



BioPreservation Today[®]

FEATURE ARTICLE:

Volume 7 - Issue 1 | Winter 2017

COLD CHAIN 2.0™: THE INTELLIGENT TRANSPORTATION WORKFLOW FOR TIME AND TEMPERATURE SENSITIVE BIOLOGICS

 **BioLife SOLUTIONS[®]**
BIOPRESERVATION TOOLS FOR CELLS, TISSUES, AND ORGANS



WHAT'S INSIDE

- BioLife Restructures biologistex™ Joint Venture to Prepare for Future Growth
- evo™ Smart Shipper Surpasses Rigorous Testing Criteria for Transporting Infectious Substances
- Growing Body of Published Performance Data Illustrates Broad Adoption of CryoStor[®] and HypoThermosol[®] Biopreservation Media



MIAMI, JANUARY 17-20, 2017

BioPreservation Today® is published quarterly by BioLife Solutions, Inc., Bothell, WA. BioPreservation Today®, BioLife Solutions®, BioLife Solutions® CryoStar®, HypoThermosol®, HypoThermosol®, CryoStar®, Preservation Chain®, BloodStar®, and the three ring logo are trademarks of BioLife Solutions, Inc. All other trademarks are the property of their respective owners. Please contact us via our website at www.BioLifeSolutions.com



IN THIS ISSUE

- 3 EDITOR'S CORNER**
Mike Rice, President and CEO, BioLife Solutions, Inc.
- 4 COLD CHAIN 2.0™: THE INTELLIGENT TRANSPORTATION WORKFLOW**
Michael Weaver, Product Development Manager, BioLife Solutions Inc.
Heidi Crawford, Software Product Manager, SAVSU Technologies, LLC
- 7 evo™ SMART SHIPPER SURPASSES RIGOROUS TESTING CRITERIA FOR TRANSPORTING INFECTIOUS SUBSTANCES**
Kevin O'Donnell, Vice President, Cold Chain Standards, Practices & Compliance, SAVSU Technologies, LLC
- 8 BROAD ADOPTION OF CRYOSTOR® & HYPOTHERMOSOL® BIOPRESERVATION MEDIA**
Todd Berard, Vice President of Marketing, BioLife Solutions, Inc.
- 9 biologistex™ COLD CHAIN LOGISTICS SaaS WINS 2016 IOT EVOLUTION ASSET TRACKING AWARD**
Heidi Crawford, Software Product Manager, SAVSU Technologies, LLC
- 10 EXPANDED USE OF CRYOSTOR® AND HYPOTHERMOSOL® IN CELL THERAPY CLINICAL TRIALS**
Mike Rice, President and CEO, BioLife Solutions, Inc.
- 11 BIOLIFE SOLUTIONS RESTRUCTURES biologistex™ JOINT VENTURE**

WEB RESOURCES

- alliancerm.org | Alliance for Regenerative Medicine
- aabb.org | American Association of Blood Banks
- bestcollaborative.org | BEST Collaborative
- lifesciences.knect365.com | KNect365 Life Sciences
- celltherapysociety.org | International Society for Cellular Therapy
- ishrs.org | International Society of Hair Restoration Surgery
- phacilitate.co.uk | Phacilitate
- regmedfoundation.org | Regenerative Medicine Foundation
- biolifesolutions.com/evidence | BioLife Solutions Cryopreservation and Hypothermic Storage Evidence

UPCOMING EVENTS



- ISCT 2017 Annual Meeting**
May 3-6, 2017, London, UK
- Cellular Therapies and Transfusion Medicine in Trauma and Critical Care 2017 (CTTACC)**
May 17-19, San Francisco, CA
- Future of Regenerative Medicine Congress (Perinatal Stem Cell Society)**
May 17-19, 2017, Teaneck, NJ
- International Cord Blood Symposium (Presented by AABB)**
June 8-10, 2017, San Diego, CA
- Cell Culture & Cell Therapy Bioprocessing Conference**
June 26-27, 2017, Philadelphia, PA





EDITOR'S CORNER

Mike Rice, Chairman & CEO, BioLife Solutions, Inc.

BOOTH
101

Greetings from the Phacilitate 2017 Cell and Gene Therapy World Conference in Miami,

Customers, suppliers, partners, and friends of BioLife, welcome to Miami and the Phacilitate 2017 Cell and Gene Therapy World Conference. We're pleased and proud to support this key industry event as a Silver sponsor in several ways, including continued industry leadership as the biopreservation experts with our CryoStor® and HypoThermosol® clinical grade biopreservation media products; and the evo™ Smart Shipper and biologistex™ cold chain SaaS for time and temperature sensitive biologic materials. In addition, on Wednesday, January 18th, biologistex's own Kevin O'Donnell will be chairing the session "What Efficiencies and Quality Benefits are the Latest Cold Chain Technologies Delivering;" and on Friday January 20th biologistex's Heidi Crawford will be performing a full evo demo at the Technology Showcase presentation "Cold Chain Biologics for Commercialization" during morning coffee. Please join if you can to see the latest in cold chain commercialization best practices.

In this issue of Biopreservation Today® (BPT), I provide an update on the adoption and use of CryoStor and HypoThermosol in regenerative medicine clinical trials.

In the feature article, Michael Weaver (BioLife Product Development Manager) and Heidi Crawford (SAVSU Software Product Manager) paint a picture for our vision of "Cold Chain 2.0" - the next generation technologies required for shipping time and temperature sensitive biologics. Read about the future in their article "Cold Chain 2.0 – The Intelligent Transportation Workflow For Time and Temperature Sensitive Biologics," and see for yourself how these technologies benefit autologous therapies.

Todd Berard, BioLife's Vice President of Marketing; also pens an article explaining the new Clinical Evidence search tool now available at biolifesolutions.com. We've collected over 250 abstracts, posters, and clinical publications highlighting biopreservation best practices, and indexed them with the latest search tool – making finding relevant biopreservation evidence support simple and easy. Learn more or try it out for yourself at <http://www.biolifesolutions.com/evidence/>.

We're also pleased to share good news about our partnership with SAVSU Technologies; and how our high potential joint venture has been changed to allow it to scale and support the cold chain vision both companies share. As an example of such, Heidi once again shares the exciting Internet of Things award our biologistex cold chain SaaS application has won recently; highlighting the potential our SaaS application holds, and Kevin highlights the need for robust and rigorous testing needs when transporting infectious substances. Read all about it in his article "evo Smart Shipper Surpasses Rigorous Testing Criteria For Transporting Infectious Substances."

Thank you for your continued interest in BioLife Solutions. I hope you enjoy this issue of Biopreservation Today. We look forward to seeing you at our exhibit and during the conference.

Best regards,

Mike



COLD CHAIN 2.0™: THE INTELLIGENT TRANSPORTATION WORKFLOW FOR TIME AND TEMPERATURE SENSITIVE BIOLOGICS

Michael Weaver, Product Development Manager, BioLife Solutions Inc.
 Heidi Crawford, Software Product Manager, SAVSU Technologies, LLC

Many cellular therapies are currently progressing through Stage 1, Stage 2 and Stage 3 clinical trials, and commercialization for several candidates could begin in 2017 following regulatory approvals. As they progress through these steps towards commercialization; these time and temperature sensitive biologics will rely even more heavily on the next generation cold chain for their safe distribution. Cold Chain 2.0 embodies the best possible biopreservation and distribution tools and practices available today, to protect these life-saving treatments from the inevitable inherent stresses induced in the transportation cold chain.

biologistex™ CCM, LLC is a joint venture formed by BioLife and SAVSU Technologies to create and market solutions to ensure the safe delivery and storage of time and temperature sensitive biologic medicines. Our vision is to create Cold Chain 2.0 rather than wait for it. Key components in this technology and services platform include the evo™ SMART Shipper (to maintain temperature control during transport), the biologistex Cold Chain Management Software as a Service (SaaS) application, and Best Flight Out (BFO) managed logistics services to avoid routing through hubs - where delays can introduce shipment delivery and patient administration risks in a mission critical, time sensitive workflow.

Critical success requirements for effective storage, distribution and patient administration of cell therapies mandate that:

- Cells remain within the product stability temperature range
- The shipment container is not opened in transit, which could make cells vulnerable to tampering
- The location of cells to the intended destination is known in near real-time
- Cells are delivered within the product stability time, allowing time for treatment

Cold Chain 2.0 Cell Therapy Workflow: From Bedside to Bench to Bedside

A common cell therapy production workflow specifies transporting cells at 2° to 8°C from the clinical site, to a cell therapy company's manufacturing facility, and then back to the clinical site for patient treatment. Frequently, hundreds of miles separate the two sites. The distribution route often traverses multiple climactic zones requiring robust temperature-control and GPS monitored shipments to ensure use within a validated shelf life protocol.

Workflow discovery discussions with our customers have yielded great insight into current cold chain challenges and opportunities for improvement. This article walks you through the stages for an autologous therapy workflow example; from transporting patient cells from a collection site at a hospital in Seattle, WA, to a cell therapy manufacturing site in Houston, TX, and then a return of the manufactured therapeutic cells back to the clinical site in Seattle. It uses an intelligent shipping solution, which integrates track and trace capabilities with temperature-controlled shipping via third party logistics provider (3PL) with the capability to schedule next/best flight out (NFO/BFO) services. The solution incorporates the evo® Smart Shipper container with biologistex™ Software as a Service (SaaS) for cold chain management, monitoring and quality assurance.

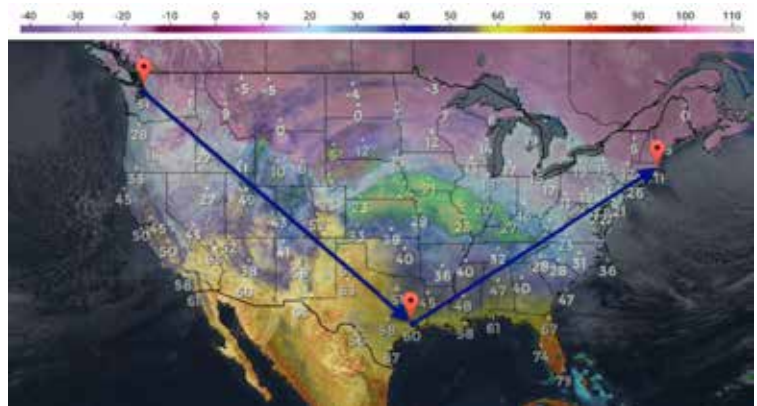


Image from Weather.com, December 16, 2016

An intelligent workflow guides a sample collected in Seattle in its shipment to Houston. It then protects a treatment in its transport to Seattle, traversing regions with winter temperatures ranging from 31°F to 60°F.

“Cell therapies have progressed from stage 1, to stage 2 and stage 3 clinical trials, and commercialization is beginning. Now is the time for cell therapy firms to design transportation processes that will do justice to this precious cargo.”



Cold Chain 2.0 in Motion

At the 3PL

PROVISION – Cold Chain 2.0 workflow begins with the cell therapy manufacturer coordinating with a trusted 3PL service to send evo to the collection center to pick up the patient's cells and transport them inside evo to the cell therapy manufacturer. The 3PL service includes capabilities to charge the battery pack that powers evo's communications and chill the reusable cold packs appropriate for the outside ambient temperature the day before shipment.

PACK AND SHIP - The day of shipment, the 3PL service returns the battery, charged, to evo and evo is packed out to include its twin cold packs and payload box. The 3PL service logs into the biologistex web app to create the shipment to deliver evo to the clinic, transport the patient's cells to the cell therapy manufacturer, and return evo to the 3PL. In the web application, shipment parameters are specified and alarms and alerts, along with people who should receive them, are configured.



Shipping methods for both shipment legs are selected, shipping labels are printed and evo is sealed inside two nested corrugated shipping boxes, one for each leg.



The Intelligent Transportation Workflow vs. Current Practices

While your firm might send payloads in single use shippers qualified for your workflow, this procedure is different. Why are cellular therapy firms qualifying the evo shipper and biologistex service for their workflows? Let's take a closer look at this modern workflow.

In-transit data: Prior to delivery, stakeholders view information regarding active shipments via the Web application. They verify that the shipment has been maintained within the appropriate temperature range, and within the product stability period, and ensure that the shipment has not been tampered with. However, with a traditional container and a data logger, the data is likely not available until the shipment is unpacked, and until the device is plugged into a computer for data download and analysis.

Geolocation without effects on payload: With evo, the Web app allows the consignor to set a geo fence via embedded technology. If your company chooses a single use shipper with a drop-in-the-box GPS locator you might be concerned that heat from the GPS device would compromise the nearby payload.

Chain of custody: evo with biologistex takes chain of custody very seriously. A sensor immediately alerts stakeholders when an intrusion occurs (box open) as well as where any custody transgression takes place during the ground portion of a trip. This enables your team or client to plan for contingency prior to package delivery. If a single use shipper was tampered with, would your company know that prior to its arrival at the destination?

Robust and Ecological: The workflow using evo and biologistex incorporates only reusable components. Unlike shippers constructed with vacuum insulated panels, which must be inspected for vacuum failure before each use, the evo with its nanoporous insulation is always ready. In addition, the evo's thermistor technology offers long-term in-calibration performance compared to shippers using thermocouples. Thermocouples can be prone to calibration "drift."

The outer shell of the evo is robust and is designed for many years of repeated use! Every shipment made spares the landfill from single-use Styrofoam or EPS, from cold packs and from data loggers.

“Our vision is to create Cold Chain 2.0 rather than wait for it.”

At the hospital

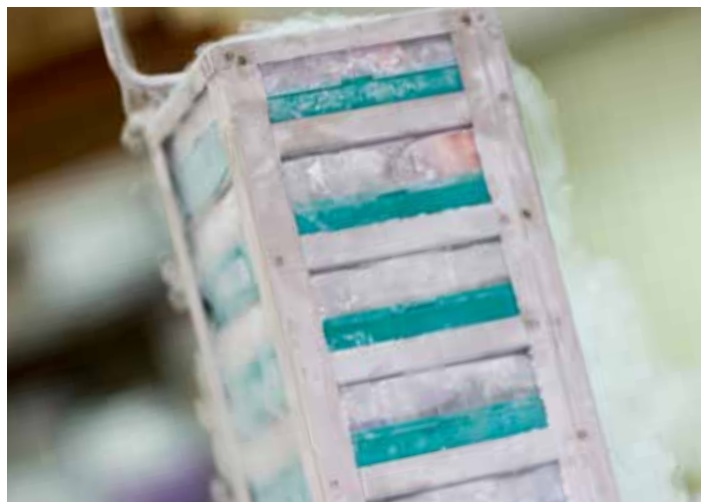
TRACK –The hospital team uses the guest access functionality of biologistex and its alerts to track the status of the shipment, including the distance from the hospital and current temperature inside evo. Knowing when evo will arrive, it takes only minutes to open evo, place the patient’s cells inside the payload box, and turn the pre-paid, pre-labeled shipment back over to the 3PL that has NFO/BFO capabilities to speed delivery of these precious cells direct to the cell therapy manufacturer.

At the Manufacturing Center

The cell therapy manufacturing team uses guest access to biologistex and its alerts to track the status of the shipment, including the distance from their location, and prior to arrival can verify the correct temperature inside evo has been maintained, the stability time for the cells has not been exceeded, and the shipment has not been tampered with. At the destination, unboxing and opening the lid of evo signals the quality manager who accesses the biologistex web service to confirm at the end of shipment that the desired temperature range has been maintained, the product was received within the validated stability period, and the chain of security was uninterrupted. A shipment report is available that documents temperature, time and security of the shipment for inclusion into the QMS record.

Return

After delivery and unpacking, the shipping specialist at the cell therapy manufacturer places evo in the pre-paid, pre-labeled return corrugated box to fulfill the efficient reverse logistics process and return evo to the 3PL logistics service. The 3PL



service can track evo’s return and efficiently manage evo for the next round of shipments.

At the 3PL

The same logistics are employed to return the manufactured cell therapy product to the hospital. Knowing when the cell therapy will be released, the manufacturer contacts the 3PL to send a chilled evo to transport the cells NFO/BFO directly back to the hospital without delay.

At the hospital

The hospital team uses guest access to biologistex and its alerts to track the status of the returning cells, including the distance from the hospital, to indicate prior to arrival and confirm upon arrival that the cell therapy remained within the product stability temperature range, the cells were delivered within the product stability time, and the shipment container was secure. The pharmacist knows when to expect arrival of the manufactured cell product. She alerts the laboratory technician that this therapy will need testing, and she alerts the physician regarding readiness for patient treatment.

After delivery and unpacking, the shipping specialist at the hospital places evo in the pre-paid, pre-labeled return corrugated box to fulfill the efficient reverse logistics process and return evo to the 3PL logistics service. The 3PL service can track evo’s return and efficiently manage evo for reuse.

The Work of evo and biologistex is Never Done!

Cold Chain 2.0 is a cell therapy specific, optimized cold chain distribution practice and system of tools to guide precious cargo through the cold chain. It is robust and ecological, providing geolocation, in-transit data and chain of custody information warranted by cellular therapies and by biologics in both commercialization and in clinical trials.





evo™ SMART SHIPPER SURPASSES RIGOROUS TESTING CRITERIA FOR TRANSPORTING INFECTIOUS SUBSTANCES

Kevin O'Donnell, Vice President, Cold Chain Standards, Practices & Compliance, SAVSU Technologies, LLC

Superior design meets industry's critical need for UN3373 Biological Substance, Category B smart packaging

Transporting cellular materials classified as an Infectious Substance, and therefore regulated in commerce, requires highly specialized packaging and considerable expertise lest you run afoul of governing national authorities. The fact that in many instances these materials are also time and temperature-sensitive can add to the level of one's anxiety over a shipment stemming from a lack of knowledge or experience. All of this, invariably, can lead to delays in delivery that put precious cell therapy or apheresis shipments – and ultimately patients – at risk.

Typically, sourcing the packaging to meet these multiple transport needs requires obtaining an insulated shipping container from one manufacturer, qualified secondary leak-proof packaging from another manufacturer and a temperature-monitoring device from yet another supplier. And it can't be just any packaging. The packaging system itself must be certified to meet rigid UN test performance requirements specified by the International Air Transport Association (IATA) as outlined in their Dangerous Goods Regulations, and in the US Department of Transportation (USDOT) US Code of Federal Regulations Title 49, Subtitle B, Chapter 1, Part 178. At best, this is a technically complicated endeavor.

In the world of transportation, regulated materials are always the responsibility of the shipper. He or she alone must ensure that the packaging used to transport a regulated material either meets the criteria to do so, or receives certification from the packaging supplier in the form of a test report summary, that it does. Failure to do so can result in civil and criminal penalties including hefty monetary fines (per occurrence) and incarceration.

First, a determination has to be made by a qualified professional that, whether in his or her judgment, and given a lack of direct evidence, a material is indeed infectious. For purposes of regulatory definition, infectious substances are those known or are reasonably expected to contain pathogens, which can cause disease in humans or animals. Pathogens are defined as microorganisms including bacteria, viruses, rickettsiae, parasites, fungi and other agents such as prions.

All designated infectious substances are regulated in transport. They are divided into two the distinctive categories: A and B. Category A is an infectious substance which is transported in a form that, when exposure to it occurs, can cause permanent disability, or life-threatening or fatal disease in otherwise healthy humans or animals. It is considered the most dangerous of the two categories and requires the strictest control.

A Category B infectious substance is one that does not meet the criteria of Category A. Its proper shipping name is UN3373 Biological Substance, Category B. Most infectious substance shipments fall into this category. In addition, there are many substances that meet the Exceptions section of the Dangerous Goods Regulations, within this Category, such as blood and blood products intended for transfusion, or substances which do not contain infectious pathogens, or have been neutralized or inactivated so that they no longer pose a health risk and will not cause disease in humans or animals. Finally, patient specimens for which there is minimal likelihood that pathogens are present are also exempt. Therefore, determining whether a substance is classified as Category A, Category B, or neither, is critical.

The evo Smart Shipper system, comprised of an intermediate packaging (insulated shipping container), 1.5 Liter payload box, specified rigid outer corrugate packaging, and qualified leak-proof secondary packaging, is the only packaging of its kind to surpass all the test criteria for the transport of materials classified as UN3373 Biological Substance, Category B. Its primary packaging payload may contain up to 506ml of liquid material without the need to test multiple types of primary receptacles packaging since "primary receptacles of any type may be used in the secondary packaging and transported by air or ground without the need for additional testing in the rigid outer packaging having met all the requirements (a) through (g)" of that sub-section.

The rigorous set of tests include 5 test package articles subjected to a 24-hour stack test, 1-hour water spray test of the corrugated outer packaging, a steel bar penetration test and drop tests of 1.2 meters.



UN3373

BIOLOGICAL SUBSTANCE
CATEGORY B

Continued on back page

^{1,2,3}Classification of Infectious Substances, 57th Edition of the IATA Dangerous Goods Regulations, Section 3.6.2.2.1, p. 159, January 1 – December 31, 2016, International Air Transport Association, Geneva Switzerland



GROWING BODY OF PUBLISHED PERFORMANCE DATA ILLUSTRATES BROAD ADOPTION OF CRYOSTOR® AND HYPOTHERMOSOL® BIOPRESERVATION MEDIA

Todd Berard, Vice President of Marketing, BioLife Solutions, Inc.

It is an exciting time for our industry, as the Regenerative Medicine and Cell Therapy markets go mainstream. As the number of available applications of these therapies increases, so does the complexity of the research, development, commercialization, and delivery to patients. Toss in additional commercialization and go-to-market challenges such as personalized medicine, multiple international clinical trial sites, product stability and temperature sensitivity limitations, and the ever-important cold chain and associated monitoring, and you have a lot to think about.

A vital but often overlooked component of this therapy delivery is also the biopreservation chain, and as such BioLife Solutions has been providing researchers, clinicians, and patients with cutting edge biopreservation media products since 2002. Co-developed by our chief Scientific Officer, Aby J. Mathew, PhD, our products have been adopted into more than 230 validations and clinical trials of novel cell-based therapies targeting blood cancers and solid tumors, stroke, heart disease, movement disorders, vision loss, and other leading causes of death and disability. As the research on biopreservation best practices has grown, so has adoption of our products in preserving different cell lines, types, and tissues. A result of this research is that the amount of clinical literature involving cryopreservation and hypothermic preservation methodologies with different cell and tissue types has grown dramatically. We are proud to list over 240 clinical publications, abstracts, and poster presentations on our website, with the list growing each month. Given this volume of evidence, we strive to make it easy for you to find relevant clinical evidence on “all things biopreservation”.

To accomplish this, we recently launched new search functionality on www.biolifesolutions.com to make it easy for users to search for relevant publications on cryopreservation and hypothermic storage topics.



Figure 1. The Evidence library section of biolifesolutions.com

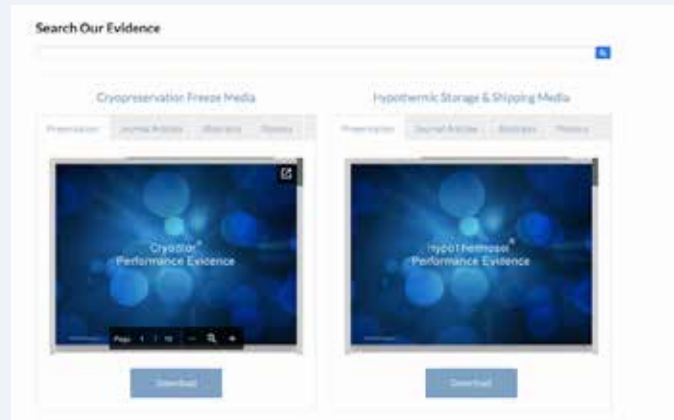


Figure 2. The Biopreservation Evidence Functionality at biolifesolutions.com

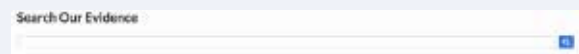


Figure 3. BioLife's Evidence Advanced Search Tool

Searching on key terms, such as a BioLife product name, cell type, author, and title now returns all evidence pieces containing these terms. The search engine also indexes the body content of PDFs and other file types, further enhancing results.

In our commitment to provide customers and partners the most up-to-date library on biopreservation literature citing use of our products, our marketing and scientific teams perform daily web searches and attend most major scientific conferences and symposiums, with new evidence added as it is discovered.

We hope you find the evidence section of our website to be a valuable resource. For additions or feedback, please email us at info@biolifesolutions.com.

Warm Regards,

Todd



biologistex™ COLD CHAIN LOGISTICS SAAS WINS 2016 IOT EVOLUTION ASSET TRACKING AWARD

Heidi Crawford, Software Product Manager, SAVSU Technologies, LLC

Integrated Ship, Track and Trace Application Provides Surveillance and Critical Alerts for Delivery of Time and Temperature Sensitive CAR T and other Cell Therapies

IoT Evolution World and IoT Evolution Magazine, leading print and online voices in the burgeoning Internet of Things marketplace, recently announced recipients of the 2016 IoT Evolution Asset Tracking Awards. The awards honor excellence in innovative use of IoT technologies to automate asset tracking, to increase efficiencies, reduce theft, or optimize asset utilization. Other award winners include AT&T, Impinj, Numerex, and Sprint.

The biologistex cloud-based cold chain management service is an integrated logistics and track and trace web app used by shippers of time and temperature sensitive biologic materials. The evo Smart Shipper is a state-of-the-art precision thermal shipping container with embedded payload monitoring, GPS location tracking, and cellular communication electronics that transmits critical



shipment information to the cloud. This SaaS app enables users to monitor high value shipments during transit and configure actionable alerts for downstream recipients for location, approaching destination, delivery, package open, and remaining shelf life or stability via the patent pending StableAlert™ countdown timer. For more information please visit www.biologistex.net, and follow BioLife on Twitter. Mike Rice, BioLife Solutions CEO, commented on the award by stating, "We are really pleased that our biologistex cold chain logistics SaaS has been recognized as an innovative and disruptive IoT platform. After many years of clinical development, companies in the cell therapy and broader regenerative medicine market are now increasing their focus on best in class tools to enable good distribution practices and worldwide delivery of time and temperature sensitive cell-based therapies and products. Our biologistex SaaS provides critical shipment monitoring and actionable alerts to stakeholders throughout the delivery chain, including destination clinicians, to improve efficiency and reduce errors that may prevent administration of potentially life-saving therapies."

Bruce McCormick, President of SAVSU Technologies, remarked, "This recognition of our mission to enable better cold chain logistics for biologic-based medicines is very rewarding. We designed the evo™ Smart Shipper to reduce packout errors and provide superior temperature maintenance of precious cell-based payloads. We believe that visibility of critical, accurate shipment and payload data, streamed live from the evo to the biologistex SaaS, will effect a paradigm shift away from the generally accepted practice of unmonitored shipments using foam coolers for life-saving cells, tissues and organs."





EXPANDED USE OF CRYOSTOR® AND HYPOTHERMOSOL® IN CELL THERAPY CLINICAL TRIALS

Mike Rice, Chairman & CEO, BioLife Solutions, Inc.

BioLife’s flagship clinical grade biopreservation media products, CryoStor and HypoThermosol, continue to be integrated in the storage, freezing and shipping processes of an expanded number of clinical trials of novel cellular therapeutics targeting the leading causes of disability and death. These include blood cancers, solid tumors, stroke, heart disease, vision loss, diabetes, movement disorders and immune disorders. Cell types being investigated include various T cells (dendritic, TCR, CAR, NK), isolated from peripheral blood and bone marrow and other sources, and several cell types derived or isolated from umbilical cord blood, cord tissue, amniotic tissue, and skeletal muscle. Widespread adoption of CryoStor and HypoThermosol has been accomplished due to demonstrable improvement in shelf life extension and the number of viable cells recovered following hypothermic and frozen storage and shipment. This is a critical determinant enabling commercialization after regulatory approvals are obtained by our customers. Total per dose manufacturing costs can dictate economic success or failure for a cell therapy candidate so shelf life and manufacturing yield

(of the delivered dose to be administered) are a key focus of our customers as they optimize processes in anticipation of approval. The quality footprint of our biopreservation media products highly impacts consideration for use by our customers and has driven adoption. In stark comparison to traditional “home-brew” or in-house formulated preservation media cocktails, CryoStor and HypoThermosol offer numerous features and benefits.

After receiving feedback from customers, to provide enhanced support for the use of CryoStor and HypoThermosol in clinical indications, and after consultation with the US FDA, the label indication was recently expanded to include reference for use in manufacturing of cellular therapies.

COMPARISON OF BIOPRESERVATION MEDIA ALTERNATIVES		
	CryoStor® and HypoThermosol®	Home-Brew
USP/multi-compendia Ingredients	Yes	Bot Typical
Contain Serum Ingredients	No	Typical: HSA
Contain Proteins Ingredients	No	Typical
Animal Origin Ingredients	No	FCS, FBS
Pre-formulated	Yes	No
DMSO Concentration Options	Yes	Yes
US FDA Master File	Yes	No
Sterility Tested to USP<71>	Yes	Not Typical
Endotoxin Tested to USP<85>	Yes	Not Typical
Manufactured per cGMP	Yes	Not Typical

LABEL USE INDICATION
For human cell and tissue preservation
For further manufacturing use
Not for human use as a stand alone product

Our Type II US FDA Master Files have been updated with this expanded label indication and are available to cross-reference in IND and BLA filings. A request can be made at this web address: <http://www.biolifesolutions.com/master-file-request-form/>. To date, over 240 abstracts, posters and journal articles have been published citing the use of CryoStor and HypoThermosol. A searchable database of this performance evidence can be found at: <http://www.biolifesolutions.com/evidence/>.

Customers throughout the world are conducting more than 230 pre-clinical validations and clinical trials of cellular therapies with CryoStor and/or HypoThermosol embedded in the manufacturing and distribution processes of starting/source material and final manufactured products. The following chart and table on page 10 illustrate the breadth of product adoption among large disease clinical indications and the phase of development of our customers’ clinical trials.

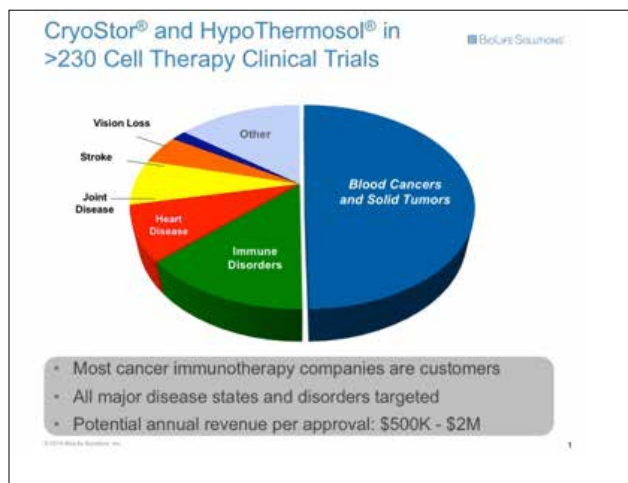
More than 50% of these validations and clinical trials are focused on hematologic malignancies and solid tumors.



BIO LIFE SOLUTIONS RESTRUCTURES biologistex™ JOINT VENTURE

BioLife Solutions, Inc.

Continued from 10



We anticipate the first of our clinical customers will submit their biologic license applications early in 2017 and if regulatory approvals are obtained, commercial manufacturing will commence thereafter. The following esteemed customers are leading the group in the regulatory approval process.

	LentiGlobin® - Transfusion Dependent Beta Thalassemia
	Invossa™ - Knee Osteoarthritis
	Axicabtagene CiloleuceL – Non-Hodgkin Lymphoma
	AMDC – Urinary Stress Incontinence

Consolidation of Cold Chain Technologies Enables External Investment in evo™ Smart Shipper and biologistex SaaS Opportunity

On January 3, 2017 BioLife announced the restructuring of its biologistex CCM LLC joint venture (JV) formed with SAVSU Technologies LLC (“SAVSU”), to develop and commercialize the evo Smart Shipper and related biologistex Cold Chain Management SaaS.



Pursuant to the restructuring, BioLife will convert its outstanding loan to the JV into a capital contribution and SAVSU will contribute all of its cold chain related operations, technology, IP and assets to the JV.

BioLife will continue to market and sell evo subscriptions and provide ongoing fulfillment and customer support in exchange for a 20% commission on revenue from its sales and marketing efforts and a fixed monthly fee for the first year. In addition, certain BioLife employees have been transitioned to the JV, as well as related costs associated with evo and biologistex product development and marketing. BioLife's ownership interest in the JV will initially be reduced from 52% to 45%, and the JV's operating results will no longer be consolidated with BioLife's results. Mike Rice, BioLife CEO, will remain a member of the JV's Management Committee.

“Following the successful completion of the development of evo hardware and software, transitioning to a revised corporate structure of our joint venture will help to accelerate growth of this disruptive IoT and cold chain technology platform,” said Mike Rice. “The restructuring consolidates the evo hardware, software and intellectual property into a single entity and moreover, allows for new, external capital to be invested into the JV to drive growth, while at the same time significantly reducing BioLife's cash operating and development expenses. We will continue to maintain a strong financial interest and operational role in driving the success of the platform and will remain intimately involved in marketing the evo Smart Shipper to the life sciences sector. BioLife has numerous high profile prospects in the cellular immunotherapy and broader regenerative medicine market that are currently evaluating evo and our award-winning IoT cold chain SaaS. We look forward to continuing to offer this best-in-class cold chain management solution to our current biopreservation media customers and the cell therapy market.”

The biologistex cloud based cold chain management service is an integrated logistics and tracking and trace web app used by shippers of time and temperature sensitive biologic materials.

Continued on back page

Continued from page 11

The evo Smart Shipper is a state of the art precision thermal shipping container with embedded payload monitoring, GPS location tracking, and cellular communication electronics that transmit critical shipment information to the cloud. The SaaS app enables users to monitor high value shipments during transit and configure actionable alerts for downstream recipients for location, approaching destination, delivery, package open, and remaining shelf life or stability via the patent pending StableAlert™ countdown timer.

Bruce McCormick, newly appointed President and CEO of the biologistex JV, commented, "This is an exciting time in the biotechnology space and our evo system offers the broadest and most sophisticated solution available for transporting precious time and temperature sensitive biologics. We have a long list of exciting product and business announcements that we look forward to sharing in 2017. As the pace of innovation increases, having evo product design and development, IT development and environmental testing all under one roof is a significant improvement for us. In 2017, biologistex plans to aggressively increase our sales presence and marketing activities. BioLife has created significant awareness of the need for improved cold chain logistics and we look forward to continuing our collaboration.

In addition to welcoming Mike Rice's continued Board of Directors role, we're also pleased to announce that Aby J. Mathew, PhD, BioLife Senior Vice President and Chief Technology Officer, has joined our Scientific Advisory Board."

Continued from page 8

Determining whether a substance offered for transport is classified or not classified as a dangerous good is critical. Both are completely acceptable as long as the shipper can defend their decision with facts and judgments. If you are willing to commit that the substance is not infectious, ship it that way and identify it as such on your paperwork. Likewise, if the determination is made that the substance has to be classified as UN3373 Biological Substance, Category B, also identify it that way.

You can have complete confidence that the evo™ Smart Shipper is capable of meeting either requirement without the need for an additional source of packaging or additional verification testing - while providing complete visibility of each package shipped.

Proud and Honored to be Named A Finalist In The Leaders In Health Care Award For Medical Technology Of The Year. – Seattle Business Magazine

**Seattle
Business
MAGAZINE**



1.866.424.6543
BioLifeSolutions.com

 **BioLIFE SOLUTIONS**[®]
BIOPRESERVATION TOOLS FOR CELLS, TISSUES, AND ORGANS

BioLife Solutions develops and markets patented hypothermic storage/transport and cryopreservation media products for cells, tissues, and organs. BioLife's proprietary HypoThermosol[®], CryoStor[®], and BloodStor[®] platform of biopreservation media products are marketed to academic research institutions, hospitals, and commercial companies involved in cell therapy, tissue engineering, cord blood banking, drug discovery, and toxicology testing. BioLife products are serum-free and protein-free, fully defined, and formulated to reduce preservation-induced, delayed-onset cell damage and death. BioLife's enabling technology provides research and clinical organizations significant improvement in post-preservation cell and tissue and viability and function.

