Zacks Small-Cap Research

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Stellar Biotechnologies (SBOT-NASDAQ)

SBOT: JV Consummated, Neovacs' Lupus Candidate Closer To Commercialization

We forecast revenue in "phase 1" of our model to grow from about $760k in fiscal 2015 to $3.2M in 2018. And then in "phase 2" to grow to just better than $110M in 2026. Our DCF model, which uses a 12% discount rate and 2% terminal growth rate, values SBOT shares at approximately $13.

Current Price (05/12/16)	$3.19
Valuation	**$13.00**

OUTLOOK

KLH is a high molecular weight protein derived from the blood of the scarce Giant Keyhole Limpet. KLH has become the carrier protein of choice in immunotherapies, ramping interest in which has fueled demand for this protein. Stellar's proprietary aquaculture (Giant Keyhole Limpet farms) and production facilities are the only source in the world capable of supplying commercial-scale quantities of the high quality KLH protein. Stellar just signed a collaboration agreement which could increase its production capacity 10-fold. The company has KLH supply and collaboration agreements supporting customer clinical trials. Additional supply agreements and, eventually to supply commercialized immunotherapies, could substantially steepen the revenue curve. JV with Neovacs just consummated, offers full life-cycle KLH opportunity.

SUMMARY DATA

52-Week High	**$9.41**
52-Week Low	**$3.05**
One-Year Return (%)	**-63.42**
Beta	**0.71**
Average Daily Volume (sh)	**35,604**
Shares Outstanding (mil)	**8**
Market Capitalization ($mil)	**$27**
Short Interest Ratio (days)	**N/A**
Institutional Ownership (%)	**1**
Insider Ownership (%)	**8**
Annual Cash Dividend	**$0.00**
Dividend Yield (%)	**0.00**
5-Yr. Historical Growth Rates	
Sales (%)	**44.3**
Earnings Per Share (%)	**N/A**
Dividend (%)	**N/A**
P/E using TTM EPS	**N/A**
P/E using 2016 Estimate	**N/A**
P/E using 2017 Estimate	**N/A**
Zacks Rank	**N/A**

Risk Level	**High,**
Type of Stock	**Small-Blend**
Industry	**Med-Biomed/Gene**

ZACKS ESTIMATES

Revenue
(in millions of $)

	Q1 (Dec)	Q2 (Mar)	Q3 (Jun)	Q4 (Sep)	Year (Sep)
2015	0.2 A	0.2 A	0.2 A	0.2 A	0.8 A
2016	0.5 A	0.3 A	0.4 E	0.6 E	1.8 E
2017					2.3 E
2018					3.2 E

Earnings per Share

	Q1 (Dec)	Q2 (Mar)	Q3 (Jun)	Q4 (Sep)	Year (Sep)
2015	-$0.17 A	-$0.05 A	$0.06 A	-$0.19 A	-$0.36 A
2016	-$0.19 A	-$0.10 A	-$0.16 E	-$0.17 E	-$0.64 E
2017					-$0.72 E
2018					-$0.68 E

Zacks Projected EPS Growth Rate - Next 5 Years % **N/A**

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Q2 2016 Financial Results

Stellar reported financial results for their second quarter ending March 31. While revenue dipped modestly from fiscal Q1 it remains elevated relative to historical levels and came in more than 25% higher than our estimate. While the company remains tight-lipped on the specifics behind the revenue numbers, they do continue to note that the top-line is being driven by an increase in the customer base, coupled with higher sales volumes to existing customers – particularly to their clinical supply customers. As we had anticipated, gross margin slipped slightly into the red – which is a reflection of lower sales volumes (as compared to Q1 when GM was +19%). But despite the slight miss to our revenue estimate, SBOT beat handily on net loss and EPS as a result of significantly tempered SG&A expense.

Q2 revenue was $326k (vs 256k estimate), all of which was related to product sales (i.e. no contract services revenue). While SBOT itemizes sources of revenue from their various supply and contract services customers in their year-end filings, they do not with interim reporting. As a reminder, product revenue in fiscal 2015 was split fairly evenly between five of SBOT's customers; Amaran, Neovacs, Araclon, AXON Neuroscience and OBI Pharma.

GM was -7% (vs. our -1% estimate), down from 19% in Q1 but up considerably from negative 65% in Q2 2015 when revenue was just $188k. Some aquaculture expenses run through COGS which are more fixed in nature and while leveragable in times of growing revenue, put downward pressure on gross margin below a certain level of sales. And as a reminder, prior periods' GM had been negatively impacted by the company choosing an accounting treatment which (conservatively) expensed all materials whether they were sold or not instead of bringing them on the balance sheet as inventory. This had the effect of flooding COGS in certain periods. Now with greater insight into salability and collectability, the company is bringing finished goods on the balance sheet which should help smooth variability going forward.

Operating expenses were $1.1M, significantly better than our $1.4M estimate. Net loss and EPS were $861k and ($0.10) and ahead of our $1.6M and ($0.19) estimates. SBOT exited the quarter with $8.0M in cash and short-term investments which management believes is sufficient to fund the company's current operations for at least the next 12 months.

Significant recent news on the operational front includes;

- an announcement of formal consummation of the JV with Neovacs
- Neovacs received FDA approval to extend their phase IIb lupus study to the U.S. and received IND approval from the S. Korean health authority where lupus is considered an orphan disease

Joint-Venture Offers Full Product Life Cycle Opportunity

Relative to the JV, as a reminder in January SBOT announced that they expected to form a joint venture ("Neostell SAS") with Neovacs S.A. This would afford Stellar the opportunity to move from just a KLH supplier to a manufacturer and seller of KLH-based vaccines. The companies have had an ongoing relationship through a supply agreement whereby Stellar has supplied KLH for Neovacs' Kinoid vaccine candidates targeting certain autoimmune disorders.

Per the terms of the supply agreement, originally penned in 2008 and recently expanded, Stellar supplies KLH as a carrier molecule for two of Neovacs' Kinoid vaccines under development for the treatment of Lupus and Crohn's disease.

Neovacs' lead candidate, IFNa-Kinoid, completed a phase I/IIa study (n=28) for lupus in 2011. Results showed IFNa-Kinoid was well tolerated and patients experienced a strong immune response with a significantly higher production of binding antibodies compared to TNF Kinoid in humans. A phase IIb study, which had originally expected to include approximately 166 patients and began patient enrollment in September 2015, has been ongoing in Europe, Latin America and Asia. In April 2016 Neovacs received IND approval from FDA to extend the study to the U.S. which also prompted an increase in total enrollment to 178 patients (in 19 countries). Full results are expected to be available in summer 2017.

It's possible that a lupus indication could be fairly near-term event – at least as it relates to S. Korea. In mid-April of this year Neovacs announced S. Korean health authorities approved an IND for their phase IIb lupus study. Importantly S. Korea is the only OECD country in which lupus is considered an orphan disease. As

such Neovacs expects to file for orphan designation, granting of which could mean Neovacs may be able to launch IFNa-Kinoid commercially in S. Korea without the need to conduct a phase III study. Neovacs has already started preparing for a potential commercial launch by partnering with Chong Kun Dan Pharmaceuticals, a S. Korean pharmaceutical (immunotherapies) company.

Stellar/Neovacs recently expanded the supply agreement to ensure sufficient KLH quantities are available to support these upcoming studies as well as a potential future commercial launch. In addition, the agreements call for Neovacs to pay Stellar for maintaining a dedicated colony of limpets. Neovacs accounted for 15% of SBOT's total 2015 revenue.

And while this and SBOT's other supply agreements are important for several reasons, including validation of the quality and sustainability of supply of SBOT's KLH as well as providing some early revenue and offering potential to supply KLH for an eventual approved therapy, this new JV offers the additional upside of participating in KLH-based vaccine sales and manufacturing. The JV will not only produce and commercialize Neovacs' vaccines (assuming eventually approved), it will also seek to supply and manufacture KLH-based products for third parties. Per terms, the JV will be owned 30% by SBOT and 70% by Neovacs.

Earlier this week (May 11th) SBOT and Neovacs formally announced the creation of the JV with an estimated closing date of June 30th (or earlier). Earlier this year Neovacs raised EUR 5M to help fund the JV manufacturing operations. SBOT noted on the Q2 call that they don't expect to make a significant financial commitment until at least the results of the IFNa-Kinoid phase II lupus study are available. Per Neovacs' Jan 21st press release announcing the collaboration, the JV is expected to be located in Paris, France and will hire between 50 and 100 employees.

We view this JV announcement as another endorsement for the quality and sustainability of the source of KLH that SBOT provides. It also provides the opportunity for SBOT to participate in the full product cycle from supply, manufacturing and sales – which broadens the scope and breathe of SBOT operations and revenue opportunities. And finally, we think this JV is another step in progress towards exploiting the expected rapid growth of immunotherapies, superiority of KLH as a carrier protein and SBOT's position as the only company in the world capable of supplying commercial-scale quantities of the high quality KLH protein.

Other recent noteworthy events…

- **Amaran / OBI Pharma:** OBI's lead candidate, OBI-822, had been in mid-to-late stage clinical testing in the U.S., S. Korea, India, Hong Kong and Taiwan for the treatment of metastatic breast cancer. It was also in a phase 2 physician-initiated clinical trial in Taiwan for the treatment of ovarian cancer (no recent updates have been announced related to the ovarian cancer program). OBI-822 utilizes KLH as a carrier protein for the carbohydrate antigen Globo-H, which is often expressed by cancer cells.

  In February 2016 OBI announced that top-line data of the phase 2/3 metastatic breast cancer study did not meet the primary endpoint of progression-free survival. But, as patients who did show an immune response demonstrated highly significant progression-free survival, coupled with the secondary endpoint of overall survival trending towards statistical significance and no safety issues reported, **OBI Pharma decided to forge ahead with a Phase 3 study.** OBI expects to meet with regulators in Taiwan, the U.S. and Europe regarding design of as Phase 3 study. Full results of the Phase 2/3 study are expected to be presented at ASCO in early June.

  What the missed endpoint in phase 2/3 means for Stellar is currently an unknown. While any supply of KLH to OBI for their clinical trials was never going to be an overly significant source of revenue for the company, supplying for a commercialized product could be. And while that is still a possibility, the likelihood became less so with the Phase 2/3 study missing the primary endpoint. We expect the picture to become clearer following OBI's meetings with regulators relative to moving to a Phase 3 study. We note, however, that even in the event OBI does not move directly to Phase 3 with their metastatic breast cancer program, that SBOT could still be providing KLH to OBI for earlier stage studies in breast and other cancers.

  Stellar recently announced that they have met all the primary objectives of the collaboration with OBI including qualification of GMP-grade Stellar KLH. The formal collaboration agreement, whereby SBOT was responsible for production and delivery of GMP grade KLH for evaluation as a potential carrier protein as well as for method development and process qualification and in return Amaran paid the company for certain expenses and costs, expired on December 31, 2015. However, the expiration has no effect on the duos' working

relationship. If all goes well, SBOT could eventually be supplying KLH for an OBI commercialized product. Next steps will be to optimize manufacturing processes for scale-up of production in the event that OBI moves into phase 3 for metastatic breast cancer.

- **Neovacs:** Neovacs' lead candidate, IFNa-Kinoid, completed a phase I/IIa study (n=28) for lupus in 2011. Results showed IFNa-Kinoid was well tolerated and patients experienced a strong immune response with a significantly higher production of binding antibodies compared to TNF Kinoid in humans. A phase IIb study, which had originally expected to include approximately 166 patients and began patient enrollment in September 2015, has been ongoing in Europe, Latin America and Asia. In April 2016 Neovacs received IND approval from the FDA approval to extend the study to the U.S. which also prompted an increase in total enrollment to 178 patients (in 19 countries). Full results are expected to be available in summer 2017.

  It's possible that a lupus indication could be fairly near-term event – at least as it relates to S. Korea. In mid-April of this year Neovacs announced S. Korean health authorities approved an IND for their phase IIb lupus study. Importantly S. Korea is the only OECD country in which lupus is considered an orphan disease. As such Neovacs expects to file for orphan designation, granting of which could mean Neovacs may be able to launch IFNa-Kinoid commercially in S. Korea without the need to conduct a phase III study. Neovacs has already started preparing for a potential commercial launch by partnering with Chong Kun Dan Pharmaceuticals, a S. Korean pharmaceutical (immunotherapies) company.

  Stellar/Neovacs recently expanded the supply agreement to ensure sufficient KLH quantities are available to support these upcoming studies as well as a potential future commercial launch.
  The development progress including commencement of later-stage, larger clinical studies should provide opportunity for increasing KLH-supply sales to Neovacs in the near-term. Eventual commercialization and continuance of the KLH supply agreement would provide the potential for significantly greater revenue upside, although this is obviously dependent on further successful clinical development, including phase II and III trials.

- **Araclon:** Per a November 2014 agreement, Stellar will supply Araclon with KLH to support their phase II/III clinical trials for their Alzheimer's candidate. Upon eventual commercialization, Stellar will also have the opportunity to supply KLH for commercial production. Per the only Alzheimer's study (n=350) on clinicaltrials.gov sponsored by Grifols, the study is still recruiting patients. If this study is successful and another phase III study is not required, this Araclon relationship could possibly represent one of the most near-term commercial supply opportunity for Stellar.

- **AXON Neuroscience:** As a reminder, in November 2015 AXON Neuroscience (private) presented positive phase I data on its Alzheimer's disease active vaccine candidate, AADvac1, at the annual International Trials on Alzheimer's Disease Conference (CTAD) in November. AADvac1, which utilizes KLH as a carrier protein, is being developed to generate specific antibodies against diseased forms of tau protein. The presentation at CTAD showed AADvac1 to be safe, well tolerated and induced a "robust response in the vast majority of the study participants and the average cognition of patients remained stable over 6 months." And while AXON's announcement did not specificy where they source their KLH, it appears that it may be from Stellar (we asked on the Q4 conf call but due to confidentiality agreement mgmt. could not confirm) given that revenue from AXON contributed ~$120k in fiscal 2015. A phase II study, designed to confirm phase I results in a larger population, is expected to begin in the near term. Clinicaltrials.gov lists AXON's phase II Alzheimer's study (n=185) as having a start date of March 2016 and currently recruiting. Assuming SBOT supplies the KLH for this study, it should provide an even greater contribution to Stellar in fiscal 2016.

BACKGROUND

In order to frame KLH's role and opportunity as therapeutic component and diagnostic agent we think it is helpful to first provide a primer on the immune system and immunotherapies. We then discuss KLH in detail and including its unique characteristics as a carrier protein and provide context of how these can be of benefit to development of novel immunotherapies.

Immune System

The immune system functions to protect the body against disease, or pathogens. A properly functioning immune system can differentiate between healthy and pathogenic tissue and only attack the latter. The immune system can be categorized into two separate sub-components, the innate system and the adaptive system. The innate system, also called the non-specific immune system, acts as an immediate defense to pathogens but is a relatively short-lived response. It also activates the adaptive immune system, also known as the specific immune system. Unlike the innate system, the adaptive system is highly specific to particular pathogens and can provide long-lasting defense.

The major cells of interest of the **innate immune system** include phagocytes and lymphocytes. Phagocytes (derived from the Greek word "phagein", meaning "eat") are a group of immune cells that eat harmful bacteria, viruses and dead or comprised cells. These immune system cells are activated by the presence of antigens - which are substances that the body identifies as foreign. There are different types of phagocytes including mast cells, neutrophils, macrophages and dendritic cells. Mast cells reside in mucosal tissue and while mostly known for their role in allergies, also are involved in fighting pathogens. **Mast cells**, through the release of granules, present characteristic immune response symptoms such as inflammation. Mast cells also recruit neutrophils and macrophages. **Neutrophils** are the most abundant type of white blood cells and are one of the first defenses, eating pathogens until they die. **Macrophages** are found in all tissues. They respond slower than neutrophils but are longer lasting and have more capacity. Macrophages also play a part in alerting the adaptive immune system. **Dendritic** cells are similar to macrophages as they are also eater cells and play an important role in alerting the adaptive immune system. But unlike macrophages, dendritic cells are only found in tissue that is in contact with the external environment such as the skin, nose and lungs, among other areas.

The **adaptive system** is more specialized than the innate system in that specific white blood cells of the adaptive system only bind to specific antigens. This tailored immune response allows for maximum killing efficiency. It also provides for development of immunity to a specific pathogen, which is similar to how vaccines work. Lymphocytes, T cells and B cells, account for about 30% of all white blood cells and are the major cells of the adaptive immune system. Lymphocytes originate in the bone marrow and migrate to parts of the lymphatic system including the lymph nodes.

T cells move from the bone marrow to the thymus. There are two types of T cells; **helper T cells** and **killer T cells**. Helper T cells' role is to activate B cells and killer T cells to eradicate pathogens. Helper T cells must be first activated which occurs when a phagocyte (from the innate system) presents an antigen from a foreign particle which it has eaten to the receptor of a helper T cell. The helper T cell then divides and produces proteins which activate B cells and killer T cells.

B cells and killer T cells have receptors on their surfaces which bind only to specific pathogens. These receptors adapt to pathogenic invasion which accounts for the ability to build immunity. Acquired immunity relies on the ability of these lymphocytes to differentiate between "self" antigens from healthy cells and those of foreign cells. The B and killer T cells search for antigens matching their specific receptors, recognizing infected cells by the presence of traces of the receptor-specific antigen on their surface.

When a killer T cell finds its receptor specific antigen, it kills the foreign cell. When the B cell finds its receptor specific antigen it is activated by the helper T cell, then divides and creates plasma cells and B memory cells. Plasma cells produce B-cell receptor matching antibodies which attract phagocytes which then kill the foreign cells. B memory cells, as their name suggests, remember specific pathogens and help trigger a more rapid immune response the next time it invades the body - which is part of the immunity-building process.

Immunotherapies
Immunotherapies involve the stimulation or suppression (or a combination of both) of the body's own immune system to fight diseases. Currently used immunotherapies are made of one or more natural, recombinant and synthetic components. Cell immunotherapies are those which are composed of living cells.

Active immunotherapies (also known as vaccines) stimulate the immune system by presenting antigens associated with a particular disease which triggers an immune response. Active immunotherapies are believed to have certain significant advantages over traditional drugs such as chemotherapy including less severe side effects and immune "memory". Active immunotherapies can take a wide variety of different forms with an array of ways that they activate a therapeutic benefit. There are three main categories of active immunotherapies; prophylactic, autologous and allogeneic.

- Prophylactic: instead of fighting an active disease, prophylactic immunotherapies prevent a disease by presenting an antigen prior to the disease afflicting a person. Following administration with a prophylactic vaccine the immune system can recognize foreign cells and destroy them. Cervarix (GSK) and Gardasil (MRK), both vaccines against human papilloma virus (HPV), are probably the most recognizable prophylactic immunotherapies.
- Autologous: both autologous and allogenic immunotherapies are given to the patient after the disease is diagnosed. Autologous vaccines are "personalized" in the sense that they contain antigens from each individual patient. While potentially more effective, these are typically more expensive to manufacture and may have less commercial opportunity than allogenic immunotherapies due to their patient-specific nature. Provenge, approved by the FDA in April 2010 for metastatic prostate cancer, was the first autologous cancer vaccine to make it to the U.S. market.
- Allogeneic: most (~70% - 75%) active immunotherapies currently under development are allogeneic (i.e. "non-personalized" or "off-the-shelf"), which are composed of tumor antigens of one or more patients and not specific for a particular person.

Delivery of both autologous and allogeneic vaccines can take several forms including;

- Dendritic cell-based immunotherapy: As explained above, dendritic cells are eater cells located in areas of the body that is in contact with the outside environment. Dendritic cells are taken from the body, pulsed with an antigen, which activates the dendritic cells, and then transfused back into the patient. The dendritic-pulsed cells then eat the antigen-expressing invaders and also initiates the adaptive immune response.
- T-cell adoptive transfer: T cells with affinity to fight specific pathogens or tumors are removed from the body and multiplied in vitro. These are then transferred back into the patient along with administration of certain interleukins, which enhances the T cell cancer fighting activity.
- Autologous immune enhancement: certain immune cells, mostly natural killer cells and T lymphocytes, are removed from the peripheral blood of a patient, multiplied, activated and then transferred back into the patient.
- Genetically engineered T cells: also used primarily with cancer. The goal is to increase immunogenicity of target tumor antigens. To do this the specificity of the T cell receptor is modified. T cells are removed from the body and exposed to a virus that is predisposed to recognize tumor antigens. This creates genetically engineered T cells which are then multiplied and transferred back into the patient.

Passive immunotherapies do not by themselves trigger an immune response but instead directly target the disease by injection of immune compounds (such as antibodies, cytokines, macrophages and B cells) into the disease location. Passive immunotherapies are, essentially, acute treatment where the antibodies kill cells as long as the antibodies remains in the body. Passive immunotherapies have drawbacks compared to active immunotherapies. Those being that they may not specifically target foreign cells and therefore also kill healthy cells and they do not normally licit a "learned" immune response - therefore they do not educate the immune system to fight the disease.

Immunotherapy Market

While forecasts differ in terms of the overall level of expected growth of immunotherapies, it seems there is a consensus that this space is garnering significant interest and will likely be one of the leading areas of drug development.

Healthcare industry research company Decision Resources Group recently published a report which forecasts the global cancer immunotherapy market to grow from $1.1B in 2012 to about $9B in 2022. While this represents a robust CAGR of almost 25%, it pales in comparison to forecasts by Citigroup analysts who expect the cancer immunotherapy market to blossom to up to $35B over the next 10 years. In addition, Citi analyst Andrew Baum believes immunotherapies will be used to treat about 60% of all cancers, citing the potential that these drugs may one day turn cancer into a more manageable chronic disease rather than the typical death sentence of today.

Still, another source, GBI Research, forecasts the cancer vaccines market to grow from approximately $1.7B in 2010 to $6.3B in 2017 (21% CAGR). GBI research notes that this growth will be driven by "the launch of promising Phase III molecules in cervical cancer lung cancer, pancreatic cancer and melanoma."

Carrier Proteins

Molecules that trigger an immune response are termed "immunogenic". While all immunogens are antigens, not all antigens are immunogenetic - that is, not all antigens are capable of soliciting an immune response. Certain attributes must be present for an antigen to be immunogenic; foreign substance, high molecular weight and chemically complex.

While the body may often be able to distinguish "self" from "non-self" substances (i.e. the foreign substance criteria may often be met), certain antigens are of too low molecular weight and/or too low complexity to be immunogenic. Proteins, which are relatively large and complex molecules, are typically highly immunogenic, other molecules such as peptides, lipids, nucleic acids and carbohydrates are generally not due to lack of complexity or weight.

Small molecules and peptides which are used as antigens are called haptens. In order for these haptens to elicit an immune response they must be conjugated with a carrier protein, which is sufficiently large and complex to be immunogenic. Antibodies are then able to be produced against the antigen/hapten. KLH, of high complexity and molecular weight, has been found to be an excellent carrier protein and has been used extensively in clinical drug trials.

KLH

KLH is the most widely used carrier protein. It is a high molecular weight, oxygen-carrying glycoprotein derived from the hemolymph of the ocean mollusk, the Giant Keyhole Limpet (Megathura crenulata). It is a respiratory protein with two copper binding sites used to transport oxygen in the Giant Keyhole Limpet. The copper binding sites give KLH a blue color. The molecular structure of KLH has multiple binding sites and has been found to be a highly effective T cell dependent carrier protein, inducing immune response through antigen presentation. These benefits; large size, multiple binding sites and immune stimulation along with a strong safety profile have generated significant interest in the molecule for development of active immunotherapies.



SOURCE: wunderground.com

The large size and complexity of the KLH protein do not lend easily to synthetically producing the molecule. Instead it is sourced from the Giant Keyhole Limpet, which is native only to the waters off of the Southern California and Baja California (Mexico) coasts, and is in relatively short supply in the wild.
While other KLH suppliers obtain KLH by sending divers into the ocean, Stellar has built proprietary aquaculture facilities where they farm the Giant Keyhole Limpet. Wild sourcing can be associated with significant issues including the potential for over-harvesting of an already relatively scarce population - which

could result in government-mandated harvesting restrictions – as well as inability to guarantee supply. In addition, it introduces risk of variability of purity and the form of KLH derived from the mollusks, which can be particularly problematic when used as a component in human pharmaceuticals. By contrast, Stellar's aquaculture and production facilities and their ability to sustain the entire lifecycle of the Giant Keyhole Limpet provides what the company believes is the only source in the world capable of supplying sustainable, commercial-scale quantities of high quality KLH protein.

KLH Biophysical Characteristics

KLH is a very large, high molecular weight, oxygen-carrying metalloprotein from the hemolymph of the marine mollusc *Megathura crenulata*.

The KLH protein is expressed in two subunit isoforms (KLH1 and KLH2) of approximately 360,000 and 400,000 monomeric molecular weight. The KLH monomers are each composed of 7 or 8 functional unit domains; each functional unit contains an oxygen binding site containing two copper atoms.

Both KLH isoforms assemble into native homo-decamers and -didecamers of 4,000,000 to 8,000,000 molecular weight in hemolymph.

KLH's immunogenicity is partly attributed to the presence of unusual carbohydrate moieties, including unique Fuc(alpha1-3)GalNAc, Gal-(beta1-6)Man-, Gal(beta1-4)Fuc-, and Gal(beta1-4)Gal(beta(1-4)Fuc- structural motifs on N-glycans.(1,2,3) Terminal mannose residues are mannose receptor ligands and fucose residues are DC-SIGN ligands, suggesting that endocytosis of KLH via C-lectin receptors for antigen presentation in KLH-based conjugate vaccines. KLH has been reported to stimulate dendritic cell maturation from human monocytes in processes possibly involving the mannose receptor.(4)

Size (and Source) Matters

Due to its exceptional size and unusual glycosylation, KLH has not been reproduced synthetically, and is more efficiently and cost-effectively prepared by purification from the hemolymph of the source animal.

Studies have shown that different forms of KLH have distinctly different structural properties and, importantly, may have different inductive effects on the immune system.(5,6,7,8,9,10,11,12,13)

Further, studies have reported that the culture, handling and processing of KLH can impact isoform structure and immunogenicity.(14,15,16)

Different forms and supply sources of KLH have been associated with differing magnitudes and variability in IgM and IgG responses.(17,18,19)

SOURCE: Stellar Bio, klhsite.org. See citations in Appendix

KLH Being Widely Used in Immunotherapy Development

KLH is being used by private and public research institutions, biotech companies and academic centers for drug development, particularly in immunotherapies. This includes Celldex's phase II EGFRvIII-positive glioblastoma multiforme (GBM) candidate, CDX-110, which earlier this year was granted Breakthrough Therapy Designation by the FDA. This is the first such KLH-based immunotherapy to receive that designation. GBM is the most common and aggressive type of brain cancer and is not effectively treated by traditional chemotherapy.

Another recent announcement supporting the use of KLH as carriers in immunotherapies came in November 2015 when AXON Neuroscience (private) presented positive phase I data on its Alzheimer s disease active vaccine candidate, AADvac1, at the annual International Trials on Alzheimer s Disease Conference (CTAD) in November. AADvac1, which utilizes KLH as a carrier protein, is being developed to generate specific antibodies against diseased forms of tau protein. The presentation at CTAD showed AADvac1 to be safe, well tolerated and induced a robust response in the vast majority of the study participants and the average cognition of patients remained stable over 6 months. And while AXON's announcement did not specific where they source their KLH, it appears that it may be from Stellar given that revenue from AXON contributed ~$120k in fiscal 2015. A phase II study, designed to confirm phase I results in a larger population, is anticipated to begin by current year-end which, assuming SBOT supplies the KLH, should provide an even greater contribution to Stellar in fiscal 2016.

Below is a sampling of KLH-based immunotherapies and their respective development stages. Note that this includes programs using KLH supplied by Stellar as was as from other sources.

KLH-Based Active Immunotherapy Trials

Status	Indication	Company or Institute
Phase III	Breast Cancer	OBI Pharma (OBI-822)
	Glioblastoma	Celldex (Rintega®)
Phase II	Lupus	Neovacs (IFNa Kinoid)
	Crohn's Disease	Neovacs (TNF Kinoid)
	Ovarian Cancer	OBI Pharma (OBI-822)
	Alzheimer's	Araclon/Grifols
	Alzheimer's	Axon Neurosciences
	Multiple Myeloma	Abramson Center
	Melanoma	Baylor Research
	Lymphoma	Clinica Navarra
	Ovarian Cancer	Loyola University
	Sarcoma	MabVax
	Ovarian Cancer	MabVax / NCI
	Neuroblastoma	Memorial Sloan-Kettering
	Leukemia	NCI
	Glioblastoma	Roswell Park
Phase I	Multiple System Atrophy	AFFiRis
	Atherosclerosis	AFFiRis
	N-H Lymphoma	Bayer (Autologous)
	Brain Tumor	Rockefeller
	Lung Cancer	Memorial Sloan-Kettering
	Sarcoma, Neuroblastoma	NCI
	Multiple Myeloma	Roswell Park
	Myeloid leukemia	Charite University

SOURCE: Stellar Biotech

Stellar's Aquaculture Facilities

Stellar's facilities, including their land-based aquaculture operations, are located at the Pacific coast providing convenient proximity to the Giant Keyhole Limpet's natural habitat. Initially built in the 1990's for research and production on gastropod mollusks, Stellar's aquaculture facilities have been expanded over the years including a major upgrade completed in 2011 which was funded in part with grants from the National Science Foundation.

The aquaculture operation currently includes 18 production tanks and 400 individual limpet production modules in two temperature-controlled recirculating systems. The closed system which includes seawater intake, recirculation, environmental controls and return of the seawater to the ocean supports the complete lifecycle of the Giant Keyhole Limpet from spawning and larvae development to maturation.

The system can support reproduction and multiple generations of the mollusk. Stellar notes that it takes approximately five years for the Giant Keyhole Limpet to fully mature from embryo to a protein-producing adult. Using a patent-protected non-lethal extraction method, the mollusk can be milked up to three times per year. The benefits of having a self-contained farming system also include being able to gauge production targets must easier than if relying on wild sources, quantities of which can be at risk of fluctuation or harvesting regulations.

Stellar's aquaculture facilities have a current capacity of 2 kg of KLH per year. The company expects, with additional funding and requisite demand, to expand production incrementally over the next few years up to a potential maximum of 20 kg/year. With each gram of GMP-grade KLH valued at approximately $50k, the value of current and future maximum annual production is equal to ~$100M and $1B.

In June 2015 Stellar entered an agreement with Ostiones Guerrero SA de CV, a Baja California (Mexico) based commercial shellfish aquaculture and fishing organization aimed at expanding Stellar's KLH aquaculture operations. Stellar is leasing undeveloped land from Ostiones and the duo, contingent on findings from a three-year suitability study, will develop marine aquaculture facilities. This will increase Stellar's KLH production capacity and also provide Ostiones with advanced aquaculture know-how and infrastructure. Stellar is responsible for construction costs. Following development the two parties expect to enter into separate usage and supply agreements.

Ostiones Guerrero has permits to farm and harvest 10 square kilometers of ocean including 10 km of coastline and the entire Isle of San Martin. While these areas are home to the Giant Keyhole Limpet, the plan is to build aquaculture facilities similar to those Stellar has in Port Hueneme. The suitability study includes the construction of a facility to pipe in seawater and for a pilot aquaculture facility to demonstrate to customers and regulators that they can meet production quality standards. Stellar expects the construction and data collection to take about three years. And while full-scale production is contingent on results of the study, based on Stellar's expertise in KLH production and aquaculture (CEO Frank Oakes is arguably the world-leading authority) and the fact that they have already done it once, we think it is a reasonable assumption that this suitability study has a good chance of success.

Arial Pic of Stellar's Aquaculture and Production Facilities



SOURCE: Stellar Biotech

Stellar's Land-Based Aquaculture Facilities





Stellar KLH

The company's Stellar KLH is offered in both GMP grade (KLH-20MV) and research grade (KLH20MVR) formulations and in different concentrations which are used for both preclinical and clinical applications in drug discovery as well as for in vitro diagnostics. Stellar KLH is used as vaccine conjugate or carrier protein in immunotherapies being developed conditions such as Alzheimer's disease, cancer, autoimmune disorders, among others. It can also be used as an injectable for immuntoxicology (i.e. measure an individual's response to drugs). In addition, Stellar offers Stellar KLH ELISA assay kits for preclinical research use in the detection of KLH antibodies.

STELLAR KLH™ KEYHOLE LIMPET HEMOCYANIN			
PRODUCT CODE	KLH-20MV	KLH-01NV	KLH-05N
Liquid formulations from sustainable, controlled, aquaculture source.			
Product	Subunit KLH	High Molecular Weight KLH	High Molecular Weight KLH
Grade	GMP Grade	GMP Grade	GMP Grade
Packaging	Type I glass vial	Type I glass vial	Call for details
Protein Content per Vial	15 mg	1 mg	Call for details
Protein Concentration	18-22 mg/mL	0.8-1.2 mg/mL	4.5-5.5 mg/mL
Formulation	Liquid in water for injection	Liquid in DPBS	Liquid in DPBS
Purity by SEC	≥ 90%	≥ 95%	≥ 95%
pH	6.9-7.9	6.8-7.8	6.8-7.6
Endotoxin Level	≤ 5.0 EU/mg		<7.0 EU/mg
Sterile	Yes	Yes	Yes
Pricing & Ordering: KLHinfo@stellarbiotech.com			



SOURCE: Stellar Biotech

The company has generated only limited sales to-date, the volume of which is mostly a determinant of the extent of their products' use in customers' research and development activities. However, with increased awareness of Stellar KLH, additional customer on-boarding and accelerated immunotherapy-related R&D activity we expect revenue momentum to significantly pick up.

Customers / Partnerships / Contracts / Licenses

Stellar has a range of customers including private and publicly held biotechnology and pharmaceutical companies as well as academic and clinical research institutions. This includes recently penned agreements to supply KLH for development of Amaran Biotechnology's lead immunotherapy candidate for breast cancer as well as for Neovacs' three Kinoid vaccine candidates targeting certain autoimmune disorders. And in late 2014 Stellar entered into an agreement to supply KLH for Araclon Biotech's clinical trials for its beta-amyloid program focused on Alzheimer's disease.

In addition to supply agreements for development programs and, eventually, for commercial products, Stellar is considering and/or currently pursuing other revenue pathways including product co-development agreements, joint ventures and research collaborations. In addition, they have in-licensed proprietary technology for the development of immunotherapies for the treatment of Clostridium difficile (C. diff) infection.

- **Amaran Biotechnology:** Amaran Biotechnology was set up in 2010 as a joint investment between the chairman of OBI Pharma and Reuntex Group. Stellar penned a collaborative agreement with Amaran, a Taiwanese biopharma company which owns over 5% of SBOTF's outstanding shares and is developing manufacturing capabilities to produce active immunotherapies. OBI's lead candidate, OBI-822, had been in mid-to-late stage clinical testing in the U.S., S. Korea, India, Hong Kong and Taiwan for the treatment of metastatic breast cancer. It was also in a phase 2 physician-initiated clinical trial in Taiwan for the treatment of ovarian cancer (no recent updates have been announced regarding the ovarian cancer program). OBI-822 utilizes KLH as a carrier protein for the carbohydrate antigen Globo-H, which is often expressed by cancer cells.

  In February 2016 OBI announced that top-line data of the phase 2/3 metastatic breast cancer study did not meet the primary endpoint of progression-free survival. But, as patients who did show an immune response demonstrated highly significant progression-free survival, coupled with the secondary endpoint of overall survival trending towards statistical significance and no safety issues reported, OBI Pharma decided to forge ahead with a Phase 3 study. OBI expects to meet with regulators in Taiwan, the U.S. and Europe regarding design of as Phase 3 study. Full results of the Phase 2/3 study are expected to be presented at ASCO in early June.

  What this means for Stellar is currently an unknown. While any supply of KLH to OBI for their clinical trials was never going to be an overly significant source of revenue for the company, supplying for a commercialized product could be. And while that is still a possibility, the likelihood became less so with the Phase 2/3 study missing the primary endpoint. We expect the picture to become clearer following OBI's meetings with regulators relative to moving to a Phase 3 study. We note, however, that even in the event OBI does not move directly to Phase 3 with their metastatic breast cancer program, that SBOT could still be providing KLH to OBI for earlier stage studies in breast and other cancers.

  Stellar recently announced that they have met all the primary objectives of the collaboration with OBI including qualification of GMP-grade Stellar KLH. The formal collaboration agreement, whereby SBOT was responsible for production and delivery of GMP grade KLH for evaluation as a potential carrier protein as well as for method development and process qualification and in return Amaran paid the company for certain expenses and costs, expired on December 31, 2015. However, the expiration has no effect on the duos' working relationship. If all goes well, SBOT could eventually be supplying KLH for an OBI commercialized product. Next steps will be to optimize manufacturing processes for scale-up of production in the event that OBI moves into phase 3 for metastatic breast cancer.

- **Neovacs SA**: Stellar has a supply agreement with Neovacs, a Paris-based biotech company engaged in the development of immunotherapies for autoimmune and inflammatory diseases. Per the terms of the agreement, originally penned in 2008 and recently expanded, Stellar supplies KLH as a carrier molecule for two of Neovacs' Kinoid vaccines under development for the treatment of Lupus and Crohn's disease.

  Neovacs' lead candidate, IFNa-Kinoid, completed a phase I/IIa study (n=28) for lupus in 2011.
  Results showed IFNa-Kinoid was well tolerated and patients experienced a strong immune response with a significantly higher production of binding antibodies compared to TNF Kinoid in humans. A phase IIb study, which had originally expected to include approximately 166 patients and began patient enrollment in September 2015, has been ongoing in Europe, Latin America and Asia. In April 2016 Neovacs received IND approval from the FDA approval to extend the study to the U.S. which also prompted an increase in total enrollment to 178 patients (in 19 countries). Full results are expected to be available in summer 2017.

  It's possible that a lupus indication could be fairly near-term event – at least as it relates to S. Korea. In mid-April of this year Neovacs announced S. Korean health authorities approved an IND for their phase IIb lupus study. Importantly S. Korea is the only OECD country in which lupus is considered an orphan disease. As such Neovacs expects to file for orphan designation, granting of which could mean Neovacs may be able to launch IFNa-Kinoid commercially in S. Korea without the need to conduct a phase III study. Neovacs has already started preparing for a potential commercial launch by partnering with Chong Kun Dan Pharmaceuticals, a S. Korean pharmaceutical (immunotherapies) company.

  Stellar/Neovacs recently expanded the supply agreement to ensure sufficient KLH quantities are available to support these upcoming studies as well as a potential future commercial launch.
  The development progress including commencement of later-stage, larger clinical studies should provide opportunity for increasing KLH-supply sales to Neovacs in the near-term. Eventual commercialization and continuance of the KLH supply agreement would provide the potential for significantly greater revenue upside, although this is obviously dependent on further successful clinical development, including phase II and III trials.

- **Araclon Biotech SL:** Per a November 2014 agreement, Stellar will supply Araclon with KLH to support their phase II/III clinical trials for their Alzheimer's candidate. Upon eventual commercialization, Stellar will also have the opportunity to supply KLH for commercial production. Per the only Alzheimer's study (n=350) on clinicaltrials.gov sponsored by Grifols, the study is still recruiting patients. If this study is successful and another phase III study is not required, this Araclon relationship could possibly represent one of the most near-term commercial supply opportunity for Stellar.

- **C. Diff License:** Stellar's first foray into their own product development program was initiated in 2013 when they in-licensed patented technology from the University of Guelph (Ontario, Canada) for the development of immunotherapies for Clostridium difficile (C. diff) infection. The patent protecting the technology expires in 2030 and covers "certain novel cell surface polysaccharides and their chemical structures and vaccine compositions for the treatment, prevention and diagnosis of C. difficile infection." The license grants Stellar the exclusive right to use the technology to develop and commercialize active immunotherapies to treat C. diff. In return Stellar paid a $225k in upfront fees and will pay $20k annually, the latter which is creditable against any future potential royalties on sales. Stellar is also subject to up to $6 million in milestone payments, which are based on achievement of certain financing and development goals.

  Stellar has provided periodic development-status updates. In December 2013 they began initial development of manufacturing methods for a C diff polysacchardide (PS)-KLH conjugate vaccine candidate. During the first half of 2014 Stellar made additional progress towards manufacturing including scale-up and method transfer to a CMO.

  C. diff is a spore-forming bacteria often found in soil and also present in about 3% of the human population. Human transmission of C. diff is via the fecal-to-oral route. The bacteria is particularly robust, surviving for extended periods in and outside of the body, able to withstand many hand cleansers, stomach acid and antibiotics. While gut flora (i.e. “good bacteria”) in the stomach and digestive system controls or kills C. diff, use of broad spectrum antibiotics (for unrelated conditions) can compromise gut flora and result in C. diff related illness. Typical symptoms include diarrhea, fever, weakness and nausea, among others. In severe cases and instances of relapse, C. diff can be fatal, particularly when there is severe inflammation of the colon.

  Incidence of C. diff is on the rise and currently causes about 3M cases of diarrhea and colitis each year in the U.S., causing between 14k and 30k deaths annually. The majority of cases occur in hospitals, with (depending on the source) as much as 30% of hospitalized patients becoming afflicted with the illness.

COMPETITION

We found only three other companies, besides Stellar, that deal in the manufacture and sale of KLH. Along with biosyn Corp., which appears to be the most substantial in terms of volume and pure-play focus, SAFC and Thermo-Fisher are also involved, at least to some extent, with the manufacture and or/sale of KLH and related products. As Stellar notes in their public filings, their KLH is similar to KLH-based products produced by other companies. So Stellar's main potential competitive advantages lie mostly in their ability to produce sustainable high volumes and uniform, high-quality KLH, which is possible through their proprietary aquaculture and non-lethal extraction methods.

biosyn Corporation
Privately-held biosyn, located in Carlsbad, CA, claims to be "the world leader in the manufacture of high quality, clinical/GMP and research grade hemocyanin products." From what we found it appears biosyn has been one of the early pioneer(s) in KLH research and development. The company currently has two commercialized products, IMMUCOTHEL and VACMUNE, which are KLH subunits (immunocyanin) and have been used in clinical trials for a bladder cancer therapy and as carrier proteins in immunotherapy vaccines. IMMUCOTHEL is also sold as a bladder cancer vaccine in the Netherlands, Austria, Argentina and S. Korea. And, similar to Stellar, biosyn also manufactures KLH starting material.

biosyn's product manual indicates that they have developed a non-lethal hemolymph collection procedure. They also allude to aquaculture facility development activities. But the language (which includes, "biosyn is currently developing such techniques") suggests that they do not currently have functioning aquaculture capabilities. This is

further supported in another part of their website which notes, "biosyn returns the animals back to its natural habitat…". So it appears that biosyn sources the Giant Keyhole Limpet from the wild by sending divers into the ocean. And we were unable to find anything indicating that biosyn expects to transition to aquaculture farming.

SAFC

Sigma-Aldrich Fine Chemicals (SAFC), part of diagnostics product heavyweight Sigma-Aldrich, manufactures KLH and offers clinical and research grade KLH-related products. In April 2011 Stellar entered into an agreement with SAFC whereby Stellar provides KLH starting material for SAFC's GMP grade KLH for applications in vaccines. However, that contract appears to have rolled off as Stellar has not booked any SAFC-related revenue since 2012 and notes in public filings that the agreement expired in June 2013.

SAFC/Sigma-Aldrich has a product webpage specific to carrier proteins which lists several hemocyanin products. From what we can tell these products are manufactured from SAFC's own KLH starting material. However, we have not been able to find how the KLH is sourced (i.e. ocean harvest or aquaculture) or if non-lethal extraction methods are employed. Stellar, in its public filings, indicates that SAFC sources its own KLH from limpets harvested from the ocean. SAFC's carrier protein product list is below.

Product #	Description	Add to Cart
H7017	Hemocyanin from *Megathura crenulata* (keyhole limpet)	pricing
H8283	Hemocyanin from *Megathura crenulata* (keyhole limpet) PBS solution	pricing
B8556	Hemocyanin from mollusk buffered aqueous solution	pricing
H9035	Hemocyanin from mollusk from *Concholepas sp.*, buffered aqueous glycerol solution	pricing
H5654	Hemocyanin, succinylated from *Megathura crenulata* (keyhole limpet) lyophilized powder	pricing
B7542	Maleimide Activated BSA	pricing
K0383	Maleimide Activated KLH	pricing
T1001	Thyroglobulin from bovine thyroid powder, ≥90% (agarose gel electrophoresis)	pricing
T9145	Thyroglobulin from bovine thyroid (For Gel Filtration Chromatography)	pricing

SOURCE: SAFC/Sigma-Aldrich

Thermo-Fisher Scientific

Thermo-Fisher, a $17B (annual revenue) life sciences company also appears to have some interest in KLH manufacturing, although this is almost certainly an inconsequential piece of the overall company. It appears, based on their website, that the KLH that they offer is research grade only. It is unclear how they source the KLH although their website notes, "KLH is harvested from select population of the mollusk Megathura crenulata (keyhole limpet) that are grown in mariculture, not extracted from wild populations." But it is not clear whether Thermo-Fisher has the mariculture operations or whether they use a third party source. From Thermo Fisher's website below.

A Thermo Fisher Scientific Brand

Features of Imject Mariculture KLH:

• **High-yield conjugation—**each molecule of KLH contains hundreds of primary amines available for coupling haptens via EDC or NHS ester crosslinkers
• **Validated quality—**purified and stabilized mariculture KLH maintains solubility in aqueous solutions, unlike traditional sources of the carrier protein
• **Sustainable source—**KLH is harvested from select populations of the mollusk *Megathura crenulata* (keyhole limpet) that are grown in mariculture, not extracted from wild populations
• **Highly immunogenic—**KLH has a high molecular mass (4.5×10^5 to 1.3×10^7 Daltons; aggregates of 350 and 390 kDa subunits) and elicits a stronger immune response than BSA or ovalbumin

For Research Use Only. Not for use in diagnostic procedures.

VALUATION

Financial Model

There are inherent difficulties in building a financial model for Stellar given the various unknowns – while we think near-term revenue will be mostly driven by the already established relationships, the biggest unknowns relate to what to anticipate in terms of future collaborations and supply agreements in support of additional clinical trials and, eventually, to supply KLH for commercialized products. As such, our modeled revenue incorporates two general assumptions; the first (bottom-up approach) that revenue over the next few years comes mostly from already established relationships (i.e Neovacs, Amaran, Araclon, etc) and the second (top-down approach), that by the (fiscal) year 2019 Stellar begins to generate meaningful revenue from supplying KLH to commercialized immunotherapies.

Through the year 2018 over 70% of our modeled revenue relates to contract services and product sales to Stellar's existing customers (most of the remaining ~30% of modeled revenue comes from assumed new service contracts). Our assumptions include that the various supported candidates including IFNa-Kinoid, OBI-822 and Araclon's Alzheimer's candidate successfully complete current clinical trials and progress to later stages. While we assume larger trials require greater quantities of KLH and generate additional services revenue, we also incorporate a revenue haircut to account for the risk of failure - this includes a 50% haircut that a candidate will progress from Ph II to Ph III and a 80% haircut that a Ph III candidate will eventually gain FDA approval. Our chosen haircuts are based on literature about immunotherapy clinical trial and regulatory approval failure rates.

Given that there is no way to know what additional customers may come onboard, our second phase of modeled revenue, which begins to make a meaningful contribution in year 2019, is based on the overall estimated market for KLH in immunotherapy applications. Key assumptions to our top-down model for the second phase include (see our chart below as well);

Annual Market Opportunity Assumptions

- Stellar sells bulk GMP KLH for approximately $50k/gram (equal to $0.05/microgram). Stellar has publicly disclosed this pricing
- Approximately 500 – 700 micrograms (mg) of KLH are used in each vaccine dose – which is based on our due diligence
- Nine doses per patient – which is consistent with cancer vaccine dosing expectations
- 30% - 75% additional KLH required for manufacturing waste, pilot runs, inventory, etc
- Multiply annual U.S. incidence rates of major cancers and other select diseases where KLH is generating interest (including some autoimmune diseases) by cost/per KLH dose. This calculates to a U.S. market worth ~$1.3B
- Assume ex-U.S. market is approximately the same size as U.S. but attainable OUS market is only about 50% as big. Calculates to a WW Mrkt = ~$2.0B
- Assume the market grows at a CAGR of 3% over the next 10 years. This calculates to a total market opportunity of $2.7B in the year 2026

Haircut Assumptions

- Immunotherapies account for 50% of all cancer (and select other disease) treatments in 10 years
- 50% of these immunotherapies use a carrier protein
- 30% of these immunotherapies that use a carrier protein use KLH as that carrier
- Stellar supplies 50% of this KLH
- This equates to product sales for Stellar of approximately $100 million in the year 2026
- We discount this back at 50% per year through fiscal 2019

Additional Comments

- Our calculated total market size is arguably conservative as it is based on only some cancers (albeit all of the most common) and a select number of other diseases. Other diseases with high prevalence rates such as the autoimmune disease, psoriasis, which afflicts as many as 10M Americans, were not included in our estimates as immunotherapies have mostly focused on cancer and only a handful of other diseases. However, we think it is likely that research will broaden to a much greater spectrum of diseases
- Our assumption that 50% of all cancers are treated with immunotherapies is more conservative than the 60% that at least one industry analyst expects
- Our 50% of all immunotherapies using KLH as the carrier protein may also be conservative as KLH is quickly becoming the carrier protein of choice

- Our model assumes 50% of KLH is supplied by Stellar. The only substantive competition today is biosyn but Stellar is the only KLH manufacturer that can rapidly and reliably ramp production. Their additional capacity (from the Ostione's facility) should be online by 2018-2019. As such, our assumed 50% supply coming from Stellar may also be low
- Also of interest is that Stellar's current annual capacity of 2.0kg would be sufficient to supply what we calculate as their total estimated revenue in the year 2026. Stellar's interest in significantly expanding their capacity with the Ostiones facility may indicate that they believe their revenue potential far exceeds our estimates - and given that they are closer to the industry and what to anticipate relative to future KLH demand, this also may imply that our forecasts are conservative

		KLH		
Cancer	Annual U.S. Incidence	mcg/patient	$/mcg	Annual U.S. Mkt Opport.
Breast Cancer	234,000	9,000	$0.05	$105,300,000
Oral	46,000	9,000	$0.05	$20,700,000
Melanoma	74,000	9,000	$0.05	$33,300,000
Kidney	62,000	9,000	$0.05	$27,900,000
Prostate Cancer	233,000	9,000	$0.05	$104,850,000
Uterine/Ovary Cancer	96,000	9,000	$0.05	$43,200,000
Urinary	139,000	9,000	$0.05	$62,550,000
Lung Cancer	224,000	9,000	$0.05	$100,800,000
Colorectal Cancer	137,000	9,000	$0.05	$61,650,000
Other digestive	150,000	9,000	$0.05	$67,500,000
Sarcoma	15,000	9,000	$0.05	$6,750,000
Leukemia	54,000	9,000	$0.05	$24,300,000
Bladder Cancer	74,000	9,000	$0.05	$33,300,000
Multiple Myeloma	24,000	9,000	$0.05	$10,800,000
Lymphoma	81,000			
-Non-Hodgkins Lymphoı	72,000	9,000	$0.05	$32,400,000
Thyroid	65,000	9,000	$0.05	$29,250,000
Brain / Tumors	68,000			
-Glioblastoma Brain Cnc	24,000	9,000	$0.05	$10,800,000
	1,723,000			**$775,350,000**
Other diseases				
Lupus	20,000	9,000	$0.05	$9,000,000
Alzheimer's Disease	500,000	9,000	$0.05	$225,000,000
Clostridium difficile	450,000	9,000	$0.05	$202,500,000
Crohn's Disease	35,000	9,000	$0.05	$15,750,000
Psoriatic Arthritis	23,000	9,000	$0.05	$10,350,000
Rheumatoid Arthritis	230,000	9,000	$0.05	$103,500,000
	1,258,000			**$566,100,000**
Total U.S. Market				$1,341,450,000
Assumed Attainable OUS Market (50% of U.S.)				$670,725,000
Total WW Market Today (pre haircuts)				**$2,012,175,000**
WW Market in 10 years (3% CAGR)				**$2,704,194,941**
Haircut Assumptions:				
Immunotherapies as % of cancer & select other disease therapies				50%
% of immunotherapies that use a carrier protein				50%
% of future immunotherapies that use KLH as carrier protein				30%
% of KLH that is supplied by Stellar				50%
Total Stellar revenue in 10 years				$101,407,310.27
Required KLH Production Capacity (kg)				2.0

DCF Values SBOT at $13/share

We forecast revenue in “phase 1” of our model to grow from about $760k in fiscal 2015 to $3.2M in 2018. And then in “phase 2” to grow to just better than $110M in 2026. Our 2026 revenue figure includes KLH sales in support of commercialized immunotherapies as well as some contribution for supply of clinical trials, in addition to a much relatively smaller revenue stream from service contracts. As detailed above, the bulk of our forecasted growth of longer-term revenue is driven by the expected explosive growth of immunotherapies and cancer vaccines, coupled with the Stellar’s rise as the leading KLH supplier.

Our DCF model, which uses a 12% discount rate and 2% terminal growth rate, values SBOT shares at approximately $13.

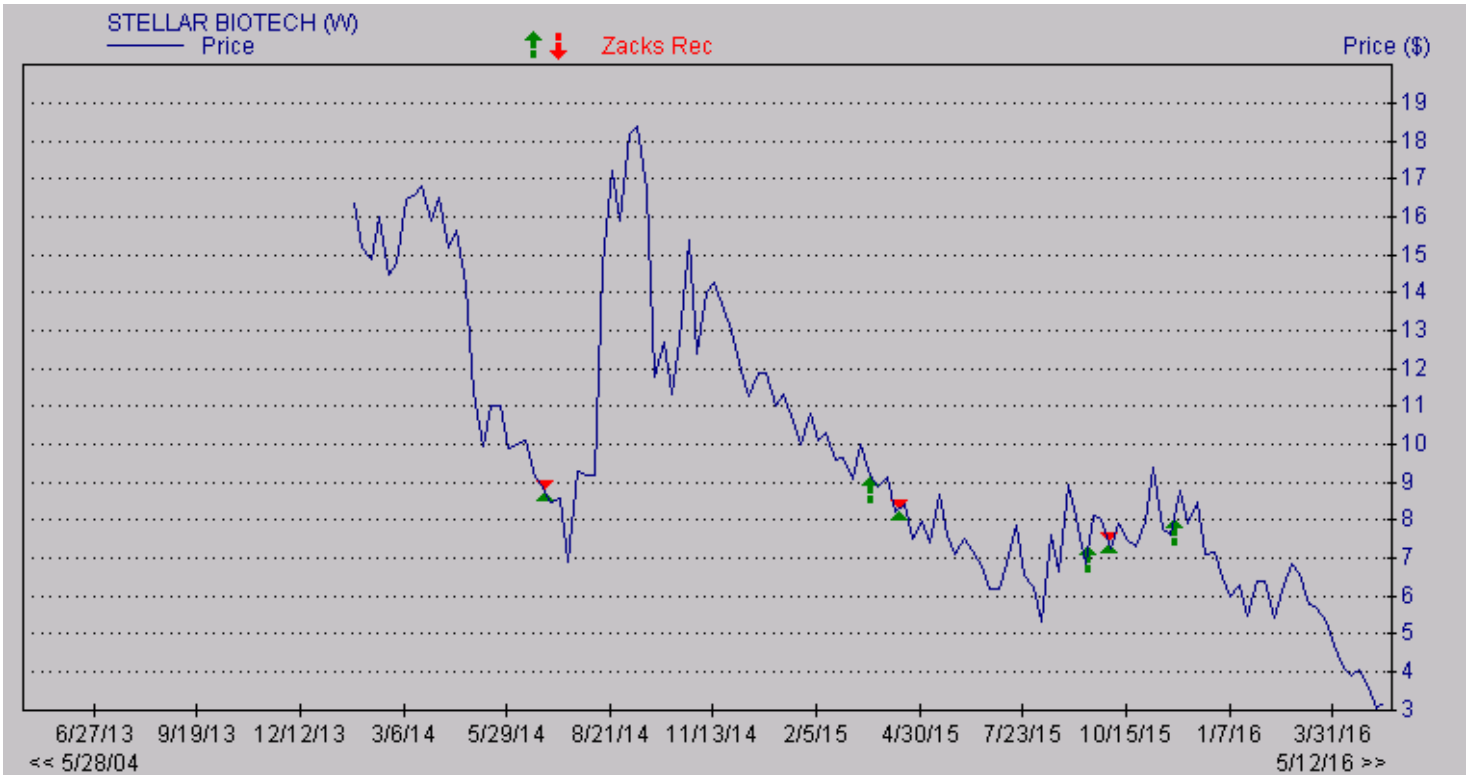
Stellar Biotechnologies

	2015 E	Q1 A	Q2 A	Q3 E	Q4 E	2016 E	2017 E	2018 E	2019 E
Contract Svcs	$195.0	$32.0	$0.0	$55.0	$60.0	$147.0	$365.0	$485.0	$630.50
YOY Growth	*1.6%*	*-46.7%*	*-100.0%*	*22.2%*	*33.3%*	*-24.6%*	*148.3%*	*32.9%*	*30.0%*
Product Sales Total	$563.7	$456.2	$326.3	$333.9	$495.4	$1,611.8	$1,887.5	$2,672.5	$3,217.2
YOY Growth	*292.7%*	*198.8%*	*128.8%*	*196.1%*	*218.3%*	*185.9%*	*17.1%*	*41.6%*	*20.4%*
Grant Revenue	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
YOY Growth	-	-	-	-	-	-	-	-	-
Total Revenues	$758.7	$488.2	$326.3	$388.9	$555.4	$1,758.8	$2,252.5	$3,157.5	$3,847.7
YOY Growth	*103.9%*	*129.5%*	*73.9%*	*146.5%*	*176.8%*	*131.8%*	*28.1%*	*40.2%*	*21.9%*
Cost of Sales	$840.2	$397.0	$348.2	$396.1	$461.6	$1,602.8	$1,819.1	$2,344.5	$2,666.3
Gross Income	($81.6)	$91.2	($21.8)	($7.2)	$93.8	$156.0	$433.4	$813.0	$1,181.5
Gross Margin	*-10.7%*	*18.7%*	*-6.7%*	*-1.9%*	*16.9%*	*8.9%*	*19.2%*	*25.7%*	*30.7%*
R&D	$1,029.5	$288.8	$309.1	$461.0	$577.0	$1,635.9	$2,788.0	$3,358.0	$3,540.0
% R&D	*135.7%*	*59.2%*	*94.7%*	*118.5%*	*103.9%*	*93.0%*	*123.8%*	*106.3%*	*92.0%*
SG&A	$3,227.5	$1,109.7	$765.1	$921.0	$982.0	$3,777.8	$3,945.0	$4,118.0	$4,310.0
% SG&A	*425.4%*	*227.3%*	*234.4%*	*236.8%*	*176.8%*	*214.8%*	*175.1%*	*130.4%*	*112.0%*
Operating Income	($4,338.5)	($1,307.4)	($1,095.9)	($1,389.2)	($1,465.2)	($5,257.7)	($6,299.6)	($6,663.0)	($6,668.5)
Operating Margin	*-571.8%*	*-267.8%*	*-335.8%*	*-357.2%*	*-263.8%*	*-298.9%*	*-279.7%*	*-211.0%*	*-173.3%*
Total Other Inc. (Exp.)	$1,532.4	($315.2)	$234.9	$4.0	$2.0	($74.3)	$0.0	$0.0	$0.0
Pre-Tax Income	($2,806.1)	($1,622.6)	($861.0)	($1,385.2)	($1,463.2)	($5,332.0)	($6,299.6)	($6,663.0)	($6,668.5)
Taxes	$36.8	$7.2	$0.0	$9.0	$9.0	$40.0	$40.0	$40.0	$40.0
Tax Rate	-	-	-	-	-	-	-	-	
Net Income	($2,842.9)	($1,629.8)	($861.0)	($1,394.2)	($1,472.2)	($5,372.0)	($6,339.6)	($6,703.0)	($6,708.5)
YOY Growth	*-66.3%*	*21.3%*	*102.0%*	*-400.5%*	*-4.2%*	*89.0%*	*18.0%*	*5.7%*	
Net Margin	*-374.7%*	*-333.9%*	*-263.8%*	*-358.5%*	*-265.1%*	*-305.4%*	*-281.4%*	*-212.3%*	
EPS	($0.36)	($0.19)	($0.10)	($0.16)	($0.17)	($0.64)	($0.72)	($0.68)	($0.64)
YOY Growth	*-67.9%*	*15.1%*	*90.2%*	*-382.9%*	*-10.7%*	*77.8%*	*13.4%*	*-5.1%*	
Diluted Shares O/S	7,957	8,373	8,449	8,450	8,550	8,456	8,800	9,800	10,500

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