BIOTIME INC
Form 10-K
March 17, 2014

UNITED STATES
SECURITIES AND EXCHANGE COMMISSION
Washington, D.C. 20549

FORM 10-K

x ANNUAL REPORT PURSUANT TO SECTION 13 OR 15(d)
OF THE SECURITIES EXCHANGE ACT OF 1934

For the fiscal year ended December 31, 2013

OR

o TRANSITION REPORT PURSUANT TO SECTION 13 OR 15(d)
OF THE SECURITIES EXCHANGE ACT OF 1934

For the transition period from_____ to _____

Commission file number 1-12830

BioTime, Inc.
(Exact name of registrant as specified in its charter)

| California | 94-3127919 |
|---|---|
| (State or other jurisdiction of incorporation or organization) | (I.R.S. Employer Identification No.) |

1301 Harbor Bay Parkway, Suite 100
Alameda, California 94502
(Address of principal executive offices) (Zip Code)

Registrant's telephone number, including area code (510) 521-3390

Securities registered pursuant to Section 12(b) of the Act

| Title of each class | Name of exchange on which registered |
|---|---|
| Common shares, no par value | NYSE MKT |

Securities registered pursuant to Section 12(g) of the Act:
None

Indicate by check mark if the registrant is a well-known seasoned issuer, as defined in Rule 405 of the Securities Act.
Yes o No x

Indicate by check mark if the registrant is not required to file reports pursuant to Section 13 or Section 15(d) of the Act.
Yes o No x

Indicate by check mark whether the registrant (1) has filed all reports required to be filed by Section 13 or 15(d) of the Securities Exchange Act of 1934 during the preceding 12 months (or for such shorter period that the registrant was required to file such reports), and (2) has been subject to such filing requirements for the past 90 days. Yes x No o

Indicate by check mark whether the registrant has submitted electronically and posted on its corporate Web site, if any, every Interactive Data File required to be submitted and posted pursuant to Rule 405 of Regulation S-T (§ 232.405 of this chapter) during the preceding 12 months (or for such shorter period that the registrant was required to submit and post such files).
Yes x o No

Indicate by check mark if disclosure of delinquent filers pursuant to Item 405 of Regulation S-K (§229.405 of this chapter) is not contained herein, and will not be contained, to the best of registrant's knowledge, in definitive proxy or information statements incorporated by reference in Part III of this Form 10-K or any amendment to this Form 10-K o

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

| | |
|---|---|
| Large accelerated filer o | Accelerated filer x |
| Non-accelerated filer o (Do not check if a smaller reporting company) | Smaller reporting company o |

Indicate by check mark whether the registrant is a shell company (as defined in Rule 12b-2 of the Exchange Act): Yes o No x

The approximate aggregate market value of voting common shares held by non-affiliates computed by reference to the price at which common shares were last sold as of June 30, 2013 was $135,804,066. Shares held by each executive officer and director and by each person who beneficially owns more than 5% of the outstanding common shares have been excluded in that such persons may under certain circumstances be deemed to be affiliates. This determination of affiliate status is not necessarily a conclusive determination for other purposes.

The number of common shares outstanding as of March 5, 2014 was 69,598,709.

Documents Incorporated by Reference
Portions of the registrant's Proxy Statement for 2014 Annual Meeting of Shareholders are incorporated by reference in Part III

BioTime, Inc.

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PART I

Statements made in this Form 10-K that are not historical facts may constitute forward-looking statements that are subject to risks and uncertainties that could cause actual results to differ materially from those discussed. Words such as “expects,” “may,” “will,” “anticipates,” “intends,” “plans,” “believes,” “seeks,” “estimates,” and similar expressions identify forward-looking statements. See Note 1 to Financial Statements.

References to “we” means BioTime, Inc. and its subsidiaries unless the context otherwise indicates.

The description or discussion, in this Form 10-K, of any contract or agreement is a summary only and is qualified in all respects by reference to the full text of the applicable contract or agreement.

Item 1. Business

Overview

We are a biotechnology company focused on the emerging field of regenerative medicine. Our core technologies center on stem cells capable of becoming all of the cell types in the human body, a property called pluripotency. Products made from these "pluripotent" stem cells are being developed by us and our subsidiaries, for use in a variety of fields of medicine, including: neuroscience, oncology, orthopedics, and blood and vascular diseases. BioTime's commercial strategy targets near-term yet strategic commercial opportunities such as: Renevia™ (a product currently in clinical trials in Europe to facilitate cell transplantation); ReGlyde™ and Premvia™ for tendon and dermatological applications; PanC-Dx™ (a family of novel blood and urine-based cancer screens); our current line of research products including PureStem® cell lines, associated ESpan™ culture media, and cGMP-capable human embryonic stem cell lines; and the LifeMap Database Suite. Four of our subsidiaries, Asterias Biotherapeutics, Inc. ("Asterias"), Cell Cure Neurosciences, Ltd (Cell Cure Neurosciences"), OrthoCyte Corporation ("OrthoCyte"), and ReCyte Therapeutics, Inc. ("ReCyte Therapeutics") are focused on developing cell based therapeutic products for diseases such as neurological disorders, cancer, age related macular degeneration, orthopedic disorders, and age-related cardiovascular disease."

“Regenerative medicine” refers to an emerging field of therapeutic product development that may allow all human cell and tissue types to be manufactured on an industrial scale. This new technology is made possible by the isolation of human embryonic stem (“hES”) cells, and by the development of “induced pluripotent stem (“iPS”) cells” which are created from regular cells of the human body using technology that allows adult cells to be “reprogrammed” into cells with pluripotency similar to hES-like cells. These pluripotent hES and iPS cells have the unique property of being able to branch out into each and every kind of cell in the human body, including the cell types that make up the brain, the blood, the heart, the lungs, the liver, and other tissues. Unlike adult-derived stem cells that have limited potential to become different cell types, pluripotent stem cells may have vast potential to supply an array of new regenerative therapeutic products, especially those targeting the large and growing markets associated with age-related degenerative disease. Unlike pharmaceuticals that require a molecular target, therapeutic strategies in regenerative medicine are generally aimed at regenerating affected cells and tissues, and therefore may have broader applicability. Regenerative medicine represents a revolution in the field of biotechnology with the promise of providing therapies for diseases previously considered incurable.

The field of regenerative medicine includes a broad range of disciplines, including tissue banking, cellular therapy, gene therapy, and tissue engineering. Our commercial efforts in regenerative medicine include the development and sale of products designed for research applications in the near term as well as products designed for diagnostic and therapeutic applications in the medium and long term. Through our ESI BIO division, we offer advanced human stem cell products and technologies that can be used by researchers at universities and at companies in the bioscience and biopharmaceutical industries. We have developed research and clinical grade hES cell lines that we market for both basic research and therapeutic product development. Our subsidiary, ES Cell International Pte Ltd (“ESI”), has

developed six hES cell lines that are among the best characterized and documented cell lines available today. Developed in compliance with the principles of current Good Manufacturing Practices ("cGMP") that facilitate transition into the clinic, these hES cell lines are extensively characterized and five of the six cell lines currently have documented and publicly-available genomic sequences. The ESI hES cell lines are now included in the Stem Cell Registry of the National Institutes of Health ("NIH"), making them eligible for use in federally funded research, and all are available for purchase through our ESI BIO division at http://esibio.com/products/. We are working with several collaborators to enable the use of these lines for production of cell therapy products for investigational new drug enabling studies. ESI BIO also markets human embryonic progenitor cells ("hEPCs"), which are called PureStem® progenitors and were developed using PureStem® (previously designated ACTCellerate)™ technology. These hEPCs are purified lineages of cells that are intermediate in the developmental process between embryonic stem cells and fully differentiated cells. We expect that hEPCs will simplify the scalable manufacture of highly purified and identified cell types and will possess the ability to become a wide array of cell types with potential applications in research, drug discovery, and human regenerative stem cell therapies. The PureStem® progenitors are also available for purchase through http://esibio.com/products/.

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Research products can be marketed without regulatory or other governmental approval, and thus offer relatively near-term business opportunities, especially when compared to therapeutic products. Certain research products, such as ESI hES lines and HyStem® hydrogels, have the advantage of being "translatable to the clinic" meaning that these products are available as economical research grade or clinical grade products. Consequently, these products allow researchers more assurance that they will be acceptable for use in future clinical trials. The medical devices and diagnostics that we and our subsidiaries are developing will require regulatory approval for marketing, but the clinical trial and approval process for medical devices is often faster and less expensive than the process for the approval of new drugs and biological therapeutics. Our current and near-term product opportunities, combined with expected long-term revenues that could be derived from cell-based therapeutic products under development at our subsidiaries, provide us with a balanced commercial strategy.

Our HyStem® hydrogel product line is one of the components in our near-term revenue strategy. HyStem® is a patented biomaterial that mimics the human extracellular matrix, which is the network of molecules surrounding cells in organs and tissues that is essential to cellular function. Many tissue engineering and regenerative cell-based therapies will require the delivery of therapeutic cells in a matrix or scaffold to sustain cell survival after transplantation and to maintain proper cellular function. HyStem® is a unique hydrogel that has been shown to support cellular attachment and proliferation in vivo.

Renevia™ is a clinical grade formulation of our HyStem®-C, a biocompatible, implantable hyaluronan and collagen-based matrix for cell delivery in human clinical applications. As an injectable product, Renevia™ may address an immediate need in cosmetic and reconstructive surgeries and other procedures by improving the process of transplanting adipose derived cells, mesenchymal stem cells, or other adult stem cells. We will need to obtain approval by the United States Food and Drug Administration (the "FDA") and comparable regulatory agencies in foreign countries in order to market Renevia™ as a medical device. We recently conducted our first European clinical trial of Renevia™ without cells to determine the safety, tolerability, and acceptance of Renevia™ after subcutaneous injection. Examinations of the subjects after they received Renevia™ injections and through the four-week follow-up period have shown that Renevia™ was well-tolerated by all subjects with no serious adverse events or subject withdrawals. Subsequent clinical studies are planned to document the efficacy of Renevia™ as a delivery matrix for adipose cells to restore normal skin contours in patients where the subcutaneous adipose tissue has been lost to lipoatrophy, beginning with HIV related facial lipoatrophy. Lipoatrophy is a localized loss of fat beneath the skin. Lipoatrophy is often a consequence of the normal aging process where the loss of fat in the cheeks or the back of the hands contributes to an aged appearance, but lipoatrophy can also be associated with trauma, surgery, and diseases, and is frequently suffered by HIV patients being treated with anti-viral drugs.

We have commenced development of two new products based on our HyStem® technology platform. The new products are unique formulations utilizing some of the same cGMP components that we are using in our clinical trials of Renevia.™ The first of these new products is ReGlyde,™ a cross-linked thiol-modified hyaluronan hydrogel for the management and protection of tendon injuries following surgical repair of the digital flexor or extensor tendons of the hand. The product is intended to be applied to the repaired tendon area via a syringe or similar device immediately prior to closing of the surgical area in order to prevent the tendon from attaching to the surrounding tissue. Separation of the tendon from surrounding tissue has been shown to significantly reduce post-surgical adhesions that can lead to complications such as restricted finger mobility and flexibility. The second new product, Premvia,™ is a HyStem® hydrogel formulation of cross-linked thiol-modified hyaluronan and thiol-modified gelatin for the management of wounds by providing a hydrating tissue matrix that permits cell, tissue, and vasculature in-growth.

Our HyStem® hydrogels may have other applications when combined with the diverse and scalable cell types our scientists have isolated from hES cells. HyStem® products are also currently being used by researchers at a number of leading medical schools in pre-clinical studies of stem cell therapies, including research that we are funding at UCLA for the treatment of ischemic stroke. Other researchers are conducting work with HyStem® in research to facilitate wound healing, to treat brain cancer, vocal fold scarring, and for myocardial infarct repair. Recent publications have

highlighted the combined use of HyStem® hydrogels with PureStem® progenitors resulting in a combined product that produces cartilage-producing cell masses known as chondrocytes. We call this experimental product HyStem®-4D. In collaboration with William Marsh Rice University, we are also using HyStem® technology to develop 3D cell culture platforms for improved methods of screening new anti-cancer drug candidates.

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Our subsidiary OncoCyte is developing novel products for the diagnosis and treatment of cancer in order to improve the quality and length of life of cancer patients. Based on large unmet need, market size, and data generated thus far from patient sample screening, OncoCyte is presently focusing its efforts on developing PanC-Dx™ diagnostic products for use in detecting breast, bladder, and lung cancers. Clinical studies designed to test the performance of PanC-Dx™ markers in these three cancers are currently underway, and completion of the studies is expected by the end of 2014. The performance of the marker panels in determining the presence or the progression of disease in various categories of patients in these clinical studies will determine the specific nature of the test to be developed and the approval pathway that OncoCyte will pursue.

Our subsidiary, LifeMap Sciences, Inc. ("LifeMap Sciences") markets, sells and distributes GeneCards®, the leading human gene database, as part of an integrated database suite that includes LifeMap Discovery®, the database of embryonic development, stem cell research and regenerative medicine; and MalaCards, the human disease database.

Our majority owned subsidiary Cell Cure Neurosciences is developing cell therapies for retinal and neural degenerative diseases. Cell Cure Neurosciences' lead product is OpRegen®, a proprietary formulation of embryonic stem cell-derived retinal pigmented epithelial cells developed to address the high, unmet medical needs of people suffering from age-related macular degeneration.

On October 1, 2013, our subsidiary Asterias acquired the stem cell assets of Geron Corporation ("Geron"), including patents and other intellectual property, biological materials, reagents and equipment for the development of new therapeutic products for regenerative medicine. The product candidates under development from various cell types that Asterias acquired from Geron are summarized in the following table:

| Product Candidate Description | Target Market | Estimated Number of Potential Patients [1] | Status |
|---|---|---|---|
| OPC1 – Glial Cells | Spinal Cord Injury | 12,000 new cases per year in U.S. | Phase I Trial initiated in U.S. 5 Patients treated – no serious adverse events related to the OPC1 drug product to date. |
| | Multiple Sclerosis ("MS") | 180,000 new cases per year in U.S. | Proof of principle achieved in animal models. |
| | Canavan's Disease[2] | Rare | Proof of principle achieved in animal models. |
| | Stroke | 800,000 new cases per year in U.S. | Pre-clinical research. |
| VAC1 – Autologous Monocyte – Derived Dendritic Cells (infused cells derived from the treated patient) | Cancer | Prostate: 240,000 new cases per year in U.S. | Phase I study in metastatic prostate cancer completed (Journal of Immunology, 2005, 174: 3798-3807). |
| VAC2 – Dendritic Cells | Lung Cancer | Acute myelogenous leukemia: more than 12,000 new cases per year in U.S. 226,000 new cases per year in U.S. | Phase I/II study in acute myelogenous leukemia completed. Manuscript in preparation. Cells derived and characterization studies performed (parameters analyzed |

| | | |
|---|---|---|
| | | showed normal cell functions in vitro[3]). |
| Multiple Myeloma | 22,000 new cases per year in U.S. | Scalable manufacturing methods under development |
| Prostate Cancer | 240,000 new cases per year in U.S | Proof of concept established in multiple human in vitro[3] systems. |

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| Product Candidate Description | Target Market | Estimated Number of Potential Patients | Status |
|---|---|---|---|
| CHND1 – Chondrocytes | Osteoarthritis | 25 million total patients in U.S. | Cells derived and partly characterized.<br><br>Early non-clinical studies have been performed in animal models of osteoarthritis. |
| | Degenerative Disk Disease | 400,000 new spinal fusion cases per year in U.S. | Pre-clinical research. |
| CM1 – Cardiomyocytes | Heart Failure | 6 million total patients in U.S. | Cells derived and characterization studies performed (parameters analyzed showed normal cell functions in vitro[3]). |
| | Myocardial Infarction | 900,000 new cases per year in U.S. | Proof of concept in three animal models of disease.<br><br>Scalable manufacturing established.<br><br>First in man clinical trial designed. |
| IC1 – Islet Cells | Type 1 and some Type 2 Diabetes | 5 million total insulin dependent patients in U.S. | Cells derived and partly characterized (most, not all normal cell functions verified in vitro[3]).<br><br>Proof of concept in rodent diabetes model.<br><br>Scalable manufacturing methods under development. |

(1) The estimates of the numbers of potential patients shown in the table are based on data for the United States only and do not include potential patients in other countries.

(2) Canavan's Disease is a congenital neurological degenerative disease in which the growth of the myelin sheath surrounding nerves is inhibited resulting in mental retardation, loss of motor function, abnormal muscle tone, poor head control and enlarged head. Death usually occurs before age 4.

(3) In vitro means in tissue culture dishes.

Asterias may also use the acquired assets, along with technology that it may develop itself or that it may acquire from third parties, to pursue the development of other products. Asterias' product development efforts may be conducted by Asterias alone or in collaboration with others if suitable co-development arrangements can be made.

Plasma Volume Expander Products

We have developed and licensed manufacturing and marketing rights to Hextend®, a physiologically balanced blood plasma volume expander used for the treatment of hypovolemia in surgery, emergency trauma treatment, and other applications. Hypovolemia is a condition caused by low blood volume, often from blood loss during surgery or from injury. Hextend® maintains circulatory system fluid volume and blood pressure and helps sustain vital organs during surgery or when a patient has sustained substantial blood loss due to an injury. Hextend® is the only blood plasma volume expander that contains lactate, multiple electrolytes, glucose, and a medically approved form of starch called

hetastarch. Hextend® is sterile, so its use avoids the risk of infection. Health insurance reimbursements and HMO coverage now include the cost of Hextend® used in surgical procedures.

Hextend® is manufactured and distributed in the United States by Hospira, Inc., and in South Korea by CJ Cheil Jedang Corp. ("CJ"), under license from us.

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Key Accomplishments in 2013

- Our subsidiary, Asterias completed its acquisition of Geron's stem cell assets, including patents and other intellectual property, biological materials, reagents and equipment for the development of new therapeutic products for regenerative medicine. The contributed assets include four cell lines, each with animal proof of concept, from which multiple therapeutic product candidates may be selected by Asterias for development in the fields of neurology, oncology, orthopedics, and cardiology.

- We conducted a clinical safety study of Renevia™ at The Stem Center in Palma de Mallorca, Spain, a patient therapy center, laboratory, and research facility located within the hospital Clinica USP Palmaplanas in Palma. Examinations of the subjects after they received Renevia™ injections have shown that Renevia™ was well tolerated by all subjects with no serious adverse events or subject withdrawals.

- Our subsidiary OncoCyte Corporation entered into a Sponsored Research Agreement and a Material Transfer Agreement with The Wistar Institute to collaboratively develop lung cancer diagnostic products. OncoCyte scientists will analyze blood samples obtained from patients in a Wistar clinical study to determine levels of tumor-associated proteins found in the blood samples. The data obtained from the samples received from Wistar's ongoing multi-center study may allow OncoCyte to more rapidly develop a diagnostic test for lung cancer to be marketed in the U.S. and other countries.

- Our subsidiary, Asterias entered into a Non-Exclusive License Agreement with the Wisconsin Alumni Research Foundation ("WARF") under which Asterias was granted a worldwide non-exclusive license to use certain WARF patents and WARF-owned embryonic stem cell lines in the development and commercialization of therapeutic, diagnostic and research products.

- We commenced the development of two new products based on our HyStem® technology platform. The new products are unique formulations utilizing some of the same cGMP components used in Renevia.™ The first of these new products is ReGlyde,™ a cross-linked thiol-modified hyaluronan hydrogel for the management and protection of tendon injuries following surgical repair of the digital flexor or extensor tendons of the hand. The second new product, Premvia,™ is a HyStem® hydrogel formulation of cross-linked thiol-modified hyaluronan and thiol-modified gelatin for the management of wounds by providing a hydrating tissue matrix that permits cell, tissue, and vasculature in-growth.

- We consolidated our research products business into a new ESI BIO division and a new ESI BIO branding program. The ESI BIO brand and US-based operating division will now be our primary developer, manufacturer and distributor of our growing portfolio of stem cell based research products. This new division includes our Singapore subsidiary ES Cell International Pte Ltd. , that will serve as an Asian manufacturer and research product distribution point. This consolidation will allow for a more focused approach on the branding, development, manufacture and marketing of our research products portfolio.

Additional Information

HyStem®, Hextend®, ESpy®, *PureStem*®, and PentaLyte® are registered trademarks of BioTime, Inc., and Renevia,™ Premvia,™ ReGlyde,™ and ESpan™ are trademarks of BioTime, Inc. ACTCellerate™ is a trademark licensed to us by Advanced Cell Technology, Inc. ReCyte™ is a trademark of ReCyte Therapeutics. PanC-Dx™ is a trademark of OncoCyte. LifeMap Discovery® is a registered trademark of LifeMap Sciences. OpRegen® is a registered trademark of Cell Cure Neurosciences. GeneCards® is a registered trademark of Yeda Research and Development Co. Ltd.

We were incorporated in 1990 in the state of California. Our principal executive offices are located at 1301 Harbor Bay Parkway, Alameda, California 94502. Our telephone number is (510) 521-3390.

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Business Strategy

One of our goals is to develop cell-based regenerative therapies for age-related degenerative disease. The degenerative diseases of aging meet several criteria that make them an attractive business opportunity. First, the elderly comprise a large and growing segment of the U.S. and world population. Second, chronic degenerative diseases account for nearly 75% of health care costs. Third, because many age-related diseases appear to be caused by the inherent limited capacity of aged human cells to regenerate damaged tissues in the body, our cell replacement technologies may eliminate the high costs associated with care for these diseases.

Our effort in regenerative medicine also includes research on more than 200 purified, scalable, and novel human embryonic progenitor cell types produced from hES and iPS cells. This research has included extensive gene expression studies of the unique properties of the cells, as well as conditions that cause the cells to differentiate into many of the cell types in the body. We have filed patent applications on the compositions of these cells, the media in which they can be expanded, and a variety of uses of the cells, including drug discovery and cell replacement therapies. This novel manufacturing technology may provide us with a competitive advantage in producing highly purified, identified, and scalable cell types for potential use in therapy.

We have organized several subsidiaries to undertake our cell replacement therapeutic programs, diagnostic product programs, and our research product programs. We will partly or wholly fund these subsidiaries, recruit their management teams, assist them in acquiring technology, and provide general guidance for building the subsidiary companies. We may license patents and technology to the subsidiaries that we do not wholly own under agreements that will entitle us to receive royalty payments from the commercialization of products or technology developed by the subsidiaries.

During September 2012, we formed Asterias to acquire assets in the stem cell field for use in developing and commercializing products for regenerative medicine. During January 2013, Asterias entered into an Asset Contribution Agreement to acquire assets that Geron had used in its stem cell research and development programs. We believe that the acquisition of Geron’s stem cell assets is a good strategic fit as it enhances and expands the intellectual property estate of the BioTime family of companies and should position us for future growth in the regenerative medicine field. Benefits from Asterias’ acquisition of Geron's stem cell assets include:

- The acquisition of a significant intellectual property estate consisting of Geron’s human hES patent portfolio of over 400 patents and patent applications.
- The assets give Asterias multiple potential opportunities to advance products derived from hES cells;
- The potential to leverage the combined technology expertise of BioTime and Asterias to provide enhanced research and development activities;
- The potential expansion of a clinical product pipeline through Asterias’ acquisition of OPC-1 cells previously in a Phase I clinical trial of hES cell-derived oligodendrocytes in patients with acute spinal cord injury, and a Phase II trial treating cancer with a dendritic cell therapeutic vaccine targeting telomerase; and
- Synergies associated with our and Geron’s stem cell assets, merging foundational technologies and allowing Asterias to build upon the pluripotent stem cell technology platform.

By acquiring Geron’s stem cell assets, Asterias now has exclusive use of cell lines and other biological materials, patents, and technology developed by Geron over 12 years of work focused in the following complementary lines of research:

- The establishment of cell banks of undifferentiated hES cells produced under cGMP and suitable for human therapeutic use;

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- The development of scalable differentiation methods which convert, at low cost, undifferentiated hES cells into functional cells suitable for human therapeutic cells that can be stored and distributed in the frozen state for "off-the-shelf" use;

- The development of regulatory paradigms to satisfy both U.S. and European regulatory authority requirements to begin human clinical testing of products made from hES cells; and

- The continuous filing and prosecution of patents covering inventions to protect commercialization rights, as well as consummating in-licenses to enable freedom to operate in a variety of fields.

The following table shows our subsidiaries, their respective principal fields of business, our percentage ownership, directly and through subsidiaries, as at December 31, 2013, and the country where their principal business is located:

| Subsidiary | Field of Business | BioTime Ownership | Country |
|---|---|---|---|
| Asterias Biotherapeutics, Inc. | Research, development and commercialization of human therapeutic products from stem cells potentially in the fields of neurology, oncology, orthopedics, and cardiology | 71.6%[1] | USA |
| ES Cell International Pte Ltd | Stem cell products for research, including clinical grade cell lines produced under cGMP | 100% | Singapore |
| OncoCyte Corporation | Diagnosis and treatment of cancer | 75.3% | USA |
| OrthoCyte Corporation | Orthopedic diseases, including chronic back pain and osteoarthritis | 100% | USA |
| Cell Cure Neurosciences Ltd. | Age-related macular degeneration<br>Multiple sclerosis<br>Parkinson's disease | 62.5% | Israel |
| ReCyte Therapeutics, Inc. | Vascular disorders, including cardiovascular-related diseases, ischemic conditions, vascular injuries<br>Stem cell-derived endothelial and cardiovascular related progenitor cells for research, drug testing, and therapeutics | 94.8% | USA |
| BioTime Asia, Limited | Stem cell products for research | 81% | Hong Kong |
| LifeMap Sciences, Inc. | Genetic, disease, and stem cell databases | 73.2% | USA |
| LifeMap Sciences, Ltd. | Stem cell database | (2) | Israel |

(1) BioTime's percentage ownership was reduced from approximately 96.7% to approximately 71.6% on October 1, 2013 when Asterias issued common stock to BioTime and Geron Corporation pursuant to an Asset Contribution Agreement and sold common stock and warrants to a private investor for cash in a related transaction.

(2) LifeMap Sciences, Ltd. is a wholly-owned subsidiary of LifeMap Sciences, Inc.

The joint ownership of subsidiaries with other investors allows us to fund the expensive development costs in a manner that spreads the costs and risk and reduces our need to obtain more equity financing of our own that could be dilutive to our shareholders. This structure also allows investors the flexibility to invest in BioTime, which is a broad portfolio of companies focused on regenerative medicine, or to invest in a particular subsidiary that is targeting a specific field of medicine or product market. In some cases, the co-investors in our subsidiaries may include other participants in the pharmaceutical or biotechnology industry and their affiliates. An example of this would be our investment in Cell Cure Neurosciences, which was made in concert with investments from Teva Pharmaceutical Industries, Ltd. (“Teva”) and HBL-Hadasit Bio-Holdings, Ltd.

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Another tenet of our business strategy is the development and sale of advanced human stem cell products and technologies that can be used by researchers at universities and other institutions, at companies in the bioscience and biopharmaceutical industries, and at other companies that provide research products to companies in those industries. By providing products and technologies that will be used by researchers and drug developers at larger institutions and corporations, we believe that we will be able to commercialize products more quickly and inexpensively, and realize greater revenues than would be possible with the development of therapeutic products alone.

We have made the filing and prosecution of patent applications an integral part of our business strategy in order to protect our investment in our products and that we and our subsidiaries have developed or licensed from others.

Renevia™ and Other HyStem® Cell Delivery Medical Devices

Our HyStem® hydrogel product line is one of the components in our near-term revenue strategy. HyStem® is a patented biomaterial that mimics the extracellular matrix ("ECM"), the network of molecules surrounding cells in organs and tissues that is essential to cellular function. Many tissue engineering and regenerative cell-based therapies will require the delivery of therapeutic cells in a matrix or scaffold for proper function. HyStem® is a unique hydrogel that has been shown to support cellular attachment and proliferation in vivo. Current research at leading medical institutions has shown that HyStem® is compatible with a wide variety of tissue types including brain, bone, skin, neural, cartilage, and heart tissues.

The patented technology underlying our HyStem® hydrogels such as ReGlyde™ and Premvia™ was developed at the University of Utah and has been licensed to us for human therapeutic uses. The HyStem® technology is based on a unique thiol cross-linking strategy to prepare hyaluronan-based hydrogels from thiol-modified hyaluronan. Since the first published report in 2002, there have been over 120 academic scientific publications supporting the biocompatibility of thiol cross-linked hyaluronan based hydrogels and their applications as medical devices and in cell culture, tissue engineering, and animal models of cell-based therapies.

The building blocks for HyStem® hydrogels are hyaluronan and in some applications, gelatin, each of which has been thiol-modified by carbodiimide mediated hydrazide chemistry. HyStem® hydrogels are formed by cross-linking mixtures of these thiolated macromolecules with polyethylene glycol diacrylate ("PEGDA"). This unique cross-linking chemistry works through an elegant chemical reaction between the acrylate groups on the PEGDA and the sulfhydryl groups on the thiolated macromolecules, that does not generate any toxic by-products, pH change or heat. The rate of the cross-linking reaction turning the liquid mixture into a hydrogel (gelation rate) as well as hydrogel stiffness can be controlled by varying the amount of the PEGDA cross-linker. Due to the unique cross-linking chemistry, HyStem® hydrogels can be injected or applied as a liquid which allows the hydrogel to conform to the cavity or space, and gelation occurs in situ without harming the recipient tissue. This property of HyStem® hydrogels offers several distinct advantages over other hydrogels, including the possibility of mixing bioactive materials with the hydrogel at the point of use and the ability to inject or otherwise apply the material in its liquid state with precision at surgical or wound sites. Building upon this platform, we have developed the HyStem® family of unique, biocompatible resorbable hydrogels.

Renevia™

We are developing Renevia™, a clinical grade HyStem® hydrogel, as an injectable product. Renevia™ may address an immediate need in cosmetic and reconstructive surgeries and other procedures by improving the process of transplanting adipose derived cells or other adult stem cells. Adult stem cell types such as adipose stem cells obtained from a patient through liposuction can be transplanted back into the same patient at another location in the body, without the risk of rejection associated with the transplant of donor tissues. However, the transplantation of cells without the molecular matrix in which cells normally reside often leads to widespread cell death or the failure of the transplanted cells to remain at the transplant site. The transfer of cells in Renevia™ may resolve this issue by localizing

the transplanted cells at the intended site and by providing a three-dimensional scaffold upon which cells can rebuild normal tissue. Renevia™ may also support other emerging cell and tissue transplant therapies such as those derived from hES and iPS cells, in addition to its potential application in the treatment of a number of conditions such as osteoarthritis, brain tumors, stroke, bone fracture, and wounds.

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During the fourth quarter of 2013 we completed a safety trial, Renevia™-01 evaluating Renevia™ followed by a four week follow-up procedure evaluating the trial subjects. Ten healthy volunteers each received one subcutaneous injection of Renevia™ without cells. The primary objective of the trial was to determine the safety, tolerability, and acceptance of Renevia™ without cells as determined by monitoring subjects for any post-treatment reactions. Examinations of the subjects post treatment have shown that Renevia™ was well-tolerated by all subjects with no serious adverse events or subject withdrawals. The trial was conducted at The Stem Center in Palma de Mallorca, Spain located within the hospital Clinica USP Palmaplanas in Palma.

A protocol for a pivotal clinical study, Renevia™-02, is under development and submission to Spanish regulatory authorities is planned for the first quarter of 2014. This clinical study will document the efficacy of Renevia™ as a delivery matrix for adipose cells to restore normal skin contours in patients where the subcutaneous adipose tissue has been lost to lipoatrophy, specifically HIV related facial lipoatrophy. Lipoatrophy is a localized loss of fat beneath the skin and is often a consequence of the normal aging process, but lipoatrophy can also be associated with trauma, surgery, and diseases. Lipoatrophy is frequently experienced by HIV patients being treated with anti-viral drugs. According to published estimates, at least several hundred thousand patients in Europe, and a similar number in the U.S., are affected by lipoatrophy and related conditions such as lipodystrophy. These patients have very limited treatment options and these conditions therefore represent a significant unmet medical need. The Renevia™-02 study will also be conducted at the Stem Center in Mallorca. Our plan to proceed with the Renevia™-02 pivotal clinical trial is subject to obtaining required regulatory and institutional approvals.

Renevia™ is manufactured in the US in compliance with cGMP requirements and has been tested pursuant to ISO 10993 standards for implantable medical devices and shown to be biocompatible without adverse effects in animal studies. Our plan is to bring Renevia™ to the medical market first in the EU, where the anticipated cost of the clinical trials would be relatively low. Once the use of Renevia™ in surgery is established in the EU, we plan to seek FDA approval to market Renevia™ in the larger American market where there are approximately 4 million surgical reconstructive procedures performed per year.

ReGlyde™ and Premvia™

We have commenced development of two new products based on our HyStem® technology platform. The new products are unique formulations utilizing some of the same cGMP components that will be used in our clinical trials of Renevia.™

The first of these new products is ReGlyde,™ a cross-linked thiol-modified hyaluronan hydrogel for the management and protection of tendon injuries following surgical repair of the digital flexor or extensor tendons of the hand. The product is intended to be applied to the repaired tendon area via a syringe or similar device immediately prior to closing of the surgical area. Separation of the tendon from surrounding tissue has been shown to significantly reduce post-surgical adhesions that can lead to complications such as restricted finger mobility and flexibility. We believe that the flowable and in-situ gelling capability of ReGlyde™ could provide an advantage over the existing technology that is in the form of a sheet causing difficulty in application in what is often a small compartment after surgery.

The second new product, Premvia,™ is a HyStem® hydrogel formulation of cross-linked thiol-modified hyaluronan and thiol-modified gelatin for the management of wounds including partial and full-thickness wounds, ulcers, tunneled/undermined wounds, surgical wounds, and burns. Due to its high water content, Premvia™ is able to donate water molecules to the wound surface and to maintain a moist environment at the wound bed, which is critical for wound healing. Additionally, the biodegradable matrix provides a scaffold for the cellular infiltration and proliferation as well as capillary growth needed to promote healing. There is significant competition in the wound healing dressing space, however, one advantage that Premvia™ appears to have over most other technologies is the ability to flow into the wound and cross-link, or change from a flowing liquid to a semi-solid gel consistency, in-situ,

thereby providing a moist environment to every part of a wound which a traditional covering cannot.

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Both ReGlyde™ and Premvia™ are expected to be regulated as medical devices in the United States, and we believe that they are each eligible for 510(k) market approvals. We have initiated for these development-stage products the requisite studies for marketing approval, including ISO 10993 biocompatibility studies and animal studies to demonstrate safety and efficacy. If these requisite studies do not show biocompatibility and efficacy, we will have to reconsider our development plans. We may be required to provide human clinical data demonstrating safety and efficacy for approval as a medical device if the FDA determines that marketing approval should not be granted on the basis of a 510(k) application.

Premvia™ is also intended to serve as a foundation for the further development of bioactive wound healing products that could deliver biological factors or cells to accelerate wound healing before marketing Premvia,™ which would likely require clinical testing to demonstrate safety and efficacy of the new products, and additional FDA review and approval.

HyStem® Hydrogel in Research

Other HyStem® hydrogels are currently being used by researchers at a number of medical schools in pre-clinical studies of stem cell therapies to facilitate wound healing; the treatment of ischemic stroke, brain cancer, and vocal fold scarring; and myocardial infarct repair. HyStem® hydrogels may have other applications when combined with the diverse and scalable cell types our scientists have isolated from hES cells. Our HyStem® technology forms the foundation for unique stem cell delivery products in both the adult and embryonic stem cell marketplace, including products manufactured using our PureStem® technology. Recent publications have highlighted the combined use of HyStem® hydrogels with PureStem® progenitors resulting in a combined product that produces cartilage- producing cell masses known as chondrocytes. We call this experimental product HyStem®-4D. In collaboration with William Marsh Rice University, we are also using HyStem® technology to develop 3D cell culture platforms for improved methods of screening new anti-cancer drug candidates

We have submitted a Device Master File (called an MAF) to the FDA with the details of the manufacturing, testing, and biocompatibility of the HyStem® hydrogels, of which Renevia™ is one version. The MAF was filed in order to allow the FDA to easily access the manufacturing and biocompatibility information to support any future clinical studies that third party investigators may elect to initiate for their cell or drug products utilizing HyStem® hydrogels.

OncoCyte: Novel Cancer Diagnostics and Therapeutics.

Formed in 2009, OncoCyte is developing novel products for the diagnosis and treatment of cancer in order to improve the quality and length of life of cancer patients. OncoCyte is presently focusing its efforts on developing PanC-Dx™ diagnostic products for use in detecting breast, bladder, and lung cancers.

PanC-Dx™ for Diagnosis of Cancer

OncoCyte's lead product is PanC-Dx™ a class of non-invasive cancer diagnostics based on a proprietary set of cancer markers characterized, in part, by broad gene expression patterns in numerous cancer types. The diagnostic products under development are designed to detect cancer using simple, low cost blood tests or, in the case of bladder cancer, a urine test. The apparent high correlation of certain combinations of biomarkers in breast cancer and bladder cancer has made these indications attractive initial targets. OncoCyte is also evaluating markers that may be used in a PanC-Dx™ screen for lung cancer. Clinical studies designed to test the performance of PanC-Dx™ markers in these three cancers are currently underway, and completion of the studies is expected by the end of 2014. The performance of the marker panels in determining the presence or the progression of disease in various categories of patients in these clinical studies will determine the specific nature of the tests to be developed and the approval pathway that OncoCyte will pursue.

The PanC-Dx™ biomarkers were discovered as a result of ongoing research within OncoCyte and BioTime on the gene expression patterns associated with embryonic development. This research has demonstrated that many of the same genes associated with normal growth during development are abnormally reactivated by cancer cells. These genes regulate such diverse processes as cell proliferation, cell migration and blood vessel formation. Many of these genes have not been previously associated with cancer. Moreover, expression of a large subset of these genes is found across numerous cancer types (e.g. cancers of the breast, colon, ovaries, etc.), suggesting these genes may control fundamental processes during cancer growth and progression. In addition to their potential value in developing diagnostic biomarkers, an understanding of the pattern of expression of these genes may also enable the development of powerful new cancer therapeutics that target rapidly proliferating cancer cells.

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OncoCyte has initiated clinical development of its bladder cancer diagnostic test in both the United States and China. In the United States, OncoCyte has entered into a Clinical Trial Agreement with a leading medical institution with an international reputation for excellence and discovery, while in China, OncoCyte has entered into a Fee-for-Service Agreement with China Medicine Inc., a contract research organization serving nine major medical institutions. The goal of these clinical studies is the testing of OncoCyte's proprietary diagnostic technology in the most common type of bladder cancer, urothelial carcinoma ("UC") (previously designated transitional cell carcinoma). Investigators in the collaborating institutions will collect urine samples from patients at the time of bladder cancer diagnosis as well as from those with a risk for recurrent disease. In certain cases, current standard-of-care diagnostic strategies such as the cellular microscopic analysis of the urine samples will be compared with OncoCyte's proprietary markers. A statistical analysis of these and other results will be performed to determine the overall relative performance of OncoCyte's PanC-Dx™ markers. Completion of these studies is expected by late 2014.

The ability of the markers tested in the studies to determine the absence, presence, or progression of UC in patients will determine the specific nature of the bladder cancer test to be developed and the regulatory approval pathway that OncoCyte will pursue. UC constitutes more than 90% of bladder cancers in the Americas, Europe and Asia. Although most patients with bladder cancer can be treated with organ-sparing chemotherapy, UC has a relapse rate of nearly 70% and can progress to invasive, metastatic, and lethal disease. The regular surveillance and treatment of recurrent disease from the time of diagnosis for the remainder of a patient's life makes UC the most costly malignancy on a per patient basis. The problem is amplified because the standard of care for surveillance – microscopic assessment of urinary cytology specimens – often lacks the sensitivity sufficient to ever declare a patient truly disease free. While cytology has a very high positive predictive value (low false positive rate), it has a low negative predictive value and a high indeterminate rate. Patients who have indeterminate urine cytology results commonly undergo cystoscopy, which is painful, time consuming, costly, and unnecessary in many cases since a neoplasm is often not present. In UC, as in virtually all other cancers, earlier and more accurate diagnosis, including diagnosis of disease recurrence, is generally associated with better outcomes and lower cost.

Overall markets for bladder cancer diagnostics are large and growing. Based on National Cancer Institute statistics released in 2012, it was estimated that in 2013 over 72,000 new cases of bladder cancer would occur in the United States and a total of over 550,000 men and women alive would have a history of bladder cancer and be subject to recurrence surveillance testing using cystoscopy or urine cytology. Based on data released in 2012, the overall incidence of bladder cancer in China is 6.1 cases per 100,000 individuals. That number is expected to increase markedly in the next two decades. It is estimated that the annual number of urine cytological analyses performed in the U.S. is over 1.5 million, with more than 3 million tests performed annually in the developed world.

During October 2013, OncoCyte entered into a Sponsored Research Agreement and a Material Transfer Agreement with The Wistar Institute to collaboratively develop lung cancer diagnostic products. As part of the collaboration, Wistar investigators are conducting a multi-center patient study in which they are assessing gene expression patterns in blood cells of patients with malignant versus non-malignant lung disease. OncoCyte scientists will analyze blood samples obtained from patients in the study to determine levels of tumor-associated proteins using its proprietary PanC-Dx™ diagnostic tests. The performance of markers tested in the study in determining the presence or the progression of disease in various categories of patients may determine the specific nature of the lung cancer test to be developed and the regulatory approval pathway that OncoCyte will pursue. OncoCyte will have an option to exclusively license any inventions, discoveries or technology developed by Wistar, or by OncoCyte using Wistar technology, in the course of the collaborative research.

Lung cancer remains a primary cause of cancer-related death, in part because there is no effective diagnostic test to screen patients for lung cancer at an early stage. The current study is being conducted on patients recruited through grant partners at multiple clinical sites. Thus far over 400 patient samples out of a planned total of 600 have been obtained. Completion of the study, which began mid-2012, is expected in mid-2014

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OncoCyte has achieved several key advances in its PanC-Dx™ program during 2013, including:

- Entrance into Sponsored Research and Material Transfer Agreements with the Wistar Institute to collaboratively develop lung cancer diagnostics;
- Formalization of additional relationships with key opinion leaders at major medical institutions to advance breast and bladder cancer programs;
- Institutional review board (IRB) approval and initiation of a large, prospective multicenter patient study at Scottsdale Medical Imaging Laboratories to assess performance of PanC-Dx™ markers in women undergoing mammography;
- Continued manufacturing and characterization of monoclonal antibodies for potential use in diagnostic kits; and
- Publication of results relating to FSIP1, a marker unique to breast cancer.

OncoCyte's key goals for 2014 will be:

- Recruitment and initiation of additional clinical study sites for breast, bladder and lung cancer diagnostics;
- Completion of ongoing clinical studies in breast, bladder and lung cancer diagnostics;
- Assessments of clinical study data and strategic product development path decisions in breast, bladder and lung cancer programs;
- Presentation of key findings at major oncology-related scientific conferences; and
- Submission of manuscripts to peer-reviewed scientific journals for publication.

Cancer Therapy

Although OncoCyte is presently devoting its research and development efforts to PanC-Dx,™ OncoCyte has also conducted research to derive vascular endothelial cells engineered to deliver a toxic payload to the developing blood vessels of a tumor, with the aim of removing malignant tumors while not affecting nearby normal tissues in the body.

The progression of human solid tumors almost always requires the development of a support network of blood vessels to provide nutrients to the expanding tumor mass. The developing tumor vasculature affords an attractive target for anti-cancer therapeutics. Drugs targeting the growth of blood vessels have shown some efficacy in specific cancer applications. However, there is clear need for additional therapeutic approaches that can be used to treat advanced, metastatic cancers. OncoCyte intends to develop a new class of cellular therapeutics that would specifically target the development of tumor vasculature in advanced cancers as an entry point for the delivery of regulated tumoricidal activities.

Through the acquisition of Cell Targeting, Inc., OncoCyte has access to technology that uses peptides selected for their ability to adhere to diseased tissues. By coating or "painting" these peptides onto the surface of therapeutic cells using techniques that do not modify the cell physiology, OncoCyte has been able to produce tissue-specific and disease-specific cell modification agents. This technology may be used in conjunction with the development of genetically modified hES-derived vascular progenitors designed to target and destroy malignant tumors.

We presently own 75.3% of the OncoCyte common stock outstanding. The other shares of OncoCyte common stock are owned by two private investors. OncoCyte has adopted a stock option plan under which it may issue up to

4,000,000 shares of its common stock to officers, directors, employees, and consultants of OncoCyte and BioTime. As of December 31, 2013, options to purchase 2,750,000 shares of OncoCyte common stock had been granted.

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Asterias: Stem Cell Therapies

Asterias and the Asset Contribution Agreement

During September 2012, we formed Asterias to acquire assets in the stem cell field for use in developing and commercializing products for regenerative medicine. During January 2013, Asterias entered into an Asset Contribution Agreement to acquire assets that Geron had used in its stem cell research and development programs.

Asterias' acquisition of the Geron stem cell assets pursuant to the Asset Contribution Agreement was completed on October 1, 2013. Asterias issued 6,537,779 shares of its Series A common stock to Geron and 21,773,340 shares of Asterias Series B common stock and warrants to purchase an additional 3,150,000 shares of Asterias Series B common stock to BioTime. See Note 15 to Consolidated Financial Statements.

Concurrently with the close of the asset contribution under the Asset Contribution Agreement, Asterias issued 2,136,000 shares of its Series B Common Stock and warrants to purchase 350,000 additional shares of Series B common stock to the private investor for $5,000,000 in cash pursuant to the Stock and Warrant Purchase Agreement.

In connection with its acquisition of the stem cell assets from Geron on October 1, 2013, Asterias entered into a Royalty Agreement with Geron and received from Geron an exclusive sublicense of certain patents owned by the University of Colorado; University License Equity Holdings, Inc. relating to telomerase. The Royalty Agreement and the agreement sublicensing the telomerase patents are described in more detail below under "Licensed Stem Cell Technology and Stem Cell Product Development Agreements – Asterias Royalty Agreement with Geron" and "– Telomerase Sublicenses,"

By acquiring Geron's stem cell assets, Asterias now has the use of cell lines and other biological materials, patents, and technology developed by Geron over 12 years of work focused in the following complementary areas:

- The establishment of cell banks of undifferentiated hES cells produced under cGMP and suitable for the manufacture of differentiated cells for human therapeutic use;

- The development of scalable differentiation methods which convert, at low cost, undifferentiated hES cells into functional cells suitable for human therapeutic cells that can be stored and distributed in the frozen state for "off-the-shelf" use;

- The development of regulatory paradigms that we believe will be sufficient to satisfy both U.S. and European regulatory authority requirements to begin human clinical testing of products made from hES cells; and

- The continuous filing and prosecution of patents covering inventions to protect commercialization rights, as well as consummating in-licenses to enable freedom to operate in a variety of fields.

Asterias has acquired a significant portfolio of patents and patent applications, cell lines, and hES technology and know-how related to potential therapeutic products in various stages of development. Two of the products under development have already been used in early stage clinical trials.

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The product candidates under development from various cell types that Asterias acquired from Geron are summarized in the following table:

| Product Candidate Description | Target Market | Estimated Number of Potential Patients[1] | Status |
|---|---|---|---|
| OPC1 – Glial Cells | Spinal Cord Injury | 12,000 new cases per year in U.S. | Phase I Trial completed in U.S. 5 Patients treated – no serious adverse events related to the OPC1 drug product to date. |
| | Multiple Sclerosis (“MS”) | 180,000 new cases per year in U.S. | Proof of principle achieved in animal models. |
| | Canavan's Disease[2] | Rare | Proof of principle achieved in animal models. |
| | Stroke | 800,000 new cases per year in U.S. | Pre-clinical research. |
| VAC1 – Autologous Monocyte – Derived Dendritic Cells (infused cells derived from the treated patient) | Cancer | Prostate: 240,000 new cases per year in U.S. | Phase I study in metastatic prostate cancer completed (Journal of Immunology, 2005, 174: 3798-3807). |
| | | Acute myelogenous leukemia: more than 12,000 new cases per year in U.S. | Phase I/II study in acute myelogenous leukemia completed. Manuscript in preparation. |
| VAC2 – Dendritic Cells | Lung Cancer | 226,000 new cases per year in U.S. | Cells derived and characterization studies performed (parameters analyzed showed normal cell functions in vitro[3]). |
| | Multiple Myeloma | 22,000 new cases per year in U.S. | Scalable manufacturing methods under development |
| | Prostate Cancer | 240,000 new cases per year in U.S. | Proof of concept established in multiple human in vitro[3] systems. |
| CHND1 – Chondrocytes | Osteoarthritis | 25 million total patients in U.S. | Cells derived and partly characterized. |
| | | | Early non-clinical studies have been performed in animal models of osteoarthritis. |
| | Degenerative Disk Disease | 400,000 new spinal fusion cases per year in U.S. | Pre-clinical research. |
| CM1 – Cardiomyocytes | Heart Failure | 6 million total patients in U.S. | Cells derived and characterization studies performed (parameters analyzed showed normal cell functions in vitro[3]. |

| | | | |
|---|---|---|---|
| | Myocardial Infarction | 900,000 new cases per year in U.S. | Proof of concept in three animal models of disease.<br><br>Scalable manufacturing established. |
| IC1 – Islet Cells | Type 1 and some Type 2 Diabetes | 5 million total insulin dependent patients in U.S. | First in man clinical trial designed.<br>Cells derived and partly characterized (most, not all normal cell functions verified in vitro[3]).<br><br>Proof of concept in rodent diabetes model.<br><br>Scalable manufacturing methods under development. |

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(1) The estimates of the numbers of potential patients shown in the table are based on data for the United States only and do not include potential patients in other countries.

(2) Canavan's Disease is a congenital neurological degenerative disease in which the growth of the myelin sheath surrounding nerves is inhibited resulting in mental retardation, loss of motor function, abnormal muscle tone, poor head control and enlarged head. Death usually occurs before age 4.

(3) In vitro means in tissue culture dishes.

The cost and time required to develop products from the acquired assets is not presently known with certainty due to many factors including the following:

- the functional state of the cells, cell lines and other biological reagents transferred to Asterias cannot be determined until they are tested in an appropriate laboratory setting by qualified scientific personnel using validated equipment, which may not be completed until the second quarter of 2014. The functionalities of the cells were within specification at the time of initial manufacturing and subsequent storage. However, the cells have remained in storage (under cGMP conditions) for more than two years. Therefore, all the functional tests need to be repeated to verify that the cells remain within specification after the two year period of frozen storage.

- the views of the FDA and comparable foreign regulatory agencies on the pre-clinical product characterization studies required to submit an IND in order to initiate human clinical testing of potential therapeutic products;

- the inherent uncertainty of laboratory research and any clinical trials that we may conduct;

- the amount of capital that Asterias will have for its development programs, including potential sources of additional capital through research grants or funded collaborations with third parties; and

- the availability and recruitment of qualified personnel to carry out the analyses and evaluations described above.

Asterias has commenced efforts to obtain project funding, manufacturing expertise, and clinical trial management for the VAC2, CHND1 and CM1 programs by initiating discussions with certain third parties that either had agreements with Geron related to, or had expressed an interest in participating in, the development of therapeutic products with those cell lines and related technologies. The extent and pace of the work Asterias can do to develop product candidates in those three programs will depend in large part on the consummation of agreements for one or more of those potential collaborations. Discussions with the third parties are in the early stages and there is no assurance that they will lead to any agreements. Asterias may also pursue discussions with other third parties for financial, manufacturing, or clinical trial management, or other co-development arrangements for those programs.

Asterias may also use the acquired assets, along with technology that it may develop or that it may acquire from third parties, to pursue the development of other products. Asterias' product development efforts may be conducted by Asterias alone or in collaboration with others if suitable co-development arrangements can be made.

We presently own 71.6% of the outstanding Asterias common stock, Geron now owns approximately 21.4% of the outstanding Asterias common stock, and a private investor now owns approximately 7.0%, of the outstanding Asterias common stock. Pursuant to the Asset Contribution Agreement, Geron has agreed to distribute its shares of Asterias Series A common stock to its stockholders on a pro rata basis. Asterias has adopted a stock option plan under which it may issue up to 4,500,000 shares of its common stock to officers, directors, employees, and consultants. As of December 31, 2013, options to purchase 2,840,000 shares of Asterias common stock had been granted.

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OPC1 Glial Progenitor Cells

Asterias acquired from Geron a quantity of glial progenitor cells, which are cells that become glial cells after injection, derived from a cGMP master cell bank of undifferentiated hES cells that has been fully qualified for human use. These cells, which are stored frozen until ready for use, are produced under cGMP conditions and screened for adventitious agents. These glial progenitor cells were Geron's first hES cell-derived cellular therapy to enter human clinical testing and are known as OPC1.

Glial cells are nature's neuronal insulating cells. Like the insulation covering an electrical wire, glial cells enable the conduction of electrical impulses along nerve fibers throughout the central and peripheral nervous system. They are also known to promote neural growth, as well as induce blood vessel formation around nerve axons. OPC1 cells reproduce all of the natural functions of glial cells in animal models, including: producing myelin that wraps around nerve fibers; producing neurotrophic factors which encourage neuro-regeneration and sprouting of new nerve endings, and inducing new blood vessels which provide nutrients and remove waste matter from neural tissue as it functions in the body.

The pathology of spinal cord injury involves extensive loss of the myelin sheath (insulation) produced by glial cells at the site of injury. Although neurons are lost, the prime pathology of spinal cord injury is loss of glial insulation which prevents transmission of nerve impulses above or below the point of injury.

There are currently no drugs approved by the FDA specifically for the treatment of spinal cord injury although methylprednisolone, a corticosteroid generally used as an anti-inflammatory drug, is sometimes prescribed on an off-label basis to reduce acute inflammation in the injured spinal cord immediately after injury. It is believed that in order to effect substantial benefit in treating this complex injury, multiple mechanisms of action are required, such as re-myelination of the demyelinated axons, generation of new blood vessels to repair the ischemic damage from injury, and the presence of biologics that cause neuro-sprouting or new nerve growth to enable the severed axons to repair. In studies to date, OPC1 cells have been shown to exhibit all three effects, and therefore we believe they have potential to effectively treat acute spinal cord injury.

Geron has published multiple studies in a validated rat model of spinal cord injury showing that a single injection of OPC1 cells at the site of injury produces durable re-myelination, new blood vessel formation, and new neuronal sprouting, all of which result in sustained and significant improvement in the animal's locomotion within several months after injection. These data provided the rationale to initiate the world's first clinical trial using hES cell-derived glial cells (OPC1) to treat acute spinal cord injury in humans. No toxicity was seen in the animals after injection – no systemic toxicity, nerve pain, benign growths (known as teratomas), or toxicity of any kind other than rare observations of benign cyst-like structures at the point of injection. Extensive in vitro immune assays demonstrated the absence of direct immune recognition of OPC1 by human immune cells. The cyst-like structures that appeared in certain rat model studies were microscopic in size, had very few dividing cells, did not grow, and were found exclusively in the spinal cord injury site where the OPC1 cells were injected. Because of the discovery of the cyst-like structures in early animal models, the FDA placed Geron's planned clinical trial on hold. The presence of cyst-like structures was investigated in additional animal studies. In four separate animal studies using the clinical grade OPC1 product, cyst-like structures were found in the frequencies shown in the following table:

| Number of Animals Developing Cyst-Like Structures | Number of Animals Studied |
|---|---|
| 5 | 128 |
| 0 | 62 |
| 1 | 68 |
| 1 | 108 |

After discussions that Geron had with the FDA, the clinical trial investigators, and the data monitoring safety board, the unanimous opinion was that these cyst-like structures were of low risk to subjects and the clinical trial was permitted to proceed. Nevertheless a plan was developed to monitor subjects in clinical trials for the development of such cyst-like structures. In the completed Phase I safety study in which 5 patients received OPC1 cells in their injured spinal cords, no cyst-like structures were detected in multiple magnetic resonance imaging exams during a one year follow-up.

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Phase I Trial Design

After FDA authorization, Geron began the world's first human embryonic stem cell trial in patients with acute spinal cord injury in October 2010. The trial was an open label design conducted at seven U.S. neuro-trauma sites. Patients enrolled in the study received a single dose of 2 x $10^6$ cells at the injury site between 7 and 14 days after injury. All subjects received temporary low dose immune suppression treatment for 45-60 days. The primary endpoint of the study was safety, with secondary endpoints of neurologic function assessed by five different validated measures of sensory and motor function.

Five patients have received OPC1 and have completed a one year follow-up data set. No surgical complications during or post-surgery have been observed, and there have been no significant adverse events to date in any patient attributable to the OPC1 product. There have been five minor adverse events possibly related to OPC1 such as transient fever and nerve pain. There have been no unexpected neurological changes to date, nor has there been evidence of adverse changes or cavitation on multiple MRIs. Immune monitoring, conducted in some of the patients, has not detected any evidence of immune responses to OPC1, an important clinical finding that was predicted by extensive in vitro immune testing of OPC1 prior to initiating the trial.

Proposed New Study Population: Subjects with Neurologically Complete Cervical Spinal Cord Injuries

Based on the results of the completed Phase I trial of OPC1 in thoracic Spinal Cord Injury (SCI), the next target patient population in which Asterias plans to clinically test OPC1 is patients with neurologically complete cervical spinal cord injuries. Asterias believes that there are both medical and scientific rationales for the transition to subjects with cervical SCI. Individuals with neurologically complete cervical SCI have an enormous unmet medical need due to the loss of function in all four limbs as well as multiple additional impairments such as impaired bowel and bladder function, reduced sensation, spasticity, sudden changes in blood pressure, deep vein thrombosis, sexual dysfunction, increased infections, skin pressure sores, and chronic pain. These individuals frequently require significant assistance for their care and activities of daily living.

Scientifically, the injured cervical spinal cord is a much better location than the upper or middle thoracic spinal cord to test the safety and potential activity of OPC1. This is partly due to the fact that damaged and demyelinated nerve axons in thoracic injuries need to regrow over several spinal segments in order to restore neural function. In contrast, damaged and demyelinated nerve axons in cervical injuries only need to regrow a short distance to restore neural function. Therefore, in cervical injuries, regeneration and/or repair of damaged axons mediated by OPC1 could result in substantial re-innervation of cervical segments and thereby have a significant impact on upper extremity motor and/or sensory function.

Asterias plans to initiate a new Phase I/IIa dose escalation trial of OPC1 in patients with complete cervical injuries and to conduct additional research and planning for subsequent trials and for other possible indications for the use of OPC1. Asterias will need to raise additional capital in order conduct the Phase I/IIa clinical trial and subsequent clinical trial and product development work.

OPC1 for the Treatment of Multiple Sclerosis and Other Diseases

In addition or as an alternative to spinal cord injury, Asterias may test the OPC1 cells in other alternative indications, including multiple sclerosis (MS), Canavan's Disease, and stroke. Because of its functional properties, OPC1 is a candidate for the repair of central nervous system lesions found in subjects with MS. In these lesions, axons are "demyelinated," meaning that they have lost the sheaths that provide insulation for nerve conduction. In many cases, lesions located in the spinal cord of patients with MS are responsible for progressive clinical deterioration and a loss of ambulatory function. OPC1 may have the potential to repair such spinal cord lesions and to reverse clinical deterioration associated with the lesions.

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In Canavan's Disease, a genetic mutation leads to the accumulation of toxic materials that result in the death of glial cells leading to consequent demyelination. OPC1 cells have been injected into a mouse model of Canavan's Disease in which the cells were shown to survive and significantly improve rotation behavior after injection, thereby establishing the rationale to possibly extend OPC1 use into that genetic disease.

VAC2 and VAC1, Technology for Potential New Cancer Vaccines

Asterias acquired from Geron two experimental therapeutic cancer vaccines designed to target cancer cells by targeting the cancer cell's expression of telomerase. Telomerase is a ubiquitous cancer target, expressed at high levels in all human cancers but at very low levels or not at all, in normal human cells. The premise underlying these vaccines is to "teach" the patient's own immune system to attack cancer cells while sparing other cells. This may be possible by repeatedly exposing the immune system to a substance (an antigen) that is either specifically expressed or over-expressed by cancer cells in a way that subsequently induces an immune response to any cells that express that antigen on their surface. Asterias believes that the characteristics of telomerase make it an ideal antigen for cancer vaccines.

VAC2: hES Cell Derived Dendritic Cells

Dendritic cells can be likened to the quarterback of the immune system. They are antigen processing and presenting cells which are potent initiators of a cellular and humoral (antibody) immune response. Immature dendritic cells initiate an antigen specific suppressive response, such as would be required to terminate an abnormal autoimmune reaction as occurs in diseases like rheumatoid arthritis, and systemic lupus erythematosis. Mature dendritic cells, on the other hand, initiate active cellular and humoral immunity such as is required for immune targeting cancer and infectious disease. VAC2 is a dendritic cell population that is produced from human embryonic stem cells that can be modified with any antigen. VAC2 can be produced in the form of immature dendritic cells for antigen specific immune suppressive therapies, or in mature form to generate antigen restricted cytotoxic responses. There is a significant amount of global clinical literature that describes the use of dendritic cells isolated from peripheral blood samples and used in various vaccination schemes, especially in various cancers (see our discussion of VAC1, below). Although effective in generating an antigen specific immune response, and in several cases showing a significant clinical impact, the drawbacks of autologous peripheral blood-derived dendritic cell vaccination schemes such as VAC1 are the limited supply of cells, the high cost of production, the long production time, and high patient to patient variability.

As a second generation dendritic cell technology, VAC2 is designed to specifically obviate theses drawbacks. VAC2 can be produced in large quantities, similar to the other hES cell-based therapeutic cells. Additionally, because VAC2 is an allogeneic cell, it is believed to be potentially more potent than an autologous dendritic cell, by means of partial antigen mismatch in the HLA system (Human Leukocyte Antigen – markers of immune system types, akin to blood types). The differentiation process for VAC2 has been optimized, the protocol is patent protected and clinically compliant (suitable for use in humans), and no serum or animal feeder cells are used. The production protocol is robust, achieving fully matured dendritic cells within 30 days with reliable process controls. The differentiation protocol is scalable to flasks in the near-term and suspended micro-beads in bioreactors in the medium-term.

VAC2 cells have been extensively characterized in vitro and have high migratory and antigen presenting functionality with limited phagocytic activity (ability to engulf other cells – not a characteristic of dendritic cells), as would be expected for mature dendritic cells. They express high levels of all the appropriate surface markers defining them as mature human dendritic cells. VAC2 cells are phenotypically similar to dendritic cells derived from peripheral blood mononuclear cells, further enabling them to be potentially used in lieu of peripheral blood derived dendritic cell vaccination protocols. VAC2 and peripheral blood monocyte derived dendritic cells produce similar cytokine profiles (patterns of biologically active proteins) before and after antigen stimulation. VAC2 has been shown to demonstrate functionality in chemotactic responses (cells are specifically attracted by certain molecules) and T-cell stimulation.

VAC2 in-vitro stimulates a TH-1 type cytokine production (T-helper 1 – a subtype of T cells) from lymphocytes in a mixed lymphocyte reaction in vitro (a test in which lymphocytes from two different individuals are mixed together to determine whether one individual "recognizes" the other's lymphocyte type) resulting in highly activated antigen restricted T-cell populations (lymphocytes that recognizes only one specific substance). In vitro studies have demonstrated that a single HLA match between VAC2 cells and responding lymphocytes is required to stimulate antigen specific T-cell responses. VAC2 has been shown to retain antigen presentation functionally (ability to "present" antigen on its surface to induce an immune response in another cell) after cryo-preservation. Irradiation of VAC2 after introduction of antigen eliminates the proliferative capacity of the dendritic cells and removes any safety concerns due to the presence of any residual undifferentiated embryonic stem cells in the preparation. Irradiated and cryo-preserved VAC2 cells are fully capable of presenting antigen to T-cells, resulting in antigen specific T-cell activation.

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A clinical protocol for the potentially first-in-man safety study of VAC2 has been outlined for prostate cancer, although Asterias believes that other tumor targets, such as lung cancer and multiple myeloma, are possible. Telomerase, a ubiquitous tumor antigen, would be the first antigen to be used with VAC2. If Asterias proceeds with clinical development in prostate cancer, approximately 15-20 prostate cancer patients who have developed a biochemical (PSA) relapse after either local radical treatment or adjuvant hormonal therapy would be eligible to participate in the trial. Patients would initially be restricted to HLA-A 2.1 and would receive 6 vaccinations at two different doses ($1 \times 10^6$ and $1 \times 10^7$) at weeks 0, 1, 2, 3, 4, 8 and 16.

In summary, VAC2, a second generation dendritic cell technology, has been demonstrated to exhibit a mature dendritic cell phenotype of reproducibly characterized cellular composition. The cells activate allogenic T-cells and migrate in response to chemokine stimulation. VAC2 stimulates a TH-1 type cytokine production and can present antigen delivered to the cells in either mRNA, or protein form. VAC2 can stimulate Class 1 and Class 2 antigen specific T-cells (two types of antigens - type 1 is within a cell, type 2 is outside the cell) and has been shown to prime and stimulate naive antigen restricted T-cells even with only a single HLA-antigen match. Lastly, the feasibility of cryo-presentation and irradiation without alteration of VAC2 function has been demonstrated. These attributes will potentially allow for a greater margin of safety in clinical studies utilizing VAC2 and reduce the number of additional preclinical studies required for an IND submission. Specifically, long-term cell survival and engraftment studies may not be required for a VAC2 IND submission.

Asterias plans to scale up the manufacturing process for the VAC2 drug product and transition it to cGMP production to support the first in man clinical study of VAC2 cancer immunotherapy in lung or prostate cancer. Asterias also will need to develop the quality, purity and potency assays needed for clinical testing, and to transfer to clinical study sites the immunological monitoring assays that will be used to measure patient immune responses in the clinical trial.

Telomerase Therapeutic Vaccine (VAC1)

Asterias acquired from Geron rights to its immunological cancer therapy product VAC1, including the IND for clinical trials conducted by Geron and the related drug master files. VAC1 is an autologous product (using cells that come from the treated patient) consisting of mature antigen-presenting dendritic cells pulsed with RNA for the protein component of human telomerase (“hTERT”) and a portion of a lysosomal targeting signal ("LAMP"). LAMP directs the telomerase RNA to the lysosome, the subcellular organelle that directs the RNA to a particular part of the cell membrane. VAC1 is injected into the patient’s skin; and from there the dendritic cells travel to the lymph nodes and instruct cytotoxic T-cells (T-cells that "kill" other cells) to kill tumor cells that express telomerase on their surface.

A Geron-sponsored Phase I/II clinical trial of VAC1 was conducted at six U.S. medical centers in patients with acute myelogenous leukemia (“AML”) in complete clinical remission. The trial examined the safety and feasibility of a prime-boost vaccination regimen (an initial injection ("prime") followed by multiple additional injections ("boost")) to generate and extend the duration of telomerase immunity. Geron evaluated the immune response to VAC1 and explored the effects of vaccination on minimal residual disease and relapse rates. This trial completed patient enrollment in December 2009.

In the Phase I/II clinical trial, patients with AML entered the study in their first or second complete remission. Prior to or shortly after completing consolidation chemotherapy, patients underwent leukapheresis (collection of white blood cells) to harvest normal peripheral blood mononuclear (white blood) cells for vaccine manufacture. VAC1 was produced at a centralized manufacturing facility from the patient-specific leukapheresis harvests. Patient mononuclear cells were differentiated in culture to immature dendritic cells, which were transfected with messenger RNA encoding hTERT and LAMP. Transfected dendritic cells were matured, aliquoted and cryopreserved. VAC1 was released for patient dosing contingent on several product specifications that included identity of mature dendritic cells, confirmation of positive transfection with hTERT, number of viable cells per dose after thawing, and product sterility.

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VAC1 was successfully manufactured and released in 21 out of the 31 patients enrolled in the study. These results reflect the variability of patient derived starting material that is often associated with an autologous, patient-specific product. Patients were vaccinated weekly for six weeks with VAC1 administered intra-dermally, followed by a non-treatment period of four weeks, and then subsequent boost injections every other week for 12 weeks. Monthly extended boost injections were then administered until the vaccine product supply was depleted or the patient relapsed.

Twenty-one patients received VAC1 in the study, including 19 in clinical remission and two in early relapse. Of the 19 patients in clinical remission, eight were considered at intermediate risk for relapse and eleven were at high risk for relapse as predicted by their cytogenetics (gene expression pattern in the AML cells), FAB type (French-American-British classification of AML into 8 subtypes), or because they were in second clinical remission. Thirteen out of 21 patients in the trial remained in clinical remission at a median duration of follow-up from first vaccination of 13.2 months. At 12 months after vaccination with VAC1, estimated disease-free survival was 81% for patients at high-risk of relapse (95% CI: 42-95%). The confidence interval ("CI") of 95% means that the true value is between 42 and 95 with a probability of 95%. Previously published data on this patient population suggests that approximately 45% of patients would normally remain free from relapse at this stage. VAC1 was found to have a favorable safety and tolerability profile in this study over multiple vaccinations, with up to 32 serial vaccinations administered (median = 17). Idiopathic thrombocytopenic purpura (bleeding into the skin caused by low platelets in blood) (grade 3-4) was reported in one patient. Other toxicities (grade 1-2) included rash or headache. These data from the Phase I/II trial were presented at the December 2010 American Society of Hematology annual meeting.

Expression of WT-1, a marker of minimal residual disease, was sequentially analyzed by qPCR (quantitative polymerase chain reaction - a method to identify DNA modules) in 21 patients. The 13 patients who remain in clinical remission remain negative for WT-1, while six of seven with clinical relapse were WT-1 positive. One patient was positive for WT-1 prior to vaccination with VAC1 and became WT-1 negative during the course of vaccination. This patient relapsed after 30 months. Asterias has begun follow-up data collection on the 21 patients treated in the study at the six participating U.S. medical centers to determine the long term effects, if any, of the VAC1 administration on remission duration and disease-free survival. Depending upon the results of that analysis, Asterias will then decide whether to continue VAC1 development in AML or another cancer indication ourselves or in conjunction with a development partner. Asterias expects the follow-up data collection to be completed in the first half of 2014.

CHND1: Chondrocytes for Cartilage Disorders and Degenerative Disc Disease

Articular cartilage is the shock absorber for joints. Cartilage is a complex tissue with multiple cell levels and is avascular (without blood vessels), and without neurons or lymphatics, and has very low cell division. Injury or chronic wear and tear can cause defects in cartilage in both joints and intervertebral discs that increase over time and leads to permanent disability due to the fact that damaged cartilage cannot generally regenerate itself in response to damage to the tissue. Current procedures for cartilage repair using adult-derived cells generally show less than ideal efficacy. The unmet medical need is for a source of reparative cells that can regenerate true articular cartilage and that does not require biopsy or multiple surgical procedures for installation. Pluripotent stem cell-derived chondrocytes have been shown in animal models of osteoarthritis to mature in situ (in place) and form stable articular cartilage for at least nine months in the knee joint.

The global market for surgical and pharmacological interventions for patients with osteo-arthritis is estimated to exceed $12 billion per year. The CDC has estimated that there are 27 million osteoarthritis sufferers in the U.S. alone, so a suitable supply of therapeutic cells for use in cartilage regeneration could potentially address a very large market. The market for degenerative disc disease is thought to be even larger.

Asterias' CHND1 cells are hES cell-derived human cartilage-forming cells. Sourced from large cGMP human embryonic stem cell banks, they can be potentially produced in large multi-dose production lots, quality controlled and cryo-preserved for shipping and storage to achieve an "off-the-shelf" product description. The differentiation process developed for CHND1 produces human cartilage forming cells that express the appropriate chondrocyte genes, including SOX9, COL2A1, COL9A1, and ACAN with embryonic stem cell markers undetectable in the final preparation. The chondrocytes produced by this methodology have undergone a significant degree of characterization and produce the appropriate markers of articular cartilage in vitro.

The CHND1 cells have been tested in two animal models of osteoarthritis, in which a trochlear groove defect is made in the knee of immune-competent rats into which a single injection of CHND1 is implanted as a micromass into the articular defect without immune suppression. CHND1 cells have also been tested in a large sheep animal model of osteoarthritis in which an 8 millimeter defect was surgically created in the animal's knee and CHND1 cells were implanted in the injured site under a nylon membrane. As in the rodent studies, no immune suppression was required. Defect repair was studied after 21 days in vivo in the sheep model as articular cartilage and repaired subchondral (beneath cartilage) bone. Further optimization will be required to enable full thickness, long-term cartilage regeneration in this large animal, weight bearing joint model. Asterias anticipates that the next steps for CHND1 product development would be to improve the surgical delivery and retention in the large, weight bearing sheep model by integrating their CHND1 cells with our HyStem® hydrogel technology, and to continue scale-up and process optimization to enable the generation of animal data sufficient for an IND submission, which could potentially lead to a Phase I clinical trial in patients with osteoarthritis.

Although Asterias has not yet tested CHND1 in models of degenerative disc disease (DDD) the pathology of DDD is similar to that of osteoarthritis and several groups, including our subsidiary OrthoCyte, have demonstrated disc repair in animals using chondrogenic cells similar to CHND1.

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An additional feature of Asterias' CHND1 program involves the integration of BioTime HyStem® hydrogel technology with CHND1. The hydrogel is essentially a covalently linked extra cellular matrix formulation that is mixed with cells just prior to injection while the gel is in the liquid phase. A cross linker is then added to the gel and cell mixture as the cells are injected into the tissue to be repaired. Depending upon the amount of cross linker added and other controllable characteristics of the hydrogel, the final gel and cell mixture can quickly congeal into a jello-like consistency with the cells imbedded in the gel, which is subsequently resorbed by the body over several weeks, or, on the other extreme, the gel can harden into a much firmer, fibrocartilage-like material with a retention in the body for many months. BioTime collaborators have demonstrated that chondrogenic cells are highly compatible with the hydrogel both in vitro and in vivo, providing the rationale for us to optimize the formulation of the hydrogel for application in both osteoarthritis and DDD.

Near-term Development Strategy for CHND1

Asterias plans to develop a scalable manufacturing process for CHND1 and to optimize a formulation of our HyStem® hydrogel that will improve CHND1 retention after injection into weight-bearing joints or degenerating intervertebral discs of animal models. Asterias has identified the steps in the current process that need improvement or scale up and have identified cellular markers on CHND1 that can be used in the assay development work required to support clinical grade manufacturing of the product candidate for use in animal studies from which Asterias plans to acquire data to support an IND filing with the FDA. Asterias will also need to develop methods to cryopreserve CHND1 after manufacturing to enable long term storage, shipment to clinical trial sites and off the shelf availability for subjects in the planned trials.

The hydrogel formulation will need to be optimized to ensure compatibility with CHND1 cells and to improve the retention of the cells after injection into weight bearing arthritic joints and degenerating intervertebral discs of animal models of these two conditions. Appropriate concentrations of various components of the hydrogel will need to be determined to maximize the viability and retention of the injected cells into the damaged joint or disc.

Asterias has entered into a Material Transfer Agreement with us through which they may obtain BioTime hydrogel for research use, but Asterias will need to enter into a sublicense agreement with us in order to use the patented hydrogel technology with their CHND1 cells in humans.

Potential Development Collaboration for manufacture of CHND1

Asterias is in early-stage discussions with a United Kingdom based technology innovation center seeking their support for the development of advanced manufacturing processes for CHND1. Methods developed at the technology innovation center would be incorporated in future commercial manufacturing processes for the product. An alliance with the technology innovation center would be on a specific project basis and would require multiple approvals from different committees and boards at the center. There can be no assurance that Asterias will reach an agreement with the center for this project.

CM1: Cell Therapy for Myocardial Disease

In heart failure, ischemic injury to the myocardium, or heart, in the form of myocardial infarction leads to cell death and loss of contractility. In a process called pathological remodeling, progressive deterioration of tissue structure leads to further cell death and loss of contractility. Although heart failure is treatable by a wide variety of pharmacologic agents with varied success, no conventional drug or biologic can restore the damaged heart wall muscle structure. Therefore, there is an urgent, unmet medical need to restore contractile function and prevent pathological remodeling.

CM1, hES cell-derived cardiomyocytes, have been extensively characterized in vitro and in vivo. The product is predominantly composed of ventricular cardiomyocytes that have been shown to electrically and mechanically couple to the animal myocardium in which they are injected and contract in synchrony with the animal host ventricular cells. CM1 has been shown in animal studies to repopulate a scar with healthy cardiac tissue. The cells have shown to be completely responsive to all major classes of current cardiac pharmacologic agents, which is important because patients who may receive CM1 for heart failure will also concurrently be treated with existing drugs. It is therefore important that the injected tissue responds to cardiac drugs appropriately. Geron had optimized and validated a scalable production methodology to meet the volumes of product required for such a large medical market.

CM1 cells have been subjected to extensive pharmacologic, electro-physiologic and molecular biological testing both in-house and in the laboratories of numerous academic collaborators. Extensive immuno-cytochemical analysis using antibodies that mark specific cell structures has shown that CM1 cells express cardiac sarcomeric and gap junction proteins (biochemical components of heart muscle cells) and appropriate transcription factors (molecules that allow the expression of a specific gene) to unequivocally identify them as human ventricular cardiac cells. Over 80% of cells in the CM1 preparation are ventricular cardiomyocytes with the appropriate electrophysiological de-polarization pattern and appropriate drug responses to HERG-channel blockers (drugs that block certain ion transport channels in heart cells), calcium channel blockers (drugs that block calcium transport into and out of heart cells) and other cardio-active agents. The cells display mature excitation contraction coupling properties, including the influx of external calcium ions through L-type calcium channels which are required for electro-chemical coupling. As is the case for OPC1, CM1 cells have been shown to not be susceptible to immune responses to genetically different human cells in vitro. The cells express HL-A B and C alleles, but not Class 2 alleles. These alleles are markers of human immune "types", akin to blood "types". Even after in vitro treatment with interferon gamma, CM1 cells do not stimulate allogenic T-cells in vitro. The use of allogenic T-cells in the studies means that the T-cells came from an individual who is genetically different from the source of the CM1 cells. Furthermore, CM1 is resistant to human serum antibody mediated cyto-toxicity. These results suggest, as in the case of OPC1, the need for only transient, low-dose immune suppression in the immediate post-injection period.

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CM1 cells have been tested in three animal models of myocardial infarction: the rat, the guinea pig and large pig. In all three animal models, CM1, after a single injection, forms long lasting cardiomyocyte grafts which form in the scar tissue into which they are injected. The cells induce host vascular proliferation which enables the long-term survival of the injected human cells. CM1 has been shown to couple electrically and mechanically with the host myocardium. The cells significantly improve ejection fraction (blood pumping efficiency) in both acute rat infarcts, and chronic infarcts in a large pig model. The rat ejection fraction improved from 45% to 50% (p=0.05); the pig ejection fraction improved by 12 percentage points (from 40% to 52%) (p=0.002). The P Value is the probability that the observed difference occurred by chance. P Values equal to or less than .05 are considered to be "significant" or unlikely to be due to chance alone.

Toxicity studies have demonstrated a favorable safety profile for these cells. The cells did not increase arrhythmias in two of three animal models, even during the induction of an arrhythmia after injection. In one of the models (guinea pig) the frequency of induced arrhythmias was decreased in animals that have received the CM1 product, presumably because the CM1 product increases normal electrical conductivity across the infarct zone. In the large pig model, arrhythmias were observed, possibly due to the inflammation at the injection site due to incomplete immune suppression. Improved ejection fraction has been documented in two animal models using echo cardiography. The magnitude of the improvement in ejection fraction is clinically and statistically significant. We believe that CM1 is the only hES cell-based cardiomyocyte cell therapy for myocardial disease that has shown stable and durable engraftment with living functional cardiomyocytes after injection into animal models of myocardial disease. The beneficial effects in the animal models are likely due to the persistence of the injected cells rather than a transient effect produced by secretion factors of cells that do not persist after injection, such as injected bone marrow cells, or mesenchymal stem cells.

IC1: hES Cell-Derived Islets for the Treatment of Diabetes

Approximately 26% of adult diabetic patients receive insulin therapy. Injected insulin, while effective at reducing hyperglycemic (high blood sugar) episodes, requires constant monitoring. Despite sophisticated pump systems and rapid glucose monitoring tests, changes in blood glucose levels still occur and exogenous insulin fails to prevent systemic complications of the disease. Proof of concept for cell therapy interventions in diabetes were provided by the cadaveric islet transplants performed according to the so-called Edmonton protocol. Although these cells reversed hypoglycemia (low blood sugar), the cadaveric islets have poor viability, differ widely in function and are often associated with a severe complication called portal hypertension (high blood pressure in the liver). The annual availability of cadaveric islets is less than 0.1% of the number of cases of Type 1 diabetes prevalent in North America. Therefore, a substantial unmet medical need exists for a consistent and scalable source of high quality human islet cells for transplantation. IC1 is a highly viable hES cell-derived islet progenitor population that potentially could satisfy that unmet medical need. Multiple animal studies have shown that IC1 cells, after injection, mature in the animal to express all islet hormones, process and release insulin in response to high glucose challenge, and reverse hyperglycemia in vivo in rodent models of diabetes.

The IC1 product profile is envisioned to require $10^8$ hES cell-derived islet cells for injection into an immuno-isolation device that would be implanted subcutaneously. The immuno-isolation device would prevent the patient’s autoimmune reaction, the hallmark of Type 1 Diabetes, from destroying or damaging the IC1 cell product. Additionally, the immuno-isolation device, with a rechargeable core, would enable the periodic re-injection of fresh IC1 cells to recharge the device, if necessary, on a yearly basis. This device is intended to avoid the requirement for any immune suppression. The prevalence of Type 1 Diabetes is nearly 2 million persons in the United States, most of whom require exogenous insulin and could therefore be potential candidates for the IC1 product. There are over 20 million Type 2 diabetics in the United States and about 20% of them also become insulin dependent, thereby creating a large potential market opportunity for the IC1 product.

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The patented differentiation protocol generates islet progenitor cells in a manner that mimics the development path for that cell in the normal human embryo. The cells that are injected in the animal models of diabetes mature in vivo over the course of several weeks into mature human islets that produce the three main islet hormones: C-peptide, glucagon and somatostatin, as well as characteristic transcription factors that identify them as human islet cells. After maturation in vivo the injected IC1 cells are shown to express one hormone per cell type; alpha cells producing glucagon, beta cells producing insulin and C-peptide, and delta cells producing somatostatin. After injection into diabetic mice, the presence of human C-peptide is detectible in blood at physiologically relevant concentrations (amounts sufficient to produce significant changes in blood glucose). When IC1 treated mice are challenged with a glucose load, they appropriately increase their insulin level in response to the glucose challenge. Studied long-term, IC1 injected diabetic animals maintain normal glucose regulation for over 140 days, the length of the animal study. Their average blood glucose concentration is normal for humans, and slightly hypoglycemic for mice, indicating the complete take-over of glucose homeostasis by the human cells injected into the animal. Importantly, IC1 treated animals maintain mormoglycemic levels following an intra-peritoneal (in the belly cavity) glucose challenge, indicating the capacity of IC1 treated mice to maintain normoglycemia in the face of a glucose challenge.

A definitive decision whether to develop IC1 will depend largely on the outcome of the appeal proceedings in the U.S. District Court for the Northern District of California (the "ViaCyte Appeal") in which Asterias is appealing two adverse rulings in favor of ViaCyte, Inc. ("ViaCyte") by the United States Patent and Trademark Office's Board of Patent and Interference. These rulings related to interference proceedings involving patent filings relating to definitive endoderm cells. Geron had requested that the Board of Patent Appeals and Interferences declare this interference after ViaCyte was granted patent claims that conflicted with subject matter Geron filed in a patent application having an earlier priority date. Those Geron patent applications relate to IC1 are among the patent assets that Geron has contributed to us, and we have been substituted as a party in interest in the appeal in place of Geron.

If Asterias is not successful in the ViaCyte Appeal, ViaCyte would retain its patent claims directed to definitive endoderm. Definitive endoderm is an early pre-cursor of numerous cell types including liver and -cells of the pancreas that could potentially treat diabetes, and it is likely that the derivation of any of the endodermal lineage cells from embryonic stem cells would necessarily pass through the definitive endoderm stage. As a result, Asterias would be unable to develop and commercialize those cell types, including IC1, without a license from ViaCyte, which we may not be able to obtain at all or on terms acceptable to Asterias.

OrthoCyte: Osteochondral Progenitor Cells for Orthopedic Indications

OrthoCyte is our wholly owned subsidiary developing cellular therapeutics for orthopedic disorders. OrthoCyte's lead project is the development of hEPC to repair cartilage damaged by injury or disease, including osteoarthritis. OrthoCyte has identified several PureStem® cell lines that display potential to differentiate into diverse types of cartilage, and these lines are showing promising results in animal preclinical testing for effectiveness of cartilage repair. Our current goal is to demonstrate the safety and efficacy of the cells using in vivo models of articular disease. OrthoCyte has compiled proprietary animal preclinical data on two therapeutic product candidates designated as OTX-CP03 and OTX-CP07, which are formulated in our HyStem® hydrogel, and which showed initial evidence of safety and efficacy in animal models of joint disease. If follow on studies in large animal models prove successful, we would plan to initiate an Investigational New Drug ("IND") filing with the FDA for this application.

Cartilage defects and disease affect our aging population. In particular osteoarthritis and spinal disc degeneration have a significant impact on the mobility and health of an aging population. Current non-surgical treatments tend to target the reduction of pain and inflammation, as opposed to the repair of tissue damage and reversal of deterioration. To date, the development of cell-based therapeutics to treat damaged cartilage has met with mixed success. Autologous chondrocytes have been tested as a means of providing cartilage-producing cells, but this approach is hampered by a multi-step process that first requires the harvesting of chondrocytes from donor tissues, followed by in vitro culture expansion of the harvested cells. Primary chondrocytes have very limited capacity for in vitro expansion and typically

lose their biological characteristics within a short period of in vitro culture. Mesenchymal stem cells have also been tested extensively as a source of cellular therapeutics for cartilage treatment, but success has remained limited, partly as a result of the hypertrophy of these cells inducing bone and fibrous tissue instead of permanent cartilage.

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Additional in vitro testing suggests a wide range of possible applications for osteochondral PureStem® cells. OrthoCyte is preparing to test the utility of various osteochondral PureStem® cells that display potential to differentiate into bone and other types of cartilage-like tissues such as intervertebral disc tissue. In collaboration with world-renown academic institutes in the field of degenerative disc disease and back pain, PureStem® cells formulated in our HyStem® hydrogel will be tested in spine disease animal models broadly recognized for their translation potential to clinical trial development. This screening phase should allow OrthoCyte to assess and potentially select a PureStem® cell candidate for intervertebral disc repair and bone induction. We anticipate that successful selection of candidates would move our spine program to an optimization phase followed with a pre-IND meeting with FDA to discuss regulatory paths and additional expected pre-clinical requirements.

Chronic back pain is one of the largest unmet health economic burdens in modern society. With more than 85% lifetime prevalence, nearly everyone is affected in their lifetime. In most cases, chronic back pain stems from the progressive degeneration of the avascular intervertebral disc tissue that cushions the vertebrae in the spinal column. This tissue is structurally and functionally similar to other cartilage tissues. Currently there are no treatment options for people suffering from degenerative disc disease other than risky invasive surgery to fuse the affected discs. A therapy that would slow down or reverse disc degeneration to delay or avoid surgery would have a great impact in the largest musculoskeletal unmet need. Various biologic approaches using growth factors or cells from different adult tissues are in various phases of preclinical and early clinical development, but so far none have proven to work effectively. The opportunity for OrthoCyte to screen, and select a candidate with the appropriate attributes to effectively impact the disease process is an important differentiating factor from other competing technologies.

We presently own, directly and through our subsidiary Asterias, a 100% equity interest in OrthoCyte. We plan to provide additional equity capital to OrthoCyte or seek outside investors. OrthoCyte has adopted a stock option plan under which it may issue up to 4,000,000 shares of its common stock to officers, directors, employees, and consultants of OrthoCyte and BioTime. As of December 31, 2013, options to purchase 2,645,000 shares of OrthoCyte common stock had been granted.

Cell Cure Neurosciences: Therapies for Retinal and Neural Degenerative Diseases

Cell Cure Neurosciences is developing cell therapies for retinal and neural degenerative diseases. Cell Cure Neurosciences is the neurological arm for BioTime's program for the development of human embryonic stem cell-based therapies.

Cell Cure Neurosciences' pipeline includes two major development programs at present:

- Retinal cell therapies OpRegen® and OpRegen®-Plus are Cell Cure Neurosciences' proprietary formulations of embryonic stem cell-derived retinal pigmented epithelial ("RPE") cells developed to address the high, unmet medical needs of people suffering from age-related macular degeneration ("dry AMD"). OpRegen®Plus is a formulation of RPE cells bound to a membrane.

- Cell therapy products for neurodegenerative diseases. Cell Cure Neurosciences is developing neural progenitor cells designed to replace the dopamine producing cells destroyed in Parkinson's disease, and NeurArrest™ neural cells that target and modulate the immune system's self-destruction of the myelin coating of nerve cells in multiple sclerosis.

The U.S. Centers for Disease Control and Prevention estimate that about 1.8 million people in the U.S. have advanced-stage AMD, while another 7.3 million have an earlier stage of AMD and are at risk of vision impairment from the disease. Most people are afflicted with the dry form of the disease, for which there is currently no effective treatment. One of the most promising future therapies for age-related AMD is the replacement of the layer of damaged RPE cells that support and nourish the retina. In the past, RPE cells have been obtained from other regions of the diseased eye, or from fetal and adult donor tissue and various cell lines. However, the lack of a reliable and ample supply of healthy RPE cells has hindered the development of RPE transplantation as a therapeutic approach to

AMD. RPE cells derived from hES cells may prove to be the best source of RPE cells for transplantation, provided the technology can be developed for producing RPE cells from hES cells in homogeneous, large quantities.

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Cell Cure Neurosciences' research and development is conducted at Hadassah University Hospital, through research and consulting agreements with HBL-Hadasit Bio-Holding's ("HBL") affiliate Hadasit Medical Research Services and Development, Ltd. ("Hadasit"), under the direction of Professor Benjamin E. Reubinoff, Cell Cure Neurosciences' Chief Scientific Officer; Professor Eyal Banin, Cell Cure Neurosciences' Director of Clinical Affairs; and Professor Tamir Ben Hur.

Until now, researchers have had to rely on the spontaneous differentiation of hES cells into RPE cells, but that differentiation occurs in only a few hES cell lines. To achieve the full potential of hES cells for the production of RPE cells, a reliable, driven differentiation method is required. Cell Cure Neurosciences is using a new method developed by scientists at Hadassah University Hospital that drives the differentiation of hES cells into RPE cells. These researchers have shown in a small animal model of AMD that RPE cells produced using this method can preserve vision when the cells are transplanted in the subretinal space.

In October 2010, we, along with Teva Pharmaceutical Industries, Ltd. ("Teva") and HBL, invested $7.1 million in Cell Cure Neurosciences, primarily to fund the development of OpRegen®. At the same time, Cell Cure Neurosciences and Teva entered into a Research and Exclusive License Option Agreement (the "Teva License Option Agreement") under which Teva obtained an option to acquire an exclusive worldwide license to complete the clinical development of, and to manufacture, distribute and sell OpRegen® as well as OpRegen®-Plus. OpRegen®-Plus is another proprietary product that Cell Cure Neurosciences is developing for the treatment of age-related macular degeneration, but in which the RPE cells are supported on or within a membrane instead of in suspension. OpRegen®-Plus is at an earlier stage of laboratory development than OpRegen®.

If Teva exercises the option, it will pay Cell Cure Neurosciences $1,000,000. Thereafter, Teva will bear all costs and expense of clinical trials and of obtaining regulatory approvals required to market the product. Teva will make the milestone payments to Cell Cure Neurosciences as the clinical development and commercialization of the product progress. Milestone payments will be made upon the first use of the product in a Phase II clinical trial; the first use of the product in a Phase III clinical trial; the first commercial sale of the product in the U.S., and the first commercial sale of the product in a European Union country. If all of the milestones are met, Cell Cure Neurosciences will receive a total of $28.5 million in milestone payments, in addition to the $1,000,000 option payment, for the first approved medical indication of OpRegen®. Cell Cure Neurosciences would be entitled to receive certain additional milestone payments upon the first commercial sale of OpRegen® for each additional medical indication in the U.S. or a European Union nation. In addition to milestone payments, Teva will pay Cell Cure Neurosciences royalties on the sale of the product, at rates ranging from 6% to 10% of the net sale price of OpRegen® depending upon the total amount of annual sales. The royalty payments will be reduced by 50% with respect to sales in any country in which a generic equivalent product is being sold by a third party unrelated to Teva.

If Teva exercises its option to license OpRegen®-Plus, Teva and Cell Cure Neurosciences would enter into an additional license agreement on substantially the same terms as the OpRegen® license, including the milestone payments for the first medical indication of OpRegen®-Plus, and additional milestone payments for the first sale of the product for additional indications, royalties on net sales, and a share of any OpRegen®-Plus sublicense payments that Teva might receive.

If Teva sublicenses its rights to a third party, Teva will pay Cell Cure Neurosciences a share of any payments of cash or other consideration that Teva receives for the sublicense, excluding (i) gross receipts for commercial sales that are subject to royalty payments to Cell Cure Neurosciences, (ii) amounts received from a sublicensee solely to finance research and development activities to be performed by or on behalf of Teva, or (iii) payments received in reimbursement for patent expenses incurred after the grant of the sublicense.

A portion of milestone payments, royalties, and sublicensing payments received by Cell Cure Neurosciences would be shared with our subsidiary ESI and with Hadasit, which have licensed to Cell Cure Neurosciences certain patents and

technology used in the development of OpRegen® and OpRegen®-Plus. Those patents will be sublicensed to Teva under the Teva Option Agreement.

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If Teva exercises its option and commercializes OpRegen® or OpRegen®-Plus, its obligation to pay royalties on sales of those products will expire on a country by country and indication by indication basis with respect to a product on the later of (i) fifteen (15) years after the first commercial sale of the product for the applicable indication for use in that country, or (ii) the expiration in that country of all valid patent claims covering the applicable indication for use of the product. The patent expiration dates cannot be presently determined with certainty, but certain patents licensed to Cell Cure Neurosciences by ESI and Hadasit for use in the development of OpRegen® and OpRegen®-Plus will expire in 2023 and 2022, respectively.

The Teva License Option Agreement will terminate if (a) Teva does not exercise its option within 60 days after an IND application filed by Cell Cure Neurosciences becomes effective for a Phase I clinical trial of a product covered by the Teva License Option Agreement, or (b) Teva determines not to continue funding of the research and development of a product after Cell Cure Neurosciences has expended its designated budget plus certain cost over-runs. Teva may also terminate the Teva License Option Agreement at any time by giving Cell Cure Neurosciences 30-day notice. Either party may terminate the license if the other party commits a material breach of its obligations and fails to cure the breach within 45 days after notice from the other party, or if the other party becomes subject to bankruptcy, insolvency, liquidation, or receivership proceedings.

Cell Cure Neurosciences' cell therapy products under development for the treatment of neurodegenerative diseases include (a) neural progenitor cells designed to replace the dopamine producing cells destroyed in Parkinson's disease, and (b) Cell Cure Neurosciences' NeurArrest™ neural cells that target and modulate the immune system's self-destruction of the myelin coating of nerve cells in multiple sclerosis.

Parkinson's is an age-related disease caused by the loss of a certain type of cell in the brain. According to the Parkinson's Disease Foundation, Parkinson's disease affects approximately 1 million people in the U.S. and more than 4 million people worldwide. The median age for the onset of all forms of Parkinson's disease is 62, and the number of new cases is rising rapidly with the aging of the baby-boomer population. There is currently no cure for the disease.

While not a classic age-related disease, multiple sclerosis is also on the rise and the National Multiple Sclerosis Society estimates that there are about 400,000 persons with multiple sclerosis in the U.S. Most people are diagnosed with the disease between the ages of 20 and 50.

To advance its programs for the development of treatments for neurodegenerative diseases such as Parkinson's disease and multiple sclerosis, Cell Cure Neurosciences has entered into an Additional Research Agreement with Hadasit pursuant to which Hadasit will perform research services for Cell Cure Neurosciences over a period of five years. Cell Cure Neurosciences will pay Hadasit $300,000 per year for the research services over the course of the five-year term of the Additional Research Agreement. Hadasit will be entitled to receive a royalty on the sale of any products developed under the agreement and commercialized by Cell Cure Neurosciences. The amount of the royalty will be determined by future agreement between Hadasit and Cell Cure Neurosciences, taking into consideration their respective contributions to the development of the product, or if they fail to agree, the royalty terms will be determined by a third-party expert.

We have entered into a Third Amended and Restated Shareholders Agreement with Cell Cure Neurosciences, Teva, HBL, and ESI pertaining to certain corporate governance matters and rights of first refusal among the shareholders to purchase on a pro rata basis any additional shares that Cell Cure Neurosciences may issue. Under the agreement, the shareholders also granted each other a right of first refusal to purchase any Cell Cure Neurosciences shares that they may determine to sell or otherwise transfer in the future. The number of members on the Cell Cure Neurosciences board of directors will be set at seven, whereby we will be entitled to elect four directors, HBL will be entitled to elect two directors, and Teva will be entitled to elect one director. These provisions were also included in an amendment to Cell Cure Neurosciences' Articles of Association.

In November 2012, we entered into a share purchase agreement with Cell Cure Neurosciences through which we increased our ownership interest in that subsidiary. Pursuant to that agreement, we purchased 87,456 additional Cell Cure Neurosciences ordinary shares in exchange for 906,735 BioTime common shares. As a result of the share purchase, which closed in January, 2013, we now own, directly and through our subsidiaries ESI and Asterias, approximately 62.5% of the outstanding ordinary shares of Cell Cure Neurosciences.

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ReCyte Therapeutics—Treatment of Vascular Disorders

ReCyte Therapeutics focuses on developing treatments for vascular disorders, including both age-related diseases and injuries. The company was founded in January 2011 as a subsidiary of BioTime, Inc. with investments by private shareholders and by us.

The therapeutic indications targeted by ReCyte Therapeutics products include age-related cardiovascular diseases such as coronary artery disease, heart failure, and peripheral artery disease. Therapeutics for age-related vascular disease represent some of the largest, fastest-growing actual and potential markets in the U.S. due to the aging baby boom generation. Cardiovascular disease is among the leading causes of death and disability in the U.S., and they consume a major and every-increasing proportion of health care costs. The National Academy of Sciences has estimated that a potential 58 million Americans are currently afflicted with cardiovascular disease.

ReCyte Therapeutics is working to produce novel first-in-class therapies for the unmet needs of these patients. Its products in development include vascular cells derived from hES and iPS cell sources.

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During August 2011, BioTime entered into a License Agreement with Cornell University for the worldwide development and commercialization of technology developed invented by Dr. Shahin Rafii and co-workers at Weill Cornell Medical College for the differentiation of hES cells into vascular endothelial cells. This technology may help to provide an improved means of generating vascular endothelial cells on an industrial scale and with stronger intellectual property protection. This technology could be utilized by ReCyte in diverse products, including those under development at ReCyte Therapeutics to treat age-related vascular diseases and injuries, and in products being developed at OncoCyte targeting the delivery of toxic payloads to cancerous tumors.

ReCyte Therapeutics has used the Cornell technology in combination with the PureStem® technology to produce highly purified monoclonal embryonic vascular endothelial progenitor stem cells.

In conjunction with the Cornell License Agreement, during August 2011, we also entered into a three year Sponsored Research Agreement under which scientists at Weill Cornell Medical College, led by Dr. Sina Rabbany, are conducting research with the goals of (1) verifying the ability of progenitor cells, derived by ReCyte Therapeutics, to generate stable populations of vascular endothelial cells, (2) testing the functionality and transplantability of the vascular endothelial cells in animal models to see if the transplanted cells generate new vascular tissue, and (3) using HyStem® hydrogels, produced by our subsidiary OrthoCyte, and other materials as “scaffolds” for the three-dimensional propagation of vascular endothelial cells into vascular tissues suitable for transplantation.

We presently own 94.8% of the ReCyte Therapeutics common stock outstanding. The other shares of ReCyte Therapeutics common stock outstanding are owned by two private investors. ReCyte Therapeutics has adopted a stock option plan under which it may issue up to 4,000,000 shares of its common stock to officers, directors, employees, and consultants of ReCyte Therapeutics and BioTime. As of December 31, 2013, options to purchase 1,290,000 shares of ReCyte Therapeutics common stock had been granted.

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LifeMap Sciences: On-Line Data Bases for Genetic, Stem Cell, and Disease Research

LifeMap Sciences markets GeneCards® the leading human gene database, as part of an integrated database suite that includes LifeMap Discovery® the database of embryonic development, stem cell research and regenerative medicine; and MalaCards, the human disease database. LifeMap Sciences makes its databases available for use by stem cell researchers at pharmaceutical and biotechnology companies and other institutions through paid subscriptions or on a fee per use basis. Academic institutions have free access to use the databases.

LifeMap Sciences is also offering our research products for sale, utilizing its databases as part of its strategy for marketing our research products online to reach life sciences researchers at biotech and pharmaceutical companies and at academic institutions and research hospitals worldwide. The LifeMap Discovery® data base provides access to available cell-related information and resources necessary to improve stem cell research and development of therapeutics based on regenerative medicine and may promote the sale of our PureStem® hEPC by permitting data base users to follow the development of hES cell lines to the purified hEPC state. This platform will also be utilized by us and our subsidiaries for internal and collaborative efforts.

We presently own 73.2% of the LifeMap Sciences common stock outstanding. The other shares of LifeMap Sciences common stock outstanding are owned by certain officers and directors of LifeMap Sciences and by other investors. LifeMap Sciences has adopted a stock option plan under which it may issue up to 2,342,269 shares of its common stock to officers, directors, employees, and consultants of LifeMap Sciences and BioTime. As of December 31, 2013, options to purchase 1,928,768 shares of LifeMap Sciences common stock had been granted.

Stem Cells and Related Products for Regenerative Medicine Research

We have consolidated the marketing of our existing research products and will be launching all new research products through ESI BIO. During 2014, we will be building the ESI BIO brand to create a single well-recognized brand and outlet for our current and future research products. One focus of ESI BIO’s research product offering will be to provide products that can be offered at both a less expensive research grade and also at a “clinical grade” if needed by our customers. This two-tiered grade and price approach will give our customers an easier transition from their therapeutic research to clinical applications and also will provide future therapeutic out-licensing opportunities for our research products and technologies.

Human Embryonic Stem Cell Lines for Research Use

Because hES and iPS cells have the ability to transform into any cell type in the human body, they may provide a means of producing a host of new products of interest to medical researchers. It is likely that hES and iPS cells could be used to develop new cell lines designed to rebuild cell and tissue function otherwise lost due to degenerative disease or injury.

In 2007, ESI announced the world's first hES cell lines derived according to cGMP principles, i.e. the detailed procedures for all aspects of production that could potentially exert an impact on the safety and quality of a product. The FDA enforces cGMP regulations with respect to the manufacturing of human therapeutics for use in the U.S., and virtually every country across the globe maintains some analogous standards for quality control in the manufacture of therapeutic products for humans.

ESI and scientists from Sydney IVF, Australia's leading center for infertility and in vitro fertilization ("IVF") treatment, also published a scientific report, “The Generation of Six Clinical-Grade Human Embryonic Stem Cell Lines” (Cell Stem Cell 1: 490-494). The paper outlined the procedures used to document the production of clinical-grade hES cell lines derived on human feeder cells obtained from an FDA approved source, produced in a licensed cGMP facility, with donor consent and medical screening of donors. Combined with our PureStem® technology that allows

for the derivation of a wide array of hEPCs with high levels of purity and scalability, and site-specific homeobox gene expression, we believe that ESI's clinical-grade master cell banks may be used to generate clonal clinical-grade embryonic progenitor cells of great interest to the biopharmaceutical industry. We expect that the acquisition of ESI's clinical-grade hES cell bank will save years of development time and thereby accelerate the development of clinical-grade progenitor cells for potential use as research and therapeutic products.

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ESI's six cGMP hES cell lines have been approved by the NIH for inclusion in the Human Embryonic Stem Cell Registry, which renders those cell lines eligible for use in federally funded research.

The ESI hES cell lines are available for purchase through http://bioreagents.lifemapsc.com/collections/human-embryonic-stem-cells and http://esibio.com/products/.

We have derived the complete genome sequence of five of the ESI hES cell lines to facilitate the development of products derived from these cell lines. We have made these cGMP-grade cell lines, along with certain documentation and complete genomic DNA sequence information, available for sale. We will charge a price for the cGMP-grade cell lines that covers our production and delivery costs. Although no royalties will be payable to us by researchers who acquire the cell lines for research use, researchers who desire to use the cGMP cell lines for therapeutic or diagnostic products, or for any other commercial purposes, may do so only after signing commercialization agreements acceptable to us..

PureStem® Human Embryonic Progenitor Cells

We acquired a license from Advanced Cell Technology to make and sell hEPCs using PureStem® technology. This technology allows the rapid isolation of novel, highly purified progenitors, which are cells that are intermediate in the developmental process between embryonic stem cells and fully differentiated cells. Using the PureStem® technology we derived more than 200 progenitors and are marketing a subset of these cells to the research community. Not only do PureStem® hEPCs possess the ability to become a wide array of cell types with potential applications in research, drug discovery, and human regenerative stem cell therapies, they are relatively easy to manufacture on a large scale and in a purified state, which may make it more advantageous to work with them than directly with hES or iPS cells.

We now offer 12 PureStem® hEPC for purchase at http://esibio.com/products/, and http://bioreagents.lifemapsc.com. We anticipate adding additional PureStem® hEPC and related ESpan™ growth media and differentiation kits over time. LifeMap Sciences is also undertaking new efforts to provide online biomedical database services through its LifeMap Discovery® database to increase awareness of molecular markers and diverse cell types comprising our PureStem® hEPCs. Through our current inventory of over 200 hEPCs, we plan to continually add additional PureStem® cells to our product offering.

We have been awarded a SBIR Phase 1 Small Business Grant from the National Institute of General Medical Sciences at the National Institutes of Health (NIH) for a project aimed at developing a simple cell culture additive that will reduce the risk of contamination of therapeutic stem cell formulations by residual pluripotent stem cells. Unlike our PureStem® technology, first generation protocols used in many laboratories to manufacture cell types from pluripotent stem cells can be contaminated with undesired cell types. Under the grant, we will work to develop reagents that selectively identify and kill residual pluripotent cells while leaving the intended therapeutic stem cells unharmed. Any products that may be developed may be marketed to the stem cell research community and to cell therapy companies that are developing pluripotent stem cell derived products without our PureStem® technology, for the treatment of degenerative diseases and injury.

We have also begun the PureStem® grant program which will award a $100,000 grant in 2014 to a winning applicant who offers the most innovative research plan to BioTime that utilizes one of our PureStem® progenitors.

hES Cells Carrying Genetic Diseases

We plan to add to our product line novel muscle progenitor cells produced from five hES cell lines carrying genes for Duchenne muscular dystrophy, Emery-Dreifuss muscular dystrophy, spinal muscular atrophy Type I, facioscapulohumeral muscular dystrophy 1A, and Becker muscular dystrophy. We have a contract to obtain the diseased hES cell lines from Reproductive Genetics Institute ("RGI"). Our goal is to produce highly purified and

characterized progenitor cell types useful to the research community for applications such as drug screening for the development of therapies for these devastating diseases.

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ESpan™ Cell Growth Media

Cell lines derived from hES and iPS cells that display novel cell signaling pathways (which are cell signals that regulate cell proliferation) may be used in screening assays for the discovery of new drugs. Since embryonic stem cells can now be derived through the use of iPS technology from patients with particular degenerative diseases, stem cells are increasingly likely to be utilized in a wide array of future research programs aimed to model disease processes in the laboratory and to restore the function of organs and tissues damaged by degenerative diseases such as heart failure, stroke, Parkinson's disease, macular degeneration, and diabetes, as well as many other chronic conditions.

We are marketing a line of cell-growth media products called ESpan.™ These growth media are optimized for the growth of hEPC types. Cells need to be propagated in liquid media, in both the laboratory setting, where basic research on stem cells is performed, and in the commercial sector where stem cells will be scaled up for the manufacture of cell-based therapies or for the discovery of new drugs. We expect that rather than propagating hES cells in large quantities, many end users will instead propagate cells using media optimized for the propagation of hEPCs created from hES cells.

ESpy® Cell Lines

Additional new products that we have targeted for launch in 2014 are ESpy® cell lines, which will be derivatives of hES cells and will emit beacons of light. The ability of the ESpy® cells to emit light will allow researchers to track the location and distribution of the cells in both in vitro and in vivo studies.

HyStem® Hydrogels

We offer hydrogel cell culture matrix products for our customers to grow ESI BIO stem cells and differentiated derivatives in a three-dimentional matrix that mimics the environment that is found in a living animal. The market is recognizing the need to culture cells in an environment that is similar to a living model, and since these hydrogel products can be provided at a research grade and at a clinical grade, they fit well within the ESI BIO product family of products that allow an easier transition from the research laboratory into the clinic.

Products for Differentiating and Reprogramming Cells

We plan to develop and launch a new line of research products to reprogram, differentiate, expand and characterize cells. These products will be designed to utilize technologies and materials that are more likely to be compliant with regulatory requirements for translation to the clinic, such as products that do not utilize animal-derived components or viruses. These products will continue our strategy of providing our customers cell based research products that are more likely to translate to therapeutic applications and that provide outlicensing opportunities for use of ESI BIO products in various therapeutic fields.

Licensed Stem Cell Technology and Stem Cell Product Development Agreements

We have obtained the right to use stem cell technology that we believe has great potential in our product development efforts, and that may be useful to other companies that are engaged in the research and development of stem cell products for human therapeutic and diagnostic use.

Wisconsin Alumni Research Foundation—Research Products

We have entered into a Commercial License and Option Agreement with Wisconsin Alumni Research Foundation ("WARF"). The WARF license permits us and our subsidiaries to use certain patented and patent pending technology belonging to WARF, as well as certain stem cell materials, for research and development purposes, and for the

production and marketing of “research products” and “related products.” “Research products” are products used as research tools, including in drug discovery and development. “Related products” are products other than research products, diagnostic products, or therapeutic products. “Diagnostic products” are products or services used in the diagnosis, prognosis, screening or detection of disease in humans. “Therapeutic products” are products or services used in the treatment of disease in humans.

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Under the WARF license agreement, we paid WARF a license fee of $225,000 in cash and $70,000 worth of our common shares. A maintenance fee of $25,000 will be due annually on March 2 of each year during the term of the WARF license beginning March 2, 2010. We also paid WARF $25,000 toward reimbursement of the costs associated with preparing, filing, and maintaining the licensed WARF patents.

We will pay WARF royalties on the sale of products and services under the WARF license. The royalty will be 4% on the sale of research products and 2% on the sale of related products. The royalty is payable on sales by us or by any sublicensee. The royalty rate is subject to certain reductions if we also become obligated to pay royalties to a third party in order to sell a product.

We have an option to negotiate with WARF to obtain a license to manufacture and market therapeutic products, excluding products in certain fields of use. The issuance of a license for therapeutic products would depend upon our submission and WARF's acceptance of a product development plan, and our reaching agreement with WARF on the commercial terms of the license such as a license fee, royalties, patent reimbursement fees, and other contractual matters.

The WARF license shall remain in effect until the expiration of the latest expiration date of the licensed patents. However, we may terminate the WARF license prior to the expiration date by giving WARF at least 90 days written notice, and WARF may terminate the WARF license if we fail to make any payment to WARF, fail to submit any required report to WARF, or commit any breach of any other covenant in the WARF license, and we fail to remedy the breach or default within 90 days after written notice from WARF. The WARF license may also be terminated by WARF if we commit any act of bankruptcy, become insolvent, are unable to pay our debts as they become due, file a petition under any bankruptcy or insolvency act, or have any such petition filed against us which is not dismissed within 60 days, or if we offer our creditors any component of the patents or materials covered by the WARF license.

Wisconsin Alumni Research Foundation License to Asterias—Therapeutic Products, Diagnostic and Research Products

Asterias has entered into a Non-Exclusive License Agreement with WARF under which Asterias was granted a worldwide non-exclusive license under certain WARF patents and WARF-owned embryonic stem cell lines to develop and commercialize therapeutic, diagnostic and research products. The licensed patents include patents covering primate embryonic stem cells as compositions of matter, as well as methods for growth and differentiation of primate embryonic stem cells. The licensed stem cell lines include the H1, H7, H9, H13 and H14 human embryonic stem cell lines.

In consideration of the rights licensed, Asterias has agreed to pay WARF an upfront license fee, payments upon the attainment of specified clinical development milestones, royalties on sales of commercialized products, and, subject to certain exclusions, a percentage of any payments that Asterias may receive from any sublicenses that it may grant to use the licensed patents or stem cell lines.

The license agreement will terminate with respect to licensed patents upon the expiration of the last licensed patent to expire. Asterias may terminate the license agreement at any time by giving WARF prior written notice. WARF may terminate the license agreement if payments of earned royalties, once begun, cease for a specified period of time or if Asterias and any third parties collaborating or cooperating with Asterias in the development of products using the licensed patents or stem cell lines fail to spend a specified minimum amount on research and development of products relating to the licensed patents or stem cell lines for a specified period of time.

WARF also has the right to terminate the license agreement if Asterias breaches the license agreement or becomes bankrupt or insolvent or if any of the licensed patents or stem cell lines are offered to creditors.

Asterias will indemnify WARF and certain other designated affiliated entities from liability arising out of or relating to the death or injury of any person or damage to property due to the sale, marketing, use, or manufacture of products that are covered by the licensed patents, or licensed stem cells, or inventions or materials developed or derived from the licensed patents or stem cell lines

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PureStem® Technology

ReCyte Therapeutics has entered into a license agreement with ACT that was subsequently assigned to us under which we acquired exclusive world-wide rights to use ACT's technology for methods to accelerate the isolation of novel cell strains from pluripotent stem cells. The licensed rights include pending patent applications, know-how, and existing cells and cell lines developed using the technology. We market PureStem® cells which were developed using this technology.

The licensed technology is designed to provide a large-scale and reproducible method of isolating clonally purified hEPC, many of which may be capable of extended propagation in vitro. Initial testing suggests that the technology may be used to isolate at least 200 distinct clones that contain many previously uncharacterized cell types derived from all germ layers that display diverse embryo- and site-specific homeobox gene expression. Despite the expression of many oncofetal genes, none of the hEPC tested led to tumor formation when transplanted into immunocompromised mice. The cells studied appear to have a finite replicative lifespan but have longer telomeres than most fetal- or adult-derived cells, which may facilitate their use in the manufacture of purified lineages for research and human therapy. Information concerning the technology was published in the May 2008 edition of the journal Regenerative Medicine.

BioTime has the right to use the licensed technology and cell lines for research purpose and for the development of therapeutic and diagnostic products for human and veterinary use, and also has the right to grant sublicenses.

We paid ACT a $250,000 license fee and will pay an 8% royalty on sales of products, services, and processes that utilize the licensed technology. Once a total of $1,000,000 of royalties has been paid, no further royalties will be due.

ACT may reacquire royalty-free, worldwide licenses to use the technology for RPE cells, hemangioblasts, and myocardial cells, on an exclusive basis, and for hepatocytes, on a non-exclusive basis, for human therapeutic use. ACT will pay us $5,000 for each license that it elects to reacquire.

The term of the licenses from ACT expire on the later of July 9, 2028 or the expiration of the last to expire of the licensed patents. The patent expiration dates cannot be presently determined with certainty because the patents are pending. ACT may terminate the license agreement if we commit a breach or default in the performance of our obligations under the agreement and fail to cure the breach or default within the permitted cure periods. BioTime has the right to terminate the license agreement at any time by giving ACT three months prior notice and paying all amounts due ACT through the effective date of the termination.

iPS Cell Technology

ReCyte Therapeutics has entered into a license agreement and a sublicense agreement with ACT under which it acquired worldwide rights to use an array of ACT technology and technology licensed by ACT from affiliates of Kirin Pharma Company, Ltd. ("Kirin"). The ACT license and Kirin sublicense permit the commercialization of products in human therapeutic and diagnostic product markets.

The licensed technology covers iPS methods to transform cells of the human body, such as skin cells, into an embryonic state in which the cells will be pluripotent. Because iPS technology does not involve human embryos or egg cells, and classical cloning techniques are not employed, the use of iPS technology may eliminate some ethical concerns that have been raised in connection with the procurement and use of hES cells in scientific research and product development.

The portfolio of licensed patents and patent applications covers methods to produce iPS cells that do not carry viral vectors or added genes. Other iPS cell technology currently being practiced by other researchers utilizes viruses and genes that are likely incompatible with human therapeutic uses. We believe that technologies that facilitate the

reprogramming of human cells to iPS cells without using viruses could be advantageous in the development of human stem cell products for use in medicine.

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The Kirin sublicense covers patent application for methods for cloning mammals using reprogrammed donor chromatin or donor cells and methods for altering cell fate. These patent applications are related to technology to alter the state of a cell by exposing the cell's DNA to the cytoplasm of another reprogramming cell with different properties. ReCyte Therapeutics may use this licensed technology for all human therapeutic and diagnostic applications.

A second series of patent applications licensed non-exclusively from ACT includes technologies for:

- the use of reprogramming cells that over-express RNAs for the genesOCT4 , SOX2 , NANOG , and MYC , and other factors known to be useful in iPS technology;

- methods of resetting cell lifespan by extending the length of telomeres;

- the use of the cytoplasm of undifferentiated cells to reprogram human cells;

- the use of a cell bank of hemizygous O-cells;

- methods of screening for differentiation agents; and

- the use of modified stem cell-derived endothelial cells to disrupt tumor angiogenesis.

ReCyte Therapeutics may use this technology in commercializing the patents licensed under the Kirin sublicense.

The ACT license also includes patent applications for other uses. One licensed patent application covers a method of differentiation of morula or inner cell mass cells and a method of making lineage-defective embryonic stem cells. That technology can be used in producing hEPCs without the utilization of hES cell lines. Another licensed patent application covers novel culture systems for ex vivo development that contains technology for utilizing avian cells in the production of stem cell products free of viruses and bacteria.

ACT iPS Cell License Provisions

Under the ACT license for iPS cell technology, we paid ACT a $200,000 license fee and ReCyte Therapeutics will pay a 5% royalty on sales of products, services, and processes that utilize the licensed technology, and a 20% royalty on any fees or other payments, other than equity investments, research and development costs, and loans and royalties, received by us from sublicensing the ACT technology to third parties. Once a total of $600,000 of royalties has been paid, no further royalties will be due.

We may use the licensed technology and cell lines for research purposes and for the development of therapeutic and diagnostic products for human and veterinary use, excluding (a) human and non-human animal cells for commercial research use, including small-molecule and other drug testing and basic research; and (b) human cells for therapeutic and diagnostic use in the treatment of human diabetes, liver diseases, retinal diseases and retinal degenerative diseases, other than applications involving the use of cells in the treatment of tumors where the primary use of the cells is the destruction or reduction of tumors and does not involve regeneration of tissue or organ function. The exclusions from the scope of permitted uses under the ACT license will lapse if ACT's license with a third party terminates or if the third party no longer has an exclusive license from ACT for those uses. Therefore, our cell lines marketed for research use are produced from hES cell lines (and not from iPS cells). In the therapeutic arena, ReCyte Therapeutics' use of the licensed iPS cell technology will be for applications such as its blood and vascular products.

The license to use some of the ACT iPS technology is non-exclusive, and is limited to use in conjunction with the technology sublicensed from ACT under the Kirin sublicense, and may not be sublicensed to third parties other than

subsidiaries and other affiliated entities. ReCyte Therapeutics has the right to grant sublicenses to the other licensed ACT technology.

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ReCyte Therapeutics will have the right to prosecute the patent applications and to enforce all patents, at our own expense, except that ACT is responsible for prosecuting patent applications for the non-exclusively licensed technology at its own expense. We will have the right to patent any new inventions arising from the use of the licensed patents and technology.

ReCyte Therapeutics will indemnify ACT for any products liability claims arising from products made by us and our sublicensees.

The term of the licenses from ACT expire on the later of August 14, 2028 or the expiration of the last to expire of the licensed patents. The patent expiration dates cannot be presently determined with certainty because certain patents are pending, but the latest expiration date of the licensed patents that have issued is 2025. ACT may terminate the license agreement if ReCyte Therapeutics commits a breach or default in the performance of its obligations under the agreement and fail to cure the breach or default within the permitted cure periods. ReCyte Therapeutics has the right to terminate the license agreement at any time by giving ACT three months prior notice and paying all amounts due ACT through the effective date of the termination.

Kirin Sublicense Provisions

The technology licensed from Kirin relates to methods of reprogramming human and animal cells. Under the Kirin sublicense, we paid ACT a $50,000 license fee and ReCyte Therapeutics will pay a 3.5% royalty on sales of products, services, and processes that utilize the licensed ACT technology, and 20% of any fees or other payments, other than equity investments, research and development costs, and loans and royalties that it may receive from sublicensing the Kirin technology to third parties. ReCyte Therapeutics will also pay to ACT or to an affiliate of Kirin, annually, the amount, if any, by which royalties payable by ACT under its license agreement with Kirin are less than the $50,000 annual minimum royalty due. Those payments will be credited against other royalties payable to ACT under the Kirin sublicense.

ReCyte Therapeutics may use the sublicensed technology for the development of therapeutic and diagnostic human cell products, including both products made, in whole or in part, of human cells, and products made from human cells. ReCyte Therapeutics has the right to grant further sublicenses.

ReCyte Therapeutics will indemnify ACT for any products liability claims arising from products made by it and its sublicensees. The licenses will expire upon the expiration of the last to expire of the licensed patents, or May 9, 2016 if no patents are issued. The patent expiration dates cannot be presently determined with certainty because certain patents are pending, but the latest expiration date of the licensed patents that have issued is 2025. ACT may terminate the license agreement if ReCyte Therapeutics commits a breach or default in the performance of its obligations under the agreement and fail to cure the breach or default within the permitted cure periods. ReCyte Therapeutics has the right to terminate the license agreement at any time by giving ACT three months prior notice and paying all amounts due ACT through the effective date of the termination.

HyStem® Hydrogel Technology

Through our acquisition of Glycosan, we acquired a license from the University of Utah to use certain patents in the production and sale of hydrogel products. During August 2012, we entered into an amendment to our License Agreement with the University of Utah that expanded the field of use for which we are licensed to produce and market products covered by the core patents underlying our HyStem® technology. We now have a worldwide license for all uses, with the exception of veterinary medicine and animal health. Our licensed field of use includes, but is not limited to, all human pharmaceutical and medical device applications, all tissue engineering and regenerative medicine uses, and all research applications. Previously, our license in the United States was not exclusive and the fields of use of the technology permitted by the license were not as broad.

Under the License Agreement, we will pay a 3% royalty on sales of products and services performed that utilize the licensed patents. Commencing in 2014, we will be obligated to pay minimum royalties to the extent that actual royalties on products sales and services utilizing the patents are less than the minimum royalty amount. The minimum royalty amounts are $22,500 in 2014, and $30,000 each year thereafter during the term of the License Agreement. We will also pay the University of Utah 30% of any sublicense fees or royalties received under any sublicense of the licensed patents.

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We will also pay a $225,000 milestone fee within six months after the first sale of a "tissue engineered product" that utilizes a licensed patent. A tissue engineered product is defined as living human tissues or cells on a polymer platform, created at a place other than the point-of-care facility, for transplantation into a human patient.

We agreed to pay and an additional license fee for the additional rights licensed to us during August 2012, and the costs of filing, prosecuting, enforcing and maintaining the patents exclusively licensed to us, and a portion of those costs for patents that have been licensed to a third party for a different field of use.

Commencing in five years, we may, under certain circumstances, be obligated to sublicense to one or more third parties, on commercially reasonable terms to be negotiated between us and each prospective sublicensee, or re-grant to the University, rights to use the licensed patents for products and services outside the general industry in which we or any of our affiliates or sublicensees is then developing or commercializing, or has plans to develop or commercialize, a product using the licensed technology.

Telomerase Sublicense

Asterias has received from Geron an exclusive sublicense under certain patents owned by the University of Colorado's University License Equity Holdings, Inc. relating to telomerase (the "Telomerase Sublicense"). The Telomerase Sublicense entitles Asterias to use the technology covered by the patents in the development of VAC1 and VAC2 as immunological treatments for cancer. Under the Telomerase Sublicense, Asterias paid Geron a one-time upfront license fee of $65,000, and will pay Geron an annual license maintenance fee of $10,000 due on each anniversary of the effective date of the Telomerase Sublicense, and a 1% royalty on sales of any products that Asterias may develop and commercialize that are covered by the sublicensed patents. The Telomerase Sublicense will expire concurrently with the expiration of Geron's license. That license will terminate during April 2017 when the licensed patents expire. The Telomerase Sublicense may also be terminated by Asterias by giving Geron 90 days written notice, by Asterias or by Geron if the other party breaches its obligations under the sublicense agreement and fails to cure their breach within the prescribed time period, or by Asterias or by Geron upon the filing or institution of bankruptcy, reorganization, liquidation or receivership proceedings, or upon an assignment of a substantial portion of the assets for the benefit of creditors by the other party.

Asterias is obligated to indemnify Geron, Geron's licensor, and certain other parties for certain liabilities, including those for personal injury, product liability, or property damage relating to or arising from the manufacture, use, promotion or sale of a product, or the use by any person of a product made, created, sold or otherwise transferred by Asterias or its sublicensees that is covered by the patents sublicensed under the agreement.

License Agreement with the University of California

Geron assigned to Asterias its Exclusive License Agreement with The Regents of the University of California for patents covering a method for directing the differentiation of multipotential human embryonic stem cells to glial-restricted progenitor cells that generate pure populations of oligodendrocytes for remyelination and treatment of spinal cord injury. Pursuant to this agreement, Asterias has an exclusive worldwide license under such patents, including the right to grant sublicenses, to create products for biological research, drug screening, and human therapy using the licensed patents. Under the license agreement, Asterias will be obligated to pay the university a royalty of 1% from sales of products that are covered by the licensed patent rights, and a minimum annual royalty of $5,000 starting in the year in which the first sale of a product covered by any licensed patent rights occurs, and continuing for the life of the applicable patent right under the agreement. The royalty payments due are subject to reduction, but not by more than 50%, to the extent of any payments that Asterias may be obligated to pay to a third party for the use of patents or other intellectual property licensed from the third party in order to make, have made, use, sell, or import products or otherwise exercise its rights under the Exclusive License Agreement. Asterias will be obligated to pay the university 7.5% of any proceeds, excluding debt financing and equity investments, and certain reimbursements, that

its receives from sublicensees, other than Asterias' affiliates and joint ventures relating to the development, manufacture, purchase, and sale of products, processes, and services covered by the licensed patent.

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The license agreement will terminate on the expiration of the last-to-expire of the university's issued licensed patents. If no further patents covered by the license agreement are issued, the license agreement would terminate in 2024. The university may terminate the agreement in the event of Asterias' breach of the agreement. Asterias can terminate the agreement upon 60 days' notice.

Stem Cell Agreement with Reproductive Genetics Institute

In 2009, we entered into a Stem Cell Agreement with RGI pursuant to which we obtained the non-exclusive right to acquire RGI's proprietary stem cell lines. The Stem Cell Agreement grants us rights to market new hES lines selected by us from 294 hES lines derived by RGI. We will initially select 10 RGI hES cell lines, and may add additional cell lines at our option. We will receive starting cultures of the cell lines we select, and will scale up those cell lines for resale as research products. Because our rights are non-exclusive, RGI will retain the right to market and use its stem cell lines for its own account. RGI is a leading fertility center that screens embryos for genetic disorders, such as cystic fibrosis and muscular dystrophy, prior to implantation. The RGI hES lines include both normal cells and 88 cell lines identified as carrying a host of inherited genetic disease genes, some of which we plan to sell as research products to universities and companies in the bioscience and pharmaceutical industries.

We will pay RGI a royalty in the amount of 7% of net sales of RGI-derived cells sold for research purposes such as the use of cells to test potential new drugs or diagnostic products. The Stem Cell Agreement requires us to sell the RGI cells for a minimum price of $7,500 per ampoule of cells. We also agreed to sell to RGI any cells that we derive from RGI stem cells at a price equal to 50% of the lowest price at which we sell those cells to third parties.

We will be marketing the acquired cells for research purposes only. However, the Stem Cell Agreement allows us and RGI to develop therapeutic or diagnostic uses of the cells, subject to approval by a joint steering committee composed of our officers and RGI officers. In the absence of an agreement by the steering committee for a different revenue-sharing arrangement, and provided that we are successful in developing and commercializing one or more of those products for therapeutic or diagnostic uses, we would pay RGI a royalty based on net sales of each product. The royalty rate would be 50% of net sales of the product, minus one-half of any other royalties required to be paid to third parties. None of the RGI cells have been approved by the FDA or any equivalent foreign regulatory agency for use in the treatment of disease, and we do not have any specific plans for the development of RGI stem cells for use in the treatment or diagnosis of disease in humans.

Our agreement with RGI is scheduled to terminate on December 31, 2039 but will be automatically extended for an additional ten years, unless we or RGI elect not to extend the term of the agreement. If the initial term of the agreement is extended for ten years, the extended term will be automatically extended for an additional period of ten years, unless we or RGI elect not to extend the term of the agreement for the additional period. RGI may terminate the agreement if we commit a breach or default in the performance of our obligations under the agreement and fail to cure the breach or default within the permitted cure periods. We have the right to terminate the agreement at any time by giving RGI 30-day prior notice and paying all royalties due with respect to the sale of cell products that occurred prior to the date of termination.

Sanford-Burnham Medical Research Institute

Through our acquisition of the assets of Cell Targeting, Inc. ("CTI"), we acquired a royalty-bearing, exclusive, worldwide license from the Sanford-Burnham Medical Research Institute ("SBMRI") permitting us and OncoCyte to use certain patents pertaining to homing peptides for preclinical research investigations of cell therapy treatments, and to enhance cell therapy products for the treatment and prevention of disease and injury in conjunction with our own proprietary technology or that of a third party. We have the right to grant sublicenses with notice to SBMRI.

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OncoCyte will pay SBMRI a royalty of 4% on the sale of pharmaceutical products, and 10% on the sale of any research-use products that we develop using or incorporating the licensed technology; and 20% of any payments we receive for sublicensing the patents to third parties. The royalties payable to SBMRI may be reduced by 50% if royalties or other fees must be paid to third parties in connection with the sale of any products. An annual license maintenance fee is payable each year during the term of the license, and after commercial sales of royalty bearing products commence, the annual fee will be credited towards our royalty payment obligations for the applicable year.

OncoCyte will reimburse SBMRI for its costs incurred in filing, prosecuting, and maintaining patent protection, subject to our approval of the costs. The reimbursement rate ranges from 33-100% of the prosecution and maintenance costs. OncoCyte has assumed in house primary responsibility for the prosecution of some of the SBMRI licensed patents. OncoCyte will indemnify SBMRI against liabilities that may arise from our use of the licensed patents in the development, manufacture, and sale of products, including any product liability and similar claims that may arise from the use of any therapeutic products that we develop using the SBMRI patents.

The license will terminate on a product-by-product and country-by-country basis, when the last-to-expire patent expires. The patent expiration dates cannot be presently determined with certainty because certain patents are pending, but the latest expiration date of the licensed patents that have issued is 2025. OncoCyte may terminate the license agreement by giving SBMRI 60-day notice. SBMRI may terminate the license agreement if OncoCyte fails to make license or royalty payments or to perform our reporting obligations after applicable cure periods.

Hadasit Research and License Agreement

Cell Cure Neurosciences has entered into an Amended and Restated Research and License Agreement under which it received an exclusive license to use certain of Hadasit's patented technologies for the development and commercialization for hES cell-derived cell replacement therapies for retinal degenerative diseases. Cell Cure Neurosciences paid Hadasit 249,058 New Israeli Shekels as a reimbursement for patent expenses incurred by Hadasit, and pays Hadasit quarterly fees for research and product development services under a related Product Development Agreement.

If Teva exercises its option to license OpRegen® or OpRegen®-Plus, Cell Cure Neurosciences will pay Hadasit 30% of all payments made by Teva to Cell Cure Neurosciences under the Teva License Option Agreement, other than payments for research, reimbursements of patent expenses, loans or equity investments.

If Teva does not exercise its option and Cell Cure Neurosciences instead commercializes OpRegen® or OpRegen®-Plus itself or sublicenses the Hadasit patents to a third party for the completion of development or commercialization of OpRegen® or OpRegen®-Plus, Cell Cure Neurosciences will pay Hadasit a 5% royalty on sales of products that utilize the licensed technology. Cell Cure Neurosciences will also pay sublicensing fees ranging from 10% to 30% of any payments Cell Cure Neurosciences receives from sublicensing the Hadasit patents to companies other than Teva. Commencing in January 2017, Hadasit will be entitled to receive an annual minimum royalty payment of $100,000 that will be credited toward the payment of royalties and sublicense fees otherwise payable to Hadasit during the calendar year. If Cell Cure Neurosciences or a sublicensee other than Teva paid royalties during the previous year, Cell Cure Neurosciences may defer making the minimum royalty payment until December and will be obligated to make the minimum annual payment to the extent that royalties and sublicensing fee payments made during that year are less than $100,000.

If Teva does not exercise its option under the Teva License Option Agreement and instead Cell Cure Neurosciences or a sublicensee other than Teva conducts clinical trials of OpRegen® or OpRegen®-Plus, Hadasit will be entitled to receive certain payments from Cell Cure Neurosciences upon the first attainment of certain clinical trial milestones in the process of seeking regulatory approval to market a product developed by Cell Cure Neurosciences using the licensed patents. Hadasit will receive $250,000 upon the enrollment of patients in the first Phase I clinical trial,

$250,000 upon the submission of Phase II clinical trial data to a regulatory agency as part of the approval process, and $1 million upon the enrollment of the first patient in the first Phase III clinical trial.

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The Hadasit license agreement will automatically expire on a country-by-country and product-by-product basis upon the later of the expiration of all of the licensed patents or 15 years following the first sale of a product developed using a licensed patent. The patent expiration dates cannot be presently determined with certainty because the patents are pending. After expiration of the license agreement, Cell Cure Neurosciences will have the right to exploit the Hadasit licensed patents without having to pay Hadasit any royalties or sublicensing fees. Either party may terminate the license agreement if the other party commits a breach or default in the performance of its obligations under the agreement and fails to cure the breach or default within the permitted cure periods.

Cornell University

During August, 2011, we entered into a License Agreement with Cornell University for the worldwide development and commercialization of technology developed at Weill Cornell Medical College for the differentiation of hES cells into vascular endothelial cells. The technology may provide an improved means of generating vascular endothelial cells on an industrial scale, and will be utilized by us in diverse products, including those under development at our subsidiary ReCyte Therapeutics to treat age-related vascular disease.

Our license to use the technology and patent rights is worldwide and exclusive and permits us to use the licensed technology and patents rights for the fields of cell therapy for age- and diabetes-related vascular diseases and cancer therapy. The license also covers (i) products utilizing human vascular or vascular forming cells for the purpose of enhancing the viability of the graft of other human cells, and (ii) cell-based research products. We also have a non-exclusive right to use any related technology provided by Cornell within the same fields of use, and non-exclusive rights with respect to any non-cell-based products for the research market not covered by the licensed patent rights.

We have the right to permit our subsidiaries and other affiliates to use the licensed patent rights and technology, and we have the right to grant sublicenses to others.

Cornell will be entitled to receive an initial license fee and annual license maintenance fees. The obligation to pay annual license maintenance fees will end when the first human therapeutic license product is sold by us or by any of our affiliates or sublicensees. A “licensed product” includes any service, composition or product that uses the licensed technology, or is claimed in the licensed patent rights, or that is produced or enabled by any licensed method, or the manufacture, use, sale, offer for sale, or importation of which would constitute an infringement, an inducement to infringe, or contributory infringement of any pending or issued claim within the patent rights licensed to us. A “licensed method” means any method that uses the licensed technology, or is claimed in the patent rights licensed to us, the use of which would constitute an infringement, an inducement to infringe, or contributory infringement of any pending or issued claim within the patent rights licensed to us.

We will pay Cornell a milestone payment upon the achievement of a research product sales milestone amount, and we will make milestone payments upon the attainment of certain FDA approval milestones, including (i) the first Phase II clinical trial dosing of a human therapeutic licensed product, (ii) the first Phase III clinical trial dosing of a human therapeutic licensed product, (iii) FDA approval of first human therapeutic licensed product for age-related vascular disease, and (iv) FDA approval of the first human therapeutic licensed product for cancer.

We will pay Cornell royalties on sales of licensed products by ourselves and our affiliates and sublicensees, and we will share with Cornell a portion of any cash payments, other than royalties, that we receive for the grant of sublicenses to non-affiliates. We will also reimburse Cornell for costs related to the patent applications and any patents that may issue that are covered by our license.

We will provide Cornell with periodic reports of progress made in our research and development and product commercialization programs, and in those programs conducted by our affiliates and sublicensees, using the licensed

patents and technology. We and our affiliates and sublicensees will be required to keep accurate records of the use, manufacture and sale of licensed products, and of sublicense fees received. Cornell has the right to audit those records that we and our affiliates maintain.

The license will expire on the later of (i) the expiration date of the longest-lived licensed patent, or (ii) on a country-by-country basis, on the twenty-first anniversary of the first commercial sale of a licensed product. We have the right to terminate the License Agreement at any time and for any reason upon ninety (90) days written notice to Cornell. Cornell may terminate our license if we fail to perform, or if we violate, any term of the License Agreement, and we fail to cure that default within thirty (30) days after written notice from Cornell.

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Cornell also may terminate the license or convert the exclusive license to a non-exclusive license if we fail to meet any of the following requirements: (i) diligently proceed with the development, manufacture and sale of licensed products; (ii) annually spend certain specified dollar amounts for the development of licensed products; (iii) submit an investigational new drug application covering at least one licensed product to the FDA within eight (8) years after the effective date of the License Agreement; (iv) initiate preclinical toxicology studies for at least one licensed product within six (6) years after the effective date of the License Agreement; (v) market at least one therapeutic licensed product in the U.S. within twelve (12) months after receiving regulatory approval to market the licensed product; or (vi) market at least one cell-based licensed product for the research market in the U.S. within twelve (12) months after the effective date of the License Agreement. We may fulfill the obligations described in (i) through (vi) through our own efforts or through the efforts of our affiliates and sublicensees.

Termination of the License Agreement by us or by Cornell or upon expiration will not relieve us of our obligations the make payments of fees owed at the time of termination, and certain provisions of the License Agreement, including the indemnification and confidentiality provisions, will survive termination. We may continue to sell all previously made or partially made licensed product for a period of one hundred and twenty (120) days after the License Agreement terminates, provided that the reporting and royalty payment provisions of the License Agreement will continue to apply to those sales.

We have agreed to indemnify Cornell; Cornell Research Foundation, Inc.; Howard Hughes Medical Institute; and their officers, trustees, employees, and agents, the sponsors of the research that led to the licensed patent rights; and the inventors and their employers, against any and all claims, suits, losses, damage, costs, fees, and expenses resulting from or arising out of exercise of the licenses and any sublicenses under the License Agreement. The indemnification will include, but not be limited to, patent infringement and product liability. We have also agreement to provide certain liability insurance coverage for Cornell and Howard Hughes Medical Institute.

Cornell and Howard Hughes Medical Institute will retain the right to use the licensed technology and patent rights for their own educational and research purposes. Cornell may also permit other nonprofit institutions to use the technology and patent rights for educational and research purposes.

In conjunction with the License Agreement, we also entered into a Sponsored Research Agreement under which scientists at Weill Cornell Medical College, led by Sina Y. Rabbany, PhD, will engage in research with the goals of (1) verifying the ability of progenitor cells, derived by ReCyte Therapeutics, to generate stable populations of vascular endothelial cells; (2) testing the functionality and transplantability of the vascular endothelial cells in animal models to see if the transplanted cells generate new vascular tissue; and (3) using HyStem® hydrogels and other materials as scaffolds for the three-dimensional propagation of vascular endothelial cells into vascular tissues suitable for transplantation. The Sponsored Research Agreement will have a term of three years, but we or Cornell can elect to terminate the agreement earlier by giving the other party thirty (30) days written notice.

If the researchers make any patentable discoveries or inventions in the course of the sponsored research program, we will have an option to negotiate an exclusive, royalty-bearing license to use the invention. If we do license the invention, Cornell would retain a right to use it on a non-exclusive royalty-free basis for its own internal research and teaching purposes.

USCN Life Science, Inc.

During December 2011, we entered into two agreements with USCN Life Science, Inc. (“USCN”), a Chinese company. One agreement is a License Option Agreement that grants us the right, but not the obligation, to license from USCN certain technology and any related patents that may issue, and certain hybridoma cell lines for the purpose of deriving new products and technologies for use in diagnostic procedures and in therapeutics for the treatment of disease, as well as for products intended for research use only. A hybridoma cell line is an expandable culture of cells engineered

to secrete a distinct antibody known as a monoclonal antibody that is directed to a specific protein. BioTime and OncoCyte scientists tested certain antibodies distributed by USCN and found them to be effective as components of PanC-Dx.™The other agreement we entered into with USCN is an assay kit Supply Agreement under which we will purchase a wide array of assay kits designed for enzyme-linked immunosorbent assay (ELISA) and chemiluminescent immuno assay (CLIA) directed to the stem cell research community and for research use only.

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Under the License Option Agreement we have the option of acquiring world-wide licenses to technology and certain hybridoma cell lines, and any patents related to the licensed technology and hybridoma cell lines, that may issue, for the purpose of deriving new products and technologies for use in diagnostic procedures and in therapeutics for the treatment of disease.

We paid USCN a license fee which will be credited toward the license fee payable if we exercise our option to license at least one hybridoma cell line. We may exercise our option to license additional hybridomas and related technology and patent rights by paying an additional license fee per hybridoma cell line. We will pay to USCN a royalty calculated as a percent of net sales received by us and our affiliates for all licensed products sold, performed, or leased by us or any of our affiliates. As defined in the License Option Agreement, Net Sales means revenues received from the manufacture, use or sale or other disposition of licensed products, less the total of all (a) discounts allowed in amounts customary in the trade; (b) sales tariffs, duties and/or taxes imposed on the licensed products; or (c) outbound transportation prepaid or allowed; and (d) amounts allowed or credited on returns. Net Sales does not include revenues from the sale or other disposition of licensed products to (i) any of our affiliates, (ii) to any of our sublicensees or any sublicensees of our affiliates, or (iii) to any affiliate of our or our affiliates' sublicensees. No multiple royalties will be payable on the basis that any licensed product is covered by more than one licensed patent or patent application. "Licensed products" means any product, service and/or process that constitutes, incorporates or utilizes, wholly or in part, any of the technology, patent rights, or hybridomas licensed by USCN under the agreement. If a royalty bearing license to use a third party's patent is required to eliminate or avoid an infringement or claim of infringement or to settle any lawsuit or other proceeding alleging patent infringement from the use of USCN's patents or technology or the use, manufacture, production, distribution, or sale of the licensed hybridoma lines or a licensed product, then we and any of our affiliates and any sublicensees may deduct the royalties paid to the third party from the royalties payable to USCN, provided that the amount of the deduction may not reduce the royalty payable to USCN by more than 50%.

We have agreed to indemnify, defend and hold harmless USCN and USCN's affiliates, successors, assigns, agents, officers, directors, shareholders and employees against all liabilities of any kind whatsoever, including legal expenses and reasonable attorneys' fees, arising out of the death of or injury to any person or persons or out of any damage to property resulting from the production, manufacture, sale, use, lease, performance, consumption or advertisement of licensed products or arising from any of our obligations, acts or omissions, or from a breach of any of our representations or warranties, under the License Option Agreement, except for claims that result from (a) the willful misconduct or gross negligence of USCN or any other indemnitee, and (b) claims alleging that the use of any of the patent rights, technology or hybridomas licensed to us, when used within our permitted field of use, infringes upon any patent, trade secret, or moral right of any third party.

USCN has agreed to indemnify, defend and hold harmless us and our affiliates, and our respective successors, assigns, agents, officers, directors, shareholders and employees against all liabilities of any kind whatsoever, including legal expenses and reasonable attorneys' fees, arising out of any claim, demand, lawsuit or other proceeding alleging that the use of any patent rights, technology, or hybridoma licensed to us or to any of our affiliates or any sublicensee within the permitted field of use infringes any patent, trade secret, or moral right of any third party.

The License Option Agreement will terminate on its fifth anniversary if the option has not been exercised on or before that date. If we exercise our option, the agreement will terminate upon written notice from us to USCN that we, our affiliates, and all sublicensees have permanently discontinued the use of the licensed technology, patent rights, hybridomas and licensed products.

We may terminate the agreement at any time on sixty (60) days prior written notice to USCN, and upon payment of all amounts due USCN through the effective date of the termination. USCN may terminate the agreement at any time if we breach or default in the performance of any of our obligations and the breach or default is not cured within thirty (30) days after a written request from USCN to remedy the breach or default, or if the breach or default cannot be

cured within that thirty (30) day period, we fail within that thirty (30) day period to proceed with reasonable promptness thereafter to cure the breach. Termination of the License Option Agreement will not release a party from any obligation that matured prior to the effective date of the termination.

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Under the Supply Agreement, USCN has agreed to sell us certain assay test kits. Our rights to purchase and resell the assay kits is "co-exclusive," meaning that USCN and its affiliates retain the right to offer, sell, and distribute the kits, and to sell the kits to other third-party distributors. We may sell the kits to our customers for research purposes only, and not for the treatment or diagnosis of any disease, injury, or physical disorder in humans, or in any human clinical trial or other clinical use. We and our customers will not have license or other rights to manufacture or produce any of the kits.

The initial term of the Supply Agreement is five years. The Supply Agreement will automatically renew for successive one year periods, unless either party provides written notice to the other of its desire not to continue the agreement.

We may terminate the Supply Agreement at any time, for any reason or no reason at all, upon sixty (60) days written notice to USCN. USCN may terminate the Supply Agreement if we breach or default in the performance of any of our obligations and the breach or default is not cured within thirty (30) days after a written request from USCN to remedy the breach or default, or if the breach or default cannot be cured within the thirty (30) day period, we fail within that thirty (30) day period to proceed with reasonable promptness to cure the breach. Either party may terminate the Supply Agreement if the other party becomes insolvent or enters into any arrangement or composition with creditors, or makes an assignment for the benefit of creditors; if there is a dissolution, liquidation or winding up of the other party's business; or if a trustee in bankruptcy is appointed for the assets of the other Party. The termination or expiration of the Supply Agreement will not act as a waiver of any breach of the agreement and will not release either party for any liability or obligation incurred under the agreement through the expiration or termination date.

Upon termination of the Supply Agreement, USCN shall have the right, but not the obligation, to repurchase all assay kits that we and our affiliates have remaining in inventory, at the original invoiced cost, plus all costs of shipping, insurance, duties, and taxes incurred in connection with the return shipment. If USCN does not elect to repurchase unsold inventory, we and our affiliates may continue to sell the remaining inventory.

Asterias Royalty Agreement with Geron

In connection with its acquisition of stem cell assets from Geron, Asterias entered into a Royalty Agreement with Geron pursuant to which Asterias agreed to pay Geron a 4% royalty on net sales (as defined in the Royalty Agreement), by Asterias or any of its affiliates or sales agents, of any products that Asterias develops and commercialize that are covered by the patents Geron contributed to Asterias. In the case of sales of such products by a person other than Asterias or one of its affiliates or sales agents, Asterias will be required to pay Geron 50% of all royalties and cash payments received by it or by its affiliate in respect of a product sale.

Plasma Volume Expanders and Related Products

Our business was initially focused on blood plasma volume expanders and related technology for use in surgery, emergency trauma treatment, and other applications. Our first product, Hextend®, is a physiologically balanced blood plasma volume expander used for the treatment of hypovolemia, a condition caused by low blood volume, often due to blood loss during surgery or injury. Hextend® maintains circulatory system fluid volume and blood pressure and helps sustain vital organs during surgery. Hextend®, approved for use in major surgery, is the only blood plasma volume expander that contains lactate, multiple electrolytes, glucose, and a medically approved form of starch called hetastarch. Hextend® is sterile and thus its use avoids the risk of infection. Health insurance reimbursements and HMO coverage now include the cost of Hextend® used in surgical procedures.

Hextend® is manufactured and distributed in the U.S. by Hospira, Inc., and in South Korea by CJ CheilJedang ("CJ"), under license from us.

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The Market for Plasma Volume Expanders

Blood transfusions are often necessary during surgical procedures and are sometimes required to treat patients suffering severe blood loss due to traumatic injury. Many surgical and trauma cases do not require blood transfusions but do involve significant bleeding that can place a patient at risk of suffering from shock caused by the loss of fluid volume (or hypovolemia) and physiological balance. Whole blood and packed red cells generally cannot be administered to a patient until the patient's blood has been typed and sufficient units of compatible blood or red cells can be located. Periodic shortages of supply of donated human blood are not uncommon, and rare blood types are often difficult to locate. The use of human blood products also poses the risk of exposing the patient to blood-borne diseases such as AIDS and hepatitis.

Due to the risks and cost of using human blood products, even when a sufficient supply of compatible blood is available, physicians treating patients suffering blood loss are generally not permitted to transfuse red blood cells until the patient's level of red blood cells has fallen to a level known as the "transfusion trigger." During the course of surgery, while blood volume is being lost, the patient is infused with plasma volume expanders to maintain adequate blood circulation. During the surgical procedure, red blood cells are not generally replaced until the patient has lost approximately 45% to 50% of his or her red blood cells, thus reaching the transfusion trigger, at which point the transfusion of red blood cells may be required. After the transfusion of red blood cells, the patient may continue to experience blood volume loss, which will be treated with plasma volume expanders. Even in those patients who do not require a transfusion, physicians routinely administer plasma volume expanders to maintain sufficient fluid volume to permit the available red blood cells to circulate throughout the body and to maintain the patient's physiological balance.

Several units of fluid replacement products are often administered during surgery. The number of units will vary depending upon the amount of blood loss and the kind of plasma volume expander administered. Crystalloid products must be used in larger volumes than those required with colloid products such as Hextend®.

Uses and Benefits of Hextend®

Hextend® has been formulated to maintain the patient's tissue and organ function by sustaining the patient's fluid volume and physiological balance. Hextend® is composed of a hydroxyethyl starch, electrolytes, sugar, and lactate in an aqueous base. Certain clinical test results indicate that Hextend® is effective at maintaining blood calcium levels when it is used to replace lost blood volume. Calcium can be a significant factor in regulating blood clotting and cardiac function. Clinical studies have also shown that Hextend® is better at maintaining the acid-base balance than are saline-based surgical fluids.

Licensing and Sale of Plasma Volume Expander Products

Hospira

Hospira has the exclusive right to manufacture and sell Hextend® in the U.S. and Canada under a license agreement with us. Hospira is presently marketing Hextend® in the U.S. Hospira's license applies to all therapeutic uses other than those involving hypothermic surgery, during which the patient's body temperature reaches temperatures lower than 12°C ("Hypothermic Use"), or those involving the replacement of substantially all of a patient's circulating blood volume ("Total Body Washout").

Hospira pays us a royalty on total annual net sales of Hextend®. The royalty rate is 5% plus an additional 0.22% for each $1,000,000 of annual net sales, up to a maximum royalty rate of 36%. The royalty rate for each year is applied on a total net sales basis. Hospira's obligation to pay royalties on sales of Hextend® will expire on a country-by-country basis when all patents protecting Hextend® in the applicable country expire and any third party

obtains certain regulatory approvals to market a generic equivalent product in that country. The relevant composition patents begin to expire in 2014 and the relevant methods of use patents expire in 2019.

We have the right to convert Hospira's exclusive license to a non-exclusive license or to terminate the license outright if certain minimum sales and royalty payments are not met. In order to terminate the license outright, we would pay a termination fee in an amount ranging from the milestone payments we received to an amount equal to three times the prior year's net sales, depending upon when termination occurs. Hospira has agreed to manufacture Hextend® for sale by us in the event that the exclusive license is terminated.

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Hospira has certain rights to acquire additional licenses to manufacture and sell our other plasma expander products in their market territory. If Hospira exercises these rights to acquire a license to sell such products for uses other than Hypothermic Use or Total Body Washout, in addition to paying royalties, Hospira will be obligated to pay a license fee based upon our direct and indirect research, development, and other costs allocable to the new product. If Hospira desires to acquire a license to sell any of our products for use in Hypothermic Surgery or Total Body Washout, the license fees and other terms of the license will be subject to negotiation between the parties. For the purpose of determining the applicable royalty rates, net sales of any such new products licensed by Hospira will be aggregated with sales of Hextend®. If Hospira does not exercise its right to acquire a new product license, we may manufacture and sell the product ourselves or we may license others to do so.

CJ

CJ markets Hextend® in South Korea under an exclusive license from us. CJ paid us a license fee to acquire their right to market Hextend®. CJ also pays us a royalty on sales of Hextend®. The royalty will range from $1.30 to $2.60 per 500 ml unit of product sold, depending upon the price approved by Korea's National Health Insurance. CJ is also responsible for obtaining the regulatory approvals required to manufacture and market PentaLyte®, including conducting any clinical trials that may be required, and will bear all related costs and expenses.

Major Customers

During 2013, 2012, and 2011, all of our royalty revenues were generated through sales of Hextend® by Hospira in the U.S. and by CJ in the Republic of Korea. We also earned license fees from CJ and Summit Pharmaceuticals International Corporation ("Summit"). We received the license fees from CJ and Summit during the years 2003 -2005. Full recognition of the revenues derived from those license fees was deferred and revenues have been recognized over the lives of the respective contracts, which had been estimated to last until approximately 2019 based on the current expected life of the governing patent covering our products in Korea and Japan. However, we recognized the unamortized balance of the Summit license fees during the fourth quarter of 2013 as a result of the termination of our license agreements with Summit. The following table shows revenues paid by customers that were recognized during the past three fiscal years and that accounted for 5% or more of our total annual revenues.

| | % of Total Revenues for the Year Ending December 31, | | |
|---|---|---|---|
| Licensee | 2013 | 2012 | 2011 |
| Hospira | 11% | 30% | 63% |
| CJ | 3 % | 8 % | 15% |
| Summit | 35% | 10% | 14% |

Royalty Revenues and License Fees by Geographic Area

The principal source of revenues has been from royalties from the sale of our product. During the past three years, we received $541,293, $753,209, and $945,461in royalty payments from Hospira and CJ from the sale of Hextend®. In 2013 and 2012, license fee revenues include subscription and advertisement revenues received by LifeMap Sciences. Revenues earned in Asia during 2013 reflect, in part, the recognition of the unamortized balance of the pre-paid Summit license fees, as a result of the termination of our license agreements with them. The following table shows the source of our 2013, 2012, and 2011 royalty and license fee revenues by geographic areas, based on the country of domicile of the licensee:

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| | Revenues for Year Ending December 31, | | |
|---|---|---|---|
| Geographic Area | 2013 | 2012 | 2011 |
| Domestic | $1,606,945 | $1,183,638 | $ |