,446,082 of common stock issuable upon exercise of options to purchase our common stock outstanding as of June 30, 2019 at a weighted average exercise price of $4.61 per share;
- 63,773 shares of common stock reserved as of June 30, 2019 for future issuance under our 2018 Stock Option and Incentive Plan;
- 570,784 shares of common stock issuable upon exercise of warrants issued pursuant to the Securities Purchase Agreement we entered into with certain investors on July 3, 2017 (which warrants became exercisable on January 7, 2018 at an exercise price of $5.04 per share and expire on January 7, 2024);
- 30,000 shares of common stock issuable upon exercise of immediately vested warrants issued to an investor relations consultant on September 12, 2017 at an exercise price of $2.90 per share and which expire on September 11, 2024; and
- 6,439,000 shares of common stock issuable upon exercise of vested Series A warrants outstanding as of June 30, 2019 pursuant to the Securities Purchase Agreement we entered into with certain investors on December 21, 2017 at an exercise price of $2.25 per share and which expire on December 21, 2022.

To the extent that options or warrants are exercised, there will be further dilution to new investors.

DESCRIPTION OF OUR CAPITAL STOCK

General

The following summary of our capital stock is based on certain provisions of our amended and restated certificate of incorporation, as amended, and amended and restated by-laws and on the applicable provisions of the DGCL. This summary does not purport to be complete and is qualified in its entirety by reference to the applicable provisions in our amended and restated certificate of incorporation, as amended, and amended and restated by-laws and the DGCL. For a complete description you should refer to our amended and restated certificate of incorporation, as amended, and our amended and restated by-laws, copies of which have been incorporated by reference herein, and to the applicable provisions of the DGCL.

Our authorized capital stock consists of 65,000,000 shares, with a par value of $0.01 per share, of which:

- 60,000,000 shares are designated as common stock; and
- 5,000,000 shares are designated as undesignated preferred stock.

Description of Securities Being Registered

We are offering Class A Units, with each Class A Unit consisting of one share of common stock and a warrant to purchase 0.5 shares of our common stock at an exercise price per share of $ [•], together with the shares

of common stock underlying such warrants, at a public offering price of $ [•] per Class A Unit. The Class A Units will not be certificated and the shares of common stock and warrants part of such units are immediately separable and will be issued separately in this offering.

We are also offering to those purchasers whose purchase of Class A Units in this offering would result in the purchaser, together with its affiliates and certain related parties, beneficially owning more than 4.99% (or, at the election of the purchaser, 9.99%) of our outstanding common stock following the consummation of this offering, the opportunity to purchase, in lieu of the number of Class A Units that would result in ownership in excess of 4.99% (or, at the election of the purchaser, 9.99%), Class B Units. Each Class B Unit will consist of one share of Series A Preferred Stock, par value $0.01 per share, convertible into shares of common stock and a warrant to purchase 50% of the shares of the common stock underlying each share of Series A Preferred Stock at an exercise price per share of $ [•], together with the shares of common stock underlying such shares of Series A Preferred Stock and warrants, at a public offering price of $ [•] per Class B Unit. The Class B Units will not be certificated and the shares of Series A Preferred Stock and the warrants part of such units are immediately separable and will be issued separately in this offering. The Series A Preferred Stock will only be entitled to dividends in the event dividends are paid on our common stock and will not have voting rights or any preferences over common stock, including liquidation rights.

Description of Series A Preferred Stock Included in the Units

Our board of directors has designated [•] shares of our preferred stock as Series A Preferred Stock ("Series A Preferred Shares"), none of which are currently issued and outstanding. The preferences and rights of the Series A Preferred Shares will be as set forth in a Certificate of Designation (the "Series A Certificate of Designation") to be filed as an exhibit to the registration statement of which this prospectus is a part.

In the event of a liquidation, the holders of Series A Preferred Shares are entitled to participate on an as-converted-to-Common Stock basis with holders of the Common Stock in any distribution of assets of the Company to the holders of the Common Stock. The Series A Certificate of Designation provides, among other things, that we shall not pay any dividends on shares of Common Stock (other than dividends in the form of Common Stock) unless and until such time as we pay dividends on each Series A Preferred Share on an as-converted basis. Other than as set forth in the previous sentence, the Series A Certificate of Designation provides that no other dividends shall be paid on Series A Preferred Shares and that we shall pay no dividends (other than dividends in the form of common stock) on shares of Common Stock unless we simultaneously comply with the previous sentence. The Series A Certificate of Designation does not provide for any restriction on the repurchase of Series A Preferred Shares by us while there is any arrearage in the payment of dividends on the Series A Preferred Shares. There are no sinking fund provisions applicable to the Series A Preferred Shares.

With certain exceptions, as described in the Series A Certificate of Designation, the Series A Preferred Stock has no voting rights. However, as long as any shares of Series A Preferred Stock remain outstanding, the Series A Certificate of Designation provides that we shall not, without the affirmative vote of holders of a majority of the then-outstanding Series A Preferred Stock, (a) alter or change adversely the powers, preferences or rights given to the Series A Preferred Stock or alter or amend the Series A Certificate of Designation, (b) increase the number of authorized shares of Series A Preferred Stock or (c) effect a stock split or reverse stock split of the Series A Preferred Stock or any like event.

Each share of Series A Preferred Stock is convertible at any time at the holder's option into a number of shares of common stock equal to $ [•] divided by the Series A Conversion Price. The "Series A Conversion Price" is initially $ [•] and is subject to adjustment for stock splits, stock dividends, distributions, subdivisions and combinations. Notwithstanding the foregoing, the Series A Certificate of Designation further provides that we shall not effect any conversion of Series A Preferred Stock, with certain exceptions, to the extent that, after giving effect to an attempted conversion, the holder of Series A Preferred Shares (together with such holder's affiliates, and any persons acting as a group together with such holder or any of such holder's affiliates) would beneficially own a number of shares of Common Stock in excess of 4.99% (or, at the election of the holder, 9.99%) of the shares of our Common Stock then outstanding after giving effect to such exercise (the "Preferred Stock Beneficial Ownership Limitation"); provided, however, that upon notice to the Company, the holder may increase or decrease the Preferred Stock Beneficial Ownership Limitation, provided that in no event shall the Preferred Stock Beneficial Ownership

Limitation exceed 9.99% and any increase in the Preferred Stock Beneficial Ownership Limitation will not be effective until 61 days following notice of such increase from the holder to us.

Subject to certain conditions, at any time following the issuance of the Series A Preferred Stock, we will have the right to cause each holder of the Series A Preferred Stock to convert all or part of such holder's Series A Preferred Stock in the event that (i) the volume weighted average price of our common stock for 30 consecutive trading days (the "Measurement Period") exceeds 300% of the initial conversion price of the Series A Preferred Stock (subject to adjustment for forward and reverse stock splits, recapitalizations, stock dividends and similar transactions), (ii) the daily trading volume on each Trading Day during such Measurement Period exceeds $500,000 per trading day and (iii) the holder is not in possession of any information that constitutes or might constitute, material non-public information which was provided by the Company. Our right to cause each holder of the Series A Preferred Stock to convert all or part of such holder's Series A Preferred Stock shall be exercised ratably among the holders of the then outstanding preferred stock.

We do not intend to apply for listing of the Series A Preferred Stock on any securities exchange or other trading system.

Description of Warrants Included in the Units

The material terms and provisions of the warrants being offered pursuant to this prospectus are summarized below. This summary of some provisions of the warrants is not complete. For the complete terms of the warrants, you should refer to the form of warrant to be filed as an exhibit to the registration statement of which this prospectus is a part.

Each warrant is exercisable to purchase 0.5 of a share of our common stock at a price equal to $ [•] per share at any time for up to five years after the date of the closing of this offering. The holder of a warrant will not be deemed a holder of our underlying common stock until the warrant is exercised. Pursuant to a warrant agency agreement between us and American Stock Transfer & Trust Company, LLC, as warrant agent, the warrants will be issued in book-entry form and shall initially be represented only by one or more global warrants deposited with the warrant agent, as custodian on behalf of The Depository Trust Company, or DTC, and registered in the name of Cede & Co. a nominee of DTC, or as otherwise direct by by DTC.

Subject to certain limitations as described below the warrants are immediately exercisable upon issuance on the closing date and expire on the five year anniversary of the closing date. Subject to limited exceptions, a holder of warrants will not have the right to exercise any portion of its warrants if the holder (together with such holder's affiliates, and any persons acting as a group together with such holder or any of such holder's affiliates) would beneficially own a number of shares of common stock in excess of 4.99% (or, at the election of the purchaser, 9.99%) of the shares of our Common Stock then outstanding after giving effect to such exercise (the "Beneficial Ownership Limitation"): provided, however, that upon notice to the Company, the holder may increase or decrease the Preferred Stock Beneficial Ownership Limitation, provided that in no event shall the Beneficial Ownership Limitation exceed 9.99% and any increase in the Beneficial Ownership Limitation will not be effective until 61 days following notice of such increase from the holder to us.

The exercise price and the number of shares issuable upon exercise of the warrants is subject to appropriate adjustment in the event of recapitalization events, stock dividends, stock splits, stock combinations, reclassifications, reorganizations or similar events affecting our common stock. The warrant holders must pay the exercise price in cash upon exercise of the warrants, unless such warrant holders are utilizing the cashless exercise provision of the warrants. On the expiration date, unexercised warrants will automatically be exercised via the "cashless" exercise provision.

Upon the holder's exercise of a warrant, we will issue the shares of common stock issuable upon exercise of the warrant within two trading days following our receipt of a notice of exercise, provided that payment of the exercise price has been made (unless exercised to the extent permitted via the "cashless" exercise provision). Prior to the exercise of any warrants to purchase common stock, holders of the warrants will not have any of the rights of holders of the common stock purchasable upon exercise, including the right to vote, except as set forth therein. Warrant holders may exercise warrants only if the issuance of the shares of common stock upon exercise of the

warrants is covered by an effective registration statement, or an exemption from registration is available under the Securities Act and the securities laws of the state in which the holder resides. We intend to use commercially reasonable efforts to have the registration statement, of which this prospectus forms a part, effective when the warrants are exercised. The warrant holders must pay the exercise price in cash upon exercise of the warrants unless there is not an effective registration statement or, if required, there is not an effective state law registration or exemption covering the issuance of the shares underlying the warrants (in which case, the warrants may only be exercised via a "cashless" exercise provision).

We do not intend to apply for listing of the warrants on any securities exchange or other trading system.

Common Stock

The holders of our common stock are entitled to one vote per share on all matters submitted to a vote of our stockholders and do not have cumulative voting rights. Subject to preferences that may be applicable to any preferred stock outstanding at the time, the holders of outstanding shares of common stock are entitled to receive ratably any dividends declared by our board of directors out of assets legally available. Upon our liquidation, dissolution or winding up, holders of our common stock are entitled to share ratably in all assets remaining after payment of liabilities and the liquidation preference of any then outstanding shares of preferred stock. Holders of common stock have no preemptive or conversion rights or other subscription rights. There are no redemption or sinking fund provisions applicable to our common stock.

Preferred Stock

Our amended and restated certificate of incorporation, as amended, authorizes it to issue up to 5,000,000 shares of $0.01 par value undesignated preferred stock. Our board of directors may designate the rights, preferences, privileges and restrictions of the preferred stock, including dividend rights, conversion rights, voting rights, terms of redemption, liquidation preference, sinking fund terms and the number of shares constituting any series or the designation of any series. As of June 30, 2019, no preferred stock was issued or outstanding.

Warrants

As of June 30, 2019, we had warrants outstanding to purchase 7,039,784 shares of our common stock.

Anti-Takeover Provisions

Certain provisions of the DGCL and our amended and restated certificate of incorporation, as amended, and amended and restated by-laws may have the effect of delaying, deferring or discouraging another party from acquiring control of our company. These provisions, which are summarized below, may discourage certain types of coercive takeover practices and inadequate takeover bids and encourage anyone seeking to acquire control of our company to first negotiate with our board of directors. These provisions might also have the effect of preventing changes in our management and could make it more difficult to accomplish transactions that stockholders might otherwise deem to be in their best interests. However, we believe that the advantages gained by protecting our ability to negotiate with any unsolicited and potentially unfriendly acquirer outweigh the disadvantages of discouraging such proposals, because, among other reasons, the negotiation of such proposals could result in improving their terms.

Amended and Restated Certificate of Incorporation and By-law Provisions

Our amended and restated certificate of incorporation, as amended, and amended and restated by-laws include a number of provisions that may have the effect of delaying, deferring or discouraging another party from acquiring control of our company or preventing changes in our management, including the following:

- *Issuance of Undesignated Preferred Stock.* Our board of directors has the authority, without further action by the stockholders, to issue up to 5,000,000 shares of undesignated preferred stock with rights, preferences and privileges designated from time to time by our board of directors without further action by stockholders. These rights, preferences and privileges could include dividend rights,

conversion rights, voting rights, terms of redemption, liquidation preferences and sinking fund terms, any or all of which may be greater than the rights of common stock.

- *Size of the Board of Directors and Filling Vacancies*. The number of directors constituting our board of directors may be set only by resolution adopted by a majority vote of our entire board of directors. Any vacancy on our board of directors, however occurring, including a vacancy resulting from an increase in the size of the board of directors, may only be filled by the affirmative vote of a majority of our directors then in office, even if less than a quorum.

- *Classified Board*. Our board of directors is divided into three classes of directors, with staggered three-year terms. Only one class of directors will be elected at each annual meeting of our stockholders, with the other classes continuing for the remainder of their respective three-year terms.

- *No Cumulative Voting*. Our amended and restated certificate of incorporation, as amended, and amended and restated by-laws do not permit cumulative voting in the election of directors. Cumulative voting allows a stockholder to vote a portion, or all of its shares for one or more candidates. The absence of cumulative voting makes it more difficult for a minority stockholder to gain a seat.

- *Removal of Directors*. Directors can only be removed by our stockholders for cause and removal of a director will require a 75% stockholder vote.

- *No Written Consent of Stockholders*. All stockholder actions are required to be taken by a vote of the stockholders at an annual or special meeting. Stockholders may not take action by written consent in lieu of a meeting. The inability of stockholders to take action by written consent means that a stockholder would need to wait until the next annual or special meeting to bring business before the stockholders for a vote.

- *Special Meetings of Stockholders*. Special meetings of our stockholders may be called only by our board of directors acting pursuant to a resolution approved by the affirmative vote of a majority of the directors then in office. Only those matters set forth in the notice of the special meeting may be considered or acted upon at a special meeting of our stockholders.

- *Advance Notice Requirements for Stockholder Proposals and Director Nominations*. Our amended and restated by-laws provide advance notice procedures for stockholders seeking to bring business before our annual meeting of stockholders or to nominate candidates for election as directors at our annual meeting of stockholders. These procedures provide that notice must be given in writing not later than the close of business on the 90th day nor earlier than the close of business on the 120th day prior to the first anniversary of the preceding year's annual meeting. These procedures may have the effect of precluding the conduct of certain business at a meeting if the proper procedures are not followed or may discourage or deter a potential acquirer from conducting a solicitation of proxies to elect its own slate of directors or otherwise attempt to obtain control of us.

- *Amendment to Amended and Restated Certificate of Incorporation and By-laws*. Any amendment, repeal or modification of certain provisions of our amended and restated certificate of incorporation or amended and restated by-laws requires a 75% stockholder vote. Provisions requiring such supermajority vote include, among other things, any amendment, repeal or modification of the provisions relating to the classification of our board of directors, the requirement that stockholder actions be effected at a duly called annual or special meeting of our stockholders and the designated parties entitled to call a special meeting of our stockholders.

Section 203 of the DGCL

We are subject to Section 203 of the DGCL. In general, Section 203 of the DGCL prohibits a publicly held Delaware corporation from engaging in a "business combination" with an "interested stockholder" for a three-year period following the time that this stockholder becomes an interested stockholder, unless it satisfies one of the following conditions:

- the transaction is approved by the board of directors prior to the time that the interested stockholder became an interested stockholder;
- upon consummation of the transaction which resulted in the stockholder becoming an interested stockholder, the interested stockholder owned at least 85% of the voting stock of the corporation outstanding at the time the transaction commenced; or

In general, Section 203 defines "business combination" to include the following:

- at or subsequent to such time that the stockholder became an interested stockholder, the business combination was approved by the board of directors and authorized at an annual or special meeting of stockholders by at least two-thirds of the outstanding voting stock which is not owned by the interested stockholder.
- any merger or consolidation involving the corporation and the interested stockholder;
- any sale, lease, exchange, mortgage, pledge, transfer or other disposition of the assets of the corporation with an aggregate market value of 10% or more of either the aggregate market value of all assets of the corporation on a consolidated basis or the aggregate market value of all of the outstanding stock of the corporation involving the interested stockholder;
- subject to certain exceptions, any transaction that results in the issuance or transfer by the corporation of any stock of the corporation to the interested stockholder;
- any transaction involving the corporation that has the effect of increasing the proportionate share of the stock or any class or series of the corporation beneficially owned by the interested stockholder; or
- the receipt by the interested stockholder of the benefit of any loans, advances, guarantees, pledges or other financial benefits by or through the corporation.

In general, Section 203 defines an "interested stockholder" as an entity or person who, together with the stockholder's affiliates and associates (as defined in Section 203), beneficially owns, or within three years prior to the time of determination of interested stockholder status did own, 15% or more of the outstanding voting stock of the corporation.

Treatment of Options Upon Change of Control

In general, under the terms of our Stock Option and Incentive Plans and our Stock Issuance Plan and our executive employment agreements, in the event of certain change in control transactions, if the successor corporation does not assume our outstanding options or issue replacement awards, or if an option holder's employment is involuntarily terminated in connection with such change in control, the vesting of the options outstanding under such plans will accelerate.

Transfer Agent and Registrar

The transfer agent and registrar for our Common Stock is American Stock Transfer & Trust Company, LLC. The transfer agent's telephone number is (718) 921-8200.

Stock Exchange Listing

Our Common Stock is listed on The Nasdaq Capital Market under the symbol YTEN.

UNDERWRITING

We have entered into an underwriting agreement dated , 2019 with Ladenburg Thalmann & Co., Inc., as the representative of the underwriters (the "representative") named below and the sole book-running manager of this offering. Subject to the terms and conditions of the underwriting agreement, the underwriters have agreed to purchase the number of our securities set forth opposite its name below.

Underwriter	Class A Units	Class B Units
Ladenburg Thalmann & Co., Inc.	[•]	[•]
Total	[•]	[•]

A copy of the underwriting agreement will be filed as an exhibit to the registration statement of which this prospectus is a part.

We have been advised by the underwriters that they propose to offer the units directly to the public at the public offering price set forth on the cover page of this prospectus. Any securities sold by the underwriters to securities dealers will be sold at the public offering price less a selling concession not in excess of $[●] per share and $[●] per warrant. The underwriting agreement provides that the underwriters' obligation to purchase the securities we are offering is subject to conditions contained in the underwriting agreement.

No action has been taken by us or the underwriters that would permit a public offering of the units, or the shares of common stock, shares of preferred stock and warrants included in the units, in any jurisdiction outside the United States where action for that purpose is required. None of our securities included in this offering may be offered or sold, directly or indirectly, nor may this prospectus or any other offering material or advertisements in connection with the offer and sales of any of the securities offering hereby be distributed or published in any jurisdiction except under circumstances that will result in compliance with the applicable rules and regulations of that jurisdiction. Persons who receive this prospectus are advised to inform themselves about and to observe any restrictions relating to this offering of securities and the distribution of this prospectus. This prospectus is neither an offer to sell nor a solicitation of any offer to buy the securities in any jurisdiction where that would not be permitted or legal.

The underwriters have advised us that they do not intend to confirm sales to any account over which they exercise discretionary authority.

Underwriting Discount and Expenses

The following table summarizes the underwriting discount and commission to be paid to the underwriters by us.

	Per Class A Unit (1)	Per Class B Unit (1)	Total	Total Including Over-Allotment(2)
Public offering price	$ [•]	$ [•]	$ [•]	$ [•]
Underwriting discount and commissions to be paid to the underwriters by us (3)	[•]	[•]	[•]	[•]
Proceeds to us (before expenses)	$ [•]	$ [•]	$ [•]	$ [•]

(1) The public offering price and underwriting discount corresponds to (x) in respect of the Class A Units (i) a public offering price per share of common stock of $ [•] and (ii) a public offering price per warrant of $ [•] and (y) in respect of the Class B Units (i) a public offering price per share of Series A Preferred Stock of $ [•] and (ii) a public offering price per warrant of $[•].

(2) We have granted the representative an option, which is exercisable not later than 45 days after the date of this prospectus, to purchase a number of additional shares of common stock in an amount that is up to 15% of the number of shares of common stock sold in the primary offering (which number includes the number of shares of common stock issuable upon conversion of shares of the Series A Preferred Stock, but excludes any shares of common stock underlying the warrants issued in this offering, and any shares of common stock issued upon any exercise of the over-allotment option). These shares would be sold to the representative at the public offering price per share of common stock sold in the primary offering, less the underwriting discounts and commissions. Further, the option we have granted to the representative is also exercisable not later than 45 days after the date of this prospectus to purchase a number of additional warrants in an amount that is up to 15% of the warrants sold in the primary offering at the public offering price per warrant set forth on the cover page hereto (which is $ [•] per warrant), less the underwriting discounts and commissions. The representative may exercise the option to cover over-allotments, if any, made in connection with this offering. If any additional shares of common stock and/or warrants are purchased from us under this over-allotment option, the representative will offer these shares of common stock and/or warrants on the same terms as those on which the other securities are being offered.

(3) Underwriting discounts and commissions per Unit with respect to the sale of Units to the Public will be 8% and underwriting discounts and commissions per Unit with respect to the sale of Units to certain Company investors and insiders will be 3%.

We estimate the total expenses payable by us for this offering to be approximately[●], which amount includes (i) the underwriting discount of 8% per Unit with respect to the sale of Units to the public and 3% per Unit with respect to the sale of Units to certain Company insiders (8% per Unit with respect to the sale of Units to the public if the underwriters' over-allotment option is exercised in full); and (ii) reimbursement of the accountable expenses of the representative equal to $90,000 including the legal fees of the representative being paid by us and (iii) other estimated company expenses of approximately $90,727 which includes legal, accounting, and printing costs and various fees associated with the registration and listing of our shares.

The securities we are offering are being offered by the underwriters subject to certain conditions specified in the underwriting agreement.

Over-allotment Option

We have granted the representative an option, which is exercisable not later than 45 days after the date of this prospectus, to purchase a number of additional shares of common stock in an amount that is up to 15% of the number of shares of common stock sold in the primary offering (which number includes the number of shares of common stock issuable upon conversion of shares of the Series A Preferred Stock, but excludes any shares of common stock underlying the warrants issued in this offering, and any shares of common stock issued upon any exercise of the over-allotment option). These shares would be sold to the representative at the public offering price per share of common stock sold in the primary offering, less the underwriting discounts and commissions. Further, the option we have granted to the representative is also exercisable not later than 45 days after the date of this prospectus to purchase a number of additional warrants in an amount that is up to 15% of the warrants sold in the primary offering at the public offering price per warrant set forth on the cover page hereto (which is $ [•] per warrant), less the underwriting discounts and commissions. The representative may exercise the option to cover over-allotments, if any, made in connection with this offering. If any additional shares of common stock and/or warrants are purchased from us under this over-allotment option, the representative will offer these shares of common stock and/or warrants on the same terms as those on which the other securities are being offered.

Nasdaq Listing

Our common stock is currently traded on The Nasdaq Capital Market under the symbol “YTEN.” On September 6, 2019 the closing price of our common stock was $0.79 per share. We do not intend to apply for listing of the Series A Preferred Stock or warrants on any securities exchange or other trading system.

Determination of Offering Price

The public offering price of the securities offered by this prospectus will be determined by negotiation between us and the underwriters. Among the factors considered in determining the public offering price of the units were:

- our history and our prospects;

- the industry in which we operate;
- our past and present operating results;
- the previous experience of our executive officers; and
- the general condition of the securities markets at the time of this offering.

The offering price stated on the cover page of this prospectus should not be considered an indication of the actual value of the securities sold in this offering. That price is subject to change as a result of market conditions and other factors and we cannot assure you that the shares of common stock, shares of Series A Preferred Stock and warrants sold in this offering can be resold at or above the public offering price.

Lock-up Agreements

Our officers, directors and each of their respective affiliates and associated persons have agreed with the representative to be subject to a lock-up period of 90 days following the date of this prospectus. This means that, during the applicable lock-up period, such persons may not offer for sale, contract to sell, sell, distribute, grant any option, right or warrant to purchase, pledge, hypothecate or otherwise dispose of, directly or indirectly, any shares of our common stock or any securities convertible into, or exercisable or exchangeable for, shares of our common stock. Certain limited transfers are permitted during the lock-up period if the transferee agrees to these lock-up restrictions. We have also agreed, in the underwriting agreement, to similar lock-up restrictions on the issuance and sale of our securities for 90 days following the closing of this offering, although we will be permitted to issue stock options or stock awards to directors, officers and employees under our existing plans. The lock-up period is subject to an additional extension to accommodate for our reports of financial results or material news releases. The representative may, in its sole discretion and without notice, waive the terms of any of these lock-up agreements.

Other Relationships

Upon completion of this offering, and subject to certain conditions, we have granted the representative a right of first refusal to act as lead or co-lead bookrunner or lead or co-lead placement agent in connection with any subsequent public or private offering of equity securities or other capital markets financing by us. This right of first refusal extends for 9 months from the closing date of this offering. The terms of any such engagement of the representative will be determined by separate agreement.

Stabilization, Short Positions and Penalty Bids

In order to facilitate the offering, the underwriters may engage in transactions that stabilize, maintain or otherwise affect the price of our shares of common stock. In connection with the offering, the underwriters may purchase and sell our shares of common stock in the open market. These transactions may include short sales, purchases on the open market to cover positions created by short sales and stabilizing transactions. Short sales involve the sale by the underwriters of a greater number of shares of common stock than they are required to purchase in the offering. "Covered" short sales are sales made in an amount not greater than the underwriters' option to purchase additional shares of common stock in the offering pursuant to the exercise of their over-allotment option to purchase additional shares of common stock and/or warrants. The underwriters may close out, or satisfy, any covered short position by either exercising the over-allotment option, in which case the shares of common stock or warrants would be purchased directly from us, or purchasing shares of common stock in the open market. Because none of our warrants, including those to be sold in this offering, are publicly listed for trading on a securities exchange, the underwriters would need to purchase warrants directly from us as part of an exercise of the over-allotment option in order to be able to deliver both of the components of the units that are being sold to the investors in the offering when closing out any covered short position. The underwriters will pay the same price for any exercise of the over-allotment options as the public offering price for the securities sold in this offering, less the underwriting discount. With respect to a share of common stock, this price will be $[●] per share, and with respect to a warrant, this price will be $[●] per warrant. In determining the source of shares of common stock that may be needed to close out a covered short position, the underwriters will consider, among other things, the price of common stock that is then available for purchase in the open market as compared to the price at which they may

purchase shares of common stock directly from us through the over-allotment option. "Naked" short sales are sales in excess of the over-allotment option. The underwriters must close out any naked short position by purchasing shares of common stock in the open market. A naked short position is more likely to be created if the underwriters are concerned that there may be downward pressure on the price of our shares of common stock in the open market after pricing that could adversely affect investors who purchase in the offering.

- Stabilizing transactions permit bids to purchase the underlying security so long as the stabilizing bids do not exceed a specific maximum.
- Penalty bids permit the underwriters to reclaim a selling concession from a syndicate member when the securities originally sold by the syndicate member are purchased in a stabilizing or syndicate covering transaction to cover syndicate short positions.

These stabilizing transactions and penalty bids may have the effect of raising or maintaining the market prices of our securities or preventing or retarding a decline in the market prices of our securities. As a result the price of our common stock may be higher than the price that might otherwise exist in the open market. Neither we nor the underwriters make any representation or prediction as to the effect that the transactions described above may have on the price of our common stock. These transactions may be effected on Nasdaq, in the over-the-counter market or on any other trading market and, if commenced, may be discontinued at any time.

In connection with this offering, the underwriters also may engage in passive market making transactions in our common stock in accordance with Regulation M during a period before the commencement of offers or sales of shares of our common stock in this offering and extending through the completion of the distribution. In general, a passive market maker must display its bid at a price not in excess of the highest independent bid for that security. However, if all independent bids are lowered below the passive market maker’s bid that bid must then be lowered when specific purchase limits are exceeded. Passive market making may stabilize the market price of the securities at a level above that which might otherwise prevail in the open market and, if commenced, may be discontinued at any time.

Neither we, nor the underwriters make any representation or prediction as to the direction or magnitude of any effect that the transactions described above may have on the prices of our securities. In addition, neither we nor the underwriters make any representation that the underwriters will engage in these transactions or that any transactions, once commenced will not be discontinued without notice.

Indemnification

We have agreed to indemnify the underwriters against certain liabilities, including certain liabilities arising under the Securities Act or to contribute to payments that the underwriters may be required to make for these liabilities.

DISCLOSURE OF COMMISSION POSITION ON INDEMNIFICATION FOR SECURITIES ACT LIABILITIES

Insofar as indemnification for liabilities arising under the Securities Act may be permitted to directors, officers, and controlling persons of the registrant pursuant to the foregoing provisions, or otherwise, the registrant has been informed that in the opinion of the SEC such indemnification is against public policy as expressed in the Securities Act and is, therefore, unenforceable.

LEGAL MATTERS

Mintz, Levin, Cohn, Ferris, Glovsky and Popeo, P.C., Boston, Massachusetts, will pass upon the validity of the issuance of the securities offered by this prospectus. Certain legal matters in connection with this offering will be passed upon for the underwriters by Ellenoff Grossman & Schole LLP., New York, New York.

EXPERTS

The consolidated financial statements of Yield10 Bioscience, Inc. as of December 31, 2018 and 2017, and for each of the years in the two-year period ended December 31, 2018 incorporated in this Prospectus by reference to the Yield10 Bioscience, Inc.'s Current Report on Form 8-K filed on September 9, 2019 have been audited by RSM US LLP, an independent registered public accounting firm, as stated in their report thereon (which report expresses an unqualified opinion and includes an explanatory paragraph relating to the change in method of accounting for leasing transactions due to the adoption of Financial Accounting Standard Board's Accounting Standards Update 2016-02, *Leases* and an explanatory paragraph relating to going concern), incorporated herein by reference, and have been incorporated in this Prospectus and Registration Statement in reliance upon such report and upon authority of such firm as experts in accounting and auditing.

WHERE YOU CAN FIND MORE INFORMATION

We file annual, quarterly and other periodic reports, proxy statements and other information with the SEC. You can read our SEC filings over the Internet at the SEC’s website at www.sec.gov.

Our Internet address is *www.yield10bio.com*. There we make available free of charge, on or through the investor relations section of our website, annual reports on Form 10-K, quarterly reports on Form 10-Q, current reports on Form 8-K and amendments to those reports filed pursuant to Section 13(a) or 15(d) of the Exchange Act as soon as reasonably practicable after we electronically file such material with the SEC. The information found on our website is not part of this prospectus supplement or the accompanying prospectus.

INCORPORATION OF CERTAIN DOCUMENTS BY REFERENCE

The SEC allows us to “incorporate by reference” much of the information we file with them, which means that we can disclose important information to you by referring you to those publicly available documents. The information that we incorporate by reference in this prospectus is considered to be part of this prospectus. Because we are incorporating by reference future filings with the SEC, this prospectus is continually updated and those future filings may modify or supersede some of the information included or incorporated in this prospectus. You should refer to the registration statement, including the exhibits, for further information about us and the securities we may offer pursuant to this prospectus. Statements in this prospectus regarding the provisions of certain documents filed with, or incorporated by reference in, the registration statement are not necessarily complete and each statement is qualified in all respects by that reference. We incorporate by reference into this prospectus the documents listed below and any future filings made by us with the SEC under Sections 13(a), 13(c), 14 or 15(d) of the Exchange Act (1) after the date of this prospectus and prior to the time that all of the securities offered by this prospectus are sold or the earlier termination of the offering, and (2) after the date of the initial registration statement of which this prospectus forms a part and prior to the effectiveness of the registration statement (except in each case in which the information contained in such documents is “furnished” and not “filed”). The documents we are incorporating by reference as of their respective dates of filing are:

- Annual Report on Form 10-K for the year ended December 31, 2018, filed with the SEC on March 28, 2019;
- The portions of our Definitive Proxy Statement on Schedule 14A that are deemed "filed" with the SEC under the Exchange Act, filed on April 4, 2019;
- Quarterly Reports on Form 10-Q filed with the SEC on May 15, 2019 and August 12, 2019, as amended where applicable;
- Current Reports on Form 8-K filed with the SEC on March 15, 2019, March 25, 2019, May 9, 2019, May 23, 2019, July 1, 2019, August 12, 2019, August 19, 2019, and September 9, 2019 (except in each case in which the information contained in such documents is "furnished" and not "filed").
- The description of our common stock contained in Item 1 of our Registration Statement on Form 8-A filed with the SEC on November 6, 2006, including any amendments or reports filed for the purpose of updating the description.

We will provide, without charge to each person, including any beneficial owner, to whom this prospectus is delivered, upon written or oral request of such person, a copy of any or all of the documents incorporated herein by reference other than exhibits, unless such exhibits are specifically incorporated by reference into such documents or this document. Requests for such documents should be addressed in writing or by telephone to:

Investor Relations
Yield10 Bioscience, Inc.
19 Presidential Way
Woburn, Massachusetts 01801
(617) 583-1700

Class A Units consisting of one share of common stock and 0.5 warrants and Class B Units consisting of one share of Series A Preferred Stock and warrants (and shares of common stock underlying shares of Series A Preferred Stock and warrants)

Prospectus

Ladenburg Thalmann

September ___, 2019

PART II INFORMATION NOT REQUIRED IN PROSPECTUS

Item 13. Other Expenses of Issuance and Distribution.

The following table sets forth the costs and expenses, payable by the Company in connection with the registration and sale of the securities being registered. All amounts are estimates except the SEC registration fee.

	Amount to be paid ($)
SEC registration fee	$ 727.20
Legal fees and expenses	150,000.00
Accounting fees and expenses	15,000.00
Other	15,000.00
Total	$ 180,727.20

Item 14. Indemnification of Directors and Officers.

Pursuant to Section 145 of the DGCL, our amended and restated by-laws provide that each director or officer of Yield10 Bioscience, who was or is made a party or is threatened to be made a party to or is involved in any threatened, pending or completed action, suit or proceeding, whether civil, criminal, administrative or investigative, by reason of the fact that he or she, or a person of whom he or she is the legal representative, is or was a director or officer of Yield10 Bioscience, or is or was serving at the request of Yield10 Bioscience as a director, officer, employee or agent of another corporation or of a partnership, joint venture, trust or other enterprise, including service with respect to employee benefit plans, shall be indemnified and held harmless by Yield10 Bioscience to the fullest extent authorized by the DGCL.

Pursuant to Section 102(b)(7) of the DGCL, Article 7 of our amended and restated certificate of incorporation, as amended, eliminates the liability of a director to us or our stockholders for monetary damages for such a breach of fiduciary duty as a director, except for liabilities arising:

- from any breach of the director's duty of loyalty to us or our stockholders;
- from acts or omissions not in good faith or which involve intentional misconduct or a knowing violation of law;
- under Section 174 of the DGCL; and
- from any transaction from which the director derived an improper personal benefit.

We carry insurance policies insuring our directors and officers against certain liabilities that they may incur in their capacity as directors and officers. In addition, we have entered into indemnification agreements with our directors and officers.

The foregoing discussion of our certificate of incorporation, by-laws and Delaware law is not intended to be exhaustive and is qualified in its entirety by such certificate of incorporation, by-laws or law.

Item 15. Recent Sales of Unregistered Securities

On July 1, 2019, the Company issued 24,286 shares of common stock, to participants in its Yield10 Bioscience, Inc. 401(k) Plan as quarterly matching contributions. The issuance of these securities is exempt from registration pursuant to Section 3(a)(2) of the Securities Act as exempted securities.

Item 16. Exhibits and Financial Statement Schedules.

See Exhibit Index following the signature page to this Registration Statement.

Item 17. Undertakings.

The undersigned registrant hereby undertakes:

(1) To file, during any period in which offers or sales are being made, a post-effective amendment to this registration statement:

(i) To include any prospectus required by Section 10(a)(3) of the Securities Act;

(ii) To reflect in the prospectus any facts or events arising after the effective date of the registration statement (or the most recent post-effective amendment thereof) which, individually or in the aggregate, represent a fundamental change in the information set forth in the registration statement. Notwithstanding the foregoing, any increase or decrease in volume of securities offered (if the total dollar value of securities offered would not exceed that which was registered) and any deviation from the low or high end of the estimated maximum offering range may be reflected in the form of prospectus filed with the Commission pursuant to Rule 424(b) if, in the aggregate, the changes in volume and price represent no more than a 20 percent change in the maximum aggregate offering price set forth in the "Calculation of Registration Fee" table in the effective registration statement.

(iii) To include any material information with respect to the plan of distribution not previously disclosed in the registration statement or any material change to such information in the registration statement;

(2) That, for the purpose of determining any liability under the Securities Act, each such post-effective amendment shall be deemed to be a new registration statement relating to the securities offered therein, and the offering of such securities at that time shall be deemed to be the initial bona fide offering thereof.

(3) To remove from registration by means of a post-effective amendment any of the securities being registered which remain unsold at the termination of the offering.

(4) That, for the purpose of determining liability under the Securities Act to any purchaser: each prospectus filed pursuant to Rule 424(b) as part of a registration statement relating to an offering, other than registration statements relying on Rule 430B or other than prospectuses filed in reliance on Rule 430A, shall be deemed to be part of and included in the registration statement as of the date it is first used after effectiveness; provided, however, that no statement made in a registration statement or prospectus that is part of the registration statement or made in a document incorporated or deemed incorporated by reference into the registration statement or prospectus that is part of the registration statement will, as to a purchaser with a time of contract of sale prior to such first use, supersede or modify any statement that was made in the registration statement or prospectus that was part of the registration statement or made in any such document immediately prior to such date of first use.

(5) Insofar as indemnification for liabilities arising under the Securities Act may be permitted to directors, officers, and controlling persons of the registrant pursuant to the foregoing provisions, or otherwise, the registrant has been advised that in the opinion of the SEC such indemnification is against public policy as expressed in the Securities Act and is, therefore, unenforceable. In the event that a claim for indemnification against such liabilities (other than the payment by the registrant of expenses incurred or paid by a director, officer or controlling person of the registrant in the successful defense of any action, suit or proceeding) is asserted by such director, officer or controlling person in connection with the securities being registered, the registrant will, unless in the opinion of its counsel the matter has been settled by controlling precedent, submit to a court of appropriate jurisdiction the question whether such indemnification by it is against public policy as expressed in the Act and will be governed by the final adjudication of such issue.

EXHIBIT INDEX

The exhibits listed below are filed as part of or incorporated by reference into this Registration Statement on Form S-1. Where certain exhibits are incorporated by reference from a previous filing, the exhibit numbers and previous filings are identified in parentheses.

Exhibit No.		Identification of Exhibit
1.1	#	Form of Underwriting Agreement.
2.1		Purchase Agreement between Metabolix, Inc. and CJ Research Center LLC, dated September 16, 2016, (incorporated by reference herein to the exhibits to the Company's Report on Form 8-K filed on September 21, 2016 (File No. 001-33133)).
3.1		Amended and Restated Certificate of Incorporation of the Company, as amended (incorporated by reference herein to the exhibits to the Company's Quarterly Report on Form 10-Q for the quarter ended June 30, 2018 (File No. 001-33133)).
3.2		Amended and Restated By-Laws of the Company (incorporated by reference herein to the exhibits to the Company's Report on Form 8-K filed on January 6, 2017 (File No. 001-33133)).
3.3	#	Form of Certificate of Designation of Series A Preferred Stock.
4.1		Specimen Stock Certificate for shares of the Registrant's Common Stock (incorporated by reference herein to the exhibits to the Company's Registration Statement on Form S-1/A filed on September 21, 2006 (File No. 333-135760)).
4.2	#	Form of Series A Preferred Stock Certificate.
4.3		Form of Investor Warrant to Purchase Common Stock (incorporated by reference herein to the exhibits to the Company's Report on Form 8-K filed on July 5, 2017 (File No. 001-33133)).
4.4		Form of Series A Common Warrant to purchase shares of Common Stock (incorporated by reference herein to the exhibits to the Company's Registration Statement on Form S-1/A filed December 15, 2017 (File No. 333-221283)).
4.5	#	Form of Common Warrant to purchase shares of Common Stock to be issued in this offering.
5.1	#	Opinion of Mintz, Levin, Cohn, Ferris, Glovsky and Popeo, P.C.
10.1	@	2006 Stock Option and Incentive Plan (incorporated by reference herein to the exhibits to the Company's Registration Statement on Form S-1/A filed on October 20, 2006 (File No. 333-135760)).
10.1.1	@	2006 Stock Option and Incentive Plan, Form of Incentive Stock Option Agreement (incorporated by reference herein to the exhibits to the Company's Registration Statement on Form S-1/A filed on October 20, 2006 (File No. 333-135760)).
10.1.2	@	2006 Stock Option and Incentive Plan, Form of Non-Qualified Stock Option Agreement (incorporated by reference herein to the exhibits to the Company's Registration Statement on Form S-1/A filed on October 20, 2006 (File No. 333-135760)).
10.1.3	@	2006 Stock Option and Incentive Plan, Form of Director Non-Qualified Stock Option Agreement (incorporated by reference herein to the exhibits to the Company's Registration Statement on Form S-1/A filed on October 20, 2006 (File No. 333-135760)).
10.2	@	2014 Stock Option and Incentive Plan, Revised and Restated (incorporated by reference herein to the Company's Quarterly Report on Form 10-Q for the quarter ended June 30, 2015 (File No. 001-33133)).
10.2.1	@	2014 Stock Option and Incentive Plan, Form of Incentive Stock Option Award (incorporated by reference herein to the exhibits to the Company's 2014 Annual Report on Form 10-K filed on March 25, 2015 (File No. 001-33133)).
10.2.2	@	2014 Stock Option and Incentive Plan, Form of Non-Qualified Stock Option Award (incorporated by reference herein to the exhibits to the Company's 2014 Annual Report on Form 10-K filed on March 25, 2015 (File No. 001-33133)).

10.2.3	@	2014 Stock Option and Incentive Plan, Form of Restricted Stock Unit Award (incorporated by reference herein to the exhibits to the Company's 2014 Annual Report on Form 10-K filed on March 25, 2015 (File No. 001-33133)).
10.2.4	@	2018 Stock Option and Incentive Plan (incorporated by reference herein to the exhibits to the Company's Quarterly Report on Form 10-Q for the quarter ended June 30, 2018 (File No. 001-33133)).
10.2.5	@	2018 Stock Option and Incentive Plan, form of Stock Option Agreement (incorporated by reference herein to the exhibits to the Company's Annual Report on Form 10-K filed on March 28, 2019 (File No. 001-33133)).
10.3	@	Employment Agreement between the Company and Oliver P. Peoples dated March 28, 2017 (incorporated by reference herein to the exhibits to the Company's 2016 Annual Report on Form 10-K filed on March 30, 2017 (File No. 001-33133)).
10.4	@	Employment Agreement between the Company and Charles B. Haaser dated March 28, 2017 (incorporated by reference herein to the exhibits to the Company's 2016 Annual Report on Form 10-K filed on March 30, 2017 (File No. 001-33133)).
10.5	@	Employment Agreement between the Company and Lynne H. Brum dated March 28, 2017 (incorporated by reference herein to the exhibits to the Company's 2016 Annual Report on Form 10-K filed on March 30, 2017 (File No. 001-33133)).
10.6	@	Employment Agreement between the Company and Kristi Snell dated March 28, 2017 (incorporated by reference herein to the exhibits to the Company's 2016 Annual Report on Form 10-K filed on March 30, 2017 (File No. 001-33133)).
10.7	@	Noncompetition, Confidentiality and Inventions Agreement between the Company and each of Oliver Peoples, Charles Haaser, Lynne H. Brum and Kristi Snell, dated March 28, 2017 (incorporated by reference herein to the exhibits to the Company's 2016 Annual Report on Form 10-K filed on March 30, 2017 (File No. 001-33133)).
10.8	@	Form of Indemnification Agreement between the Registrant and its Directors and Officers (incorporated by reference herein to the exhibits to the Company's Registration Statement on Form S-1/A filed on October 20, 2006 (File No. 333-135760)).
10.9	@	Non-Qualified Stock Option Agreement between the Company and Joseph Shaulson dated December 19, 2013 (incorporated by reference herein to the exhibits to the Company's Quarterly Report on Form 10-Q for the quarter ended March 31, 2014 (File No. 001-33133)).
10.10	@	Restricted Stock Unit Award Agreement between the Registrant and Joseph Shaulson dated March 24, 2014 (incorporated by reference herein to the exhibits to the Company's Quarterly Report on Form 10-Q for the quarter ended March 31, 2014 (File No. 001-33133)).
10.11	@	Separation Agreement between the Company and Joseph Shaulson, dated as of November 3, 2016 (incorporated by reference herein to the exhibits to the Company's Annual Report on Form 10-K filed on March 30, 2017 (File No. 001-33133)).
10.12		Lease between Fortune Wakefield, LLC and Metabolix, Inc. dated March 30, 2007 (incorporated by reference herein to the exhibits to the Company's Quarterly Report on Form 10-Q for the quarter ended March 31, 2007 (File No. 001-33133)).
10.12.1		First Amendment of Lease between Fortune Wakefield, LLC and Metabolix, Inc. dated February 29, 2012 (incorporated by reference herein to the exhibits to the Company's Quarterly Report on Form 10-Q for the quarter ended March 31, 2012 (File No. 001-33133)).
10.12.2		Second Amendment of Lease between Fortune Wakefield, LLC and Metabolix, Inc. dated October 24, 2013 (incorporated by reference herein to the exhibits to the Company's 2013 Annual Report on Form 10-K filed on March 28, 2014 (File No. 001-33133)).
10.13		Securities Purchase Agreement dated June 15, 2015 between the Company and the Investors named therein (incorporated by reference herein to the exhibits to the Company's Report on Form 8-K filed on June 17, 2015 (File No. 001-33133)).
10.14		Standstill Agreement dated June 19, 2015 between the Company and Jack W. Schuler, Renate Schuler and the Schuler Family Foundation (incorporated by reference herein to the exhibits to the Company's Report on Form 8-K filed on June 17, 2015 (File No. 001-33133)).

10.15		Lease Agreement between the Company and ARE MA Region No. 20, LLC dated January 20, 2016 for the premises located at 19 Presidential Way, Woburn, MA (incorporated by reference herein to the exhibits to the Company's Report on Form 8-K filed on January 26, 2016 (File No. 001-33133)).
10.16		Common Stock Purchase Agreement, dated October 7, 2015 between Metabolix, Inc. and Aspire Capital Fund, LLC (incorporated by reference herein to the exhibits to the Company's Report on Form 8-K filed on October 7, 2015 (File No. 001-33133)).
10.17	+	Exclusive License Agreement, dated as of June 30, 2015, between the Company and the University of Massachusetts (incorporated by reference herein to the exhibits to the Company's 2016 Annual Report on Form 10-K filed on March 30, 2017 (File No. 001-33133)).
10.18		Sublease between CJ Research Center LLC and the Company, dated as of September 16, 2016 (incorporated by reference herein to the exhibits to the Company's 2016 Annual Report on Form 10-K filed on March 30, 2017 (File No. 001-33133)).
10.19		Form of Securities Purchase Agreement, dated as of July 3, 2017, by and among the Company and the purchasers named therein (incorporated by reference herein to the exhibits to the Company's Report on Form 8-K filed on July 5, 2017 (File No. 333-33133)).
10.20	+	Exclusive License Agreement, dated May 17, 2018, between the Company and the University of Missouri (incorporated by reference herein to the exhibits to the Company's Quarterly Report on Form 10-Q for the quarter ended June 30, 2018 (File No. 001-33133)).
10.21		Form of Securities Purchase Agreement, dated as of March 14, 2019, by and among the Company and the purchasers named therein (incorporated by reference herein to the exhibits on Form 8-K filed on March 15, 2019 (File No. 001-33133)).
14.1		Yield10 Bioscience, Inc. Code of Business Conduct and Ethics (incorporated by reference herein to the exhibits to the Company's 2018 Annual Report on Form 10-K filed on March 28, 2019)
21.1		Subsidiaries of the Registrant (incorporated by reference herein to the exhibits to the Company's 2018 Annual Report on Form 10-K filed on March 28, 2019) (File No. 001-33133)).
23.1	*	Consent of RSM US LLP, an independent registered public accounting firm.
23.3		Consent of Mintz, Levin, Cohn, Ferris, Glovsky and Popeo, P.C. (included in Exhibit 5.1).
24.1		Power of Attorney (included in the signature pages to the Registration Statement).
101.1		The following financial information from the Yield10 Bioscience, Inc. Annual Report on Form 10-K for the year ended December 31, 2018 formatted in XBRL; (i) Consolidated Balance Sheets, December 31, 2018 and December 31, 2017; (ii) Consolidated Statements of Operations, Years Ended December 31, 2018 and 2017; (iii) Consolidated Statements of Comprehensive Income (Loss), Years Ended December 31, 2018 and 2017; (iv) Consolidated Statements of Cash Flows, Years Ended December 31, 2018 and 2017; and (v) Consolidated Statements of Stockholders' Equity for the Years Ended December 31, 2018 and 2017; and (vi) Notes to Consolidated Financial Statements (incorporated by reference herein to the exhibits to the Company's 2018 Annual Report on Form 10-K filed March 30, 2019 (File No. 001-33133)).

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*	Filed herewith.
@	Indicates a management contract or any compensatory plan, contract or arrangement.
+	Confidential treatment has been requested for certain portions of this document.
#	Exhibit will be filed by amendment.

SIGNATURES

Pursuant to the requirements of the Securities Act of 1933, the registrant has duly caused this Registration Statement on Form S-1 to be signed on its behalf by the undersigned, thereunto duly authorized, in the City of Woburn, Massachusetts, on September 9, 2019.

YIELD10 BIOSCIENCE, INC.

By /s/ Oliver P. Peoples
Oliver P. Peoples
President and Chief Executive Officer

POWER OF ATTORNEY

We, the undersigned directors and officers of Yield10 Bioscience, Inc., hereby severally constitute and appoint Oliver P. Peoples, Charles B. Haaser, and Lynne H. Brum, and each of them singly, our true and lawful attorneys, with full power to them, and to each of them singly, to sign for us and in our names in the capacities indicated below, the registration statement on Form S-1 filed herewith, and any and all pre-effective and post-effective amendments to said registration statement, and any registration statement filed pursuant to Rule 462(b) under the Securities Act of 1933, as amended, in connection with the registration under the Securities Act of 1933, as amended, of equity securities of the Company, and to file or cause to be filed the same, with all exhibits thereto and other documents in connection therewith, with the Securities and Exchange Commission, granting unto said attorneys, and each of them, full power and authority to do and perform each and every act and thing requisite and necessary to be done in connection therewith, as fully to all intents and purposes as each us might or could do in person, and hereby ratifying and confirming all that said attorneys, and each of them, or their substitute or substitutes, shall do or cause to be done by virtue of this Power of Attorney.

Pursuant to the requirements of the Securities Act of 1933, this Registration Statement on Form S-1 has been signed below by the following persons in the capacities and on the dates indicated.

Signatures	Title	Date
/s/ Oliver P. Peoples Oliver P. Peoples	Director, President and Chief Executive Officer (Principal Executive Officer)	September 9, 2019
/s/ Charles B. Haaser Charles B. Haaser	Chief Accounting Officer (Principal Financial Officer and Principal Accounting Officer)	September 9, 2019
/s/ Joseph Shaulson Joseph Shaulson	Director	September 9, 2019
/s/ Peter N. Kellogg Peter N. Kellogg	Director	September 9, 2019
/s/ Richard Hamilton Richard Hamilton	Director	September 9, 2019
/s/ Anthony J. Sinskey Anthony J. Sinskey	Director	September 9, 2019
/s/ Robert L. Van Nostrand Robert L. Van Nostrand	Director	September 9, 2019

Exhibit 23.1

CONSENT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

We consent to the incorporation by reference in this Registration Statement on Form S-1 of Yield10 Bioscience, Inc. of our report dated March 28, 2019, except for the change in method of accounting for leasing transactions due to the adoption of Financial Accounting Standard Board's Accounting Standards Update 2016-02, *Leases*, described in the Change in Accounting Principle section of Note 2, and the New Lease Accounting section of Note 11, as to which the date is September 9, 2019, relating to the consolidated financial statements of Yield10 Bioscience, Inc. and its subsidiaries, appearing in the Current Report on Form 8-K of Yield10 Bioscience, Inc. filed on September 9, 2019.

We also consent to the reference to our firm under the heading "Experts" in such Registration Statement.

/s/ RSM US LLP
Boston, Massachusetts
September 9, 2019