Drug Development & Delivery

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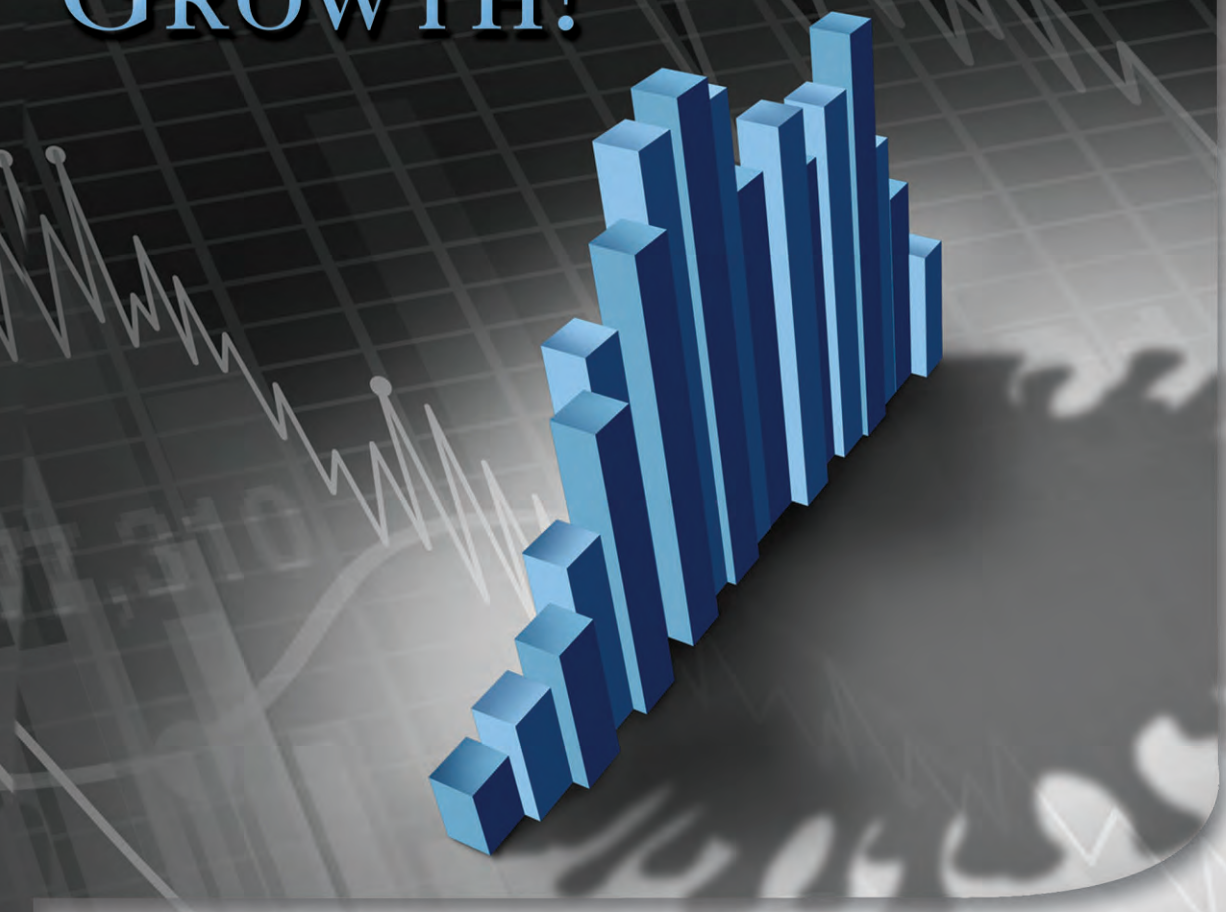
Injection Devices: What's Driving Growth?



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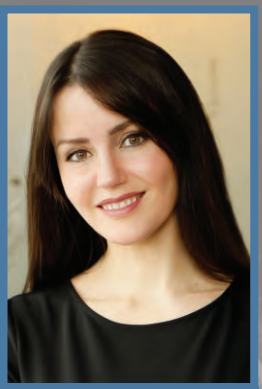

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Special Feature

Injection Devices: Will COVID-19 Deliver Growth to the Market?

Self-administration and digital connectivity keep patients out of healthcare settings and enable social distancing.

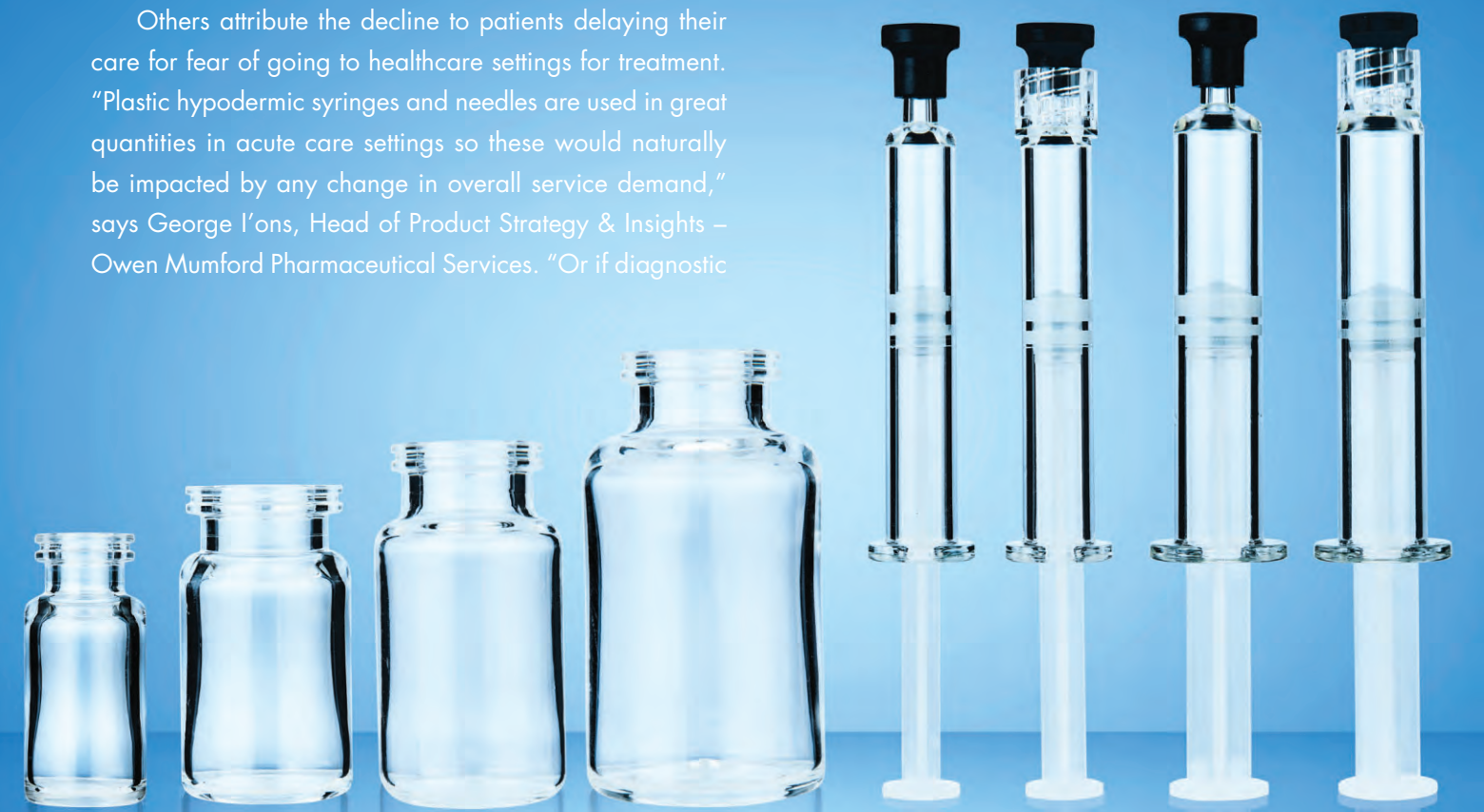
By: Cindy H. Dubin, Contributor

In May, Project Jumpstart, a public-private initiative, was announced that will pump $138 million into the production of 100 million prefilled syringes by the end of this year and another 500 million in 2021, should a COVID-19 vaccine become available.[1] Yet, industry gurus do not necessarily agree that the pandemic will have a positive impact on the injection delivery market.

According to one report, the global injectable drug delivery devices market is expected to decline from $16 billion in 2019 to $15.4 billion in 2020, in part due to the COVID-19 outbreak.[2] Some experts attribute this downturn to a slow down in clinical trial recruitment, which in turn has slowed down bringing new products and therapies to market.

Others attribute the decline to patients delaying their care for fear of going to healthcare settings for treatment. "Plastic hypodermic syringes and needles are used in great quantities in acute care settings so these would naturally be impacted by any change in overall service demand," says George I'ons, Head of Product Strategy & Insights – Owen Mumford Pharmaceutical Services. "Or if diagnostic procedures such as medical imaging declines, then the syringes specifically designed for use with contract media could be impacted. And, if cancer services and treatment is delayed, as has been reported, this could affect the pharmacy prepared prefilled syringes of cytotoxics and other anti-cancer agents."

However, others expect the market to recover and reach $21.3 billion in 2023[2], partly due to increased demand for injection devices that can be used and monitored in the home environment. For example, treatment of chronic diseases such as diabetes, Rheumatoid Arthritis and Crohn's disease are most commonly self-administered at home, and prefilled safety syringes and autoinjectors are typically used by these patients.



Multilayer syringes and vials ensure drug stability (Mitsubishi Gas Chemical).

The increasing prevalence of chronic diseases is leading to a rise in the overall use of syringes, particularly disposable syringes.[3] "Chronic disease products already on the market are expected to be largely unaffected by COVID-19," says Amy Boyle, Vice President Strategy, Planning and Marketing, Flex Health Solutions Segment. "This includes insulin delivery devices, rheumatoid therapeutics delivery devices, and well established cancer therapies." Consequently, the rise in the incidence of chronic diseases is expected to continue to drive the growth of the market.

Furthermore, technological advancements in self-administration, coupled with a rise of biologics in the pharmaceutical market, are some of the other factors propelling the growth of the market. Wearable injectors, for instance, capable of delivering high-volume biologics, are poised to grow $4 billion through 2024.[4]

"We believe we may be entering a new era where global pandemics become more common, which will only increase global reliance on pharma," says William Fortina, Business Development Director, Duoject Medical Systems. "Hence, we do not see a long-term decline of the need for injectable devices. Quite the opposite. Society will ask for pharma companies, their device suppliers, contract fillers, and regulators to be more agile to face such circumstances. That said, COVID-19 has delayed drug and device pipelines, which is affecting short-term investments. Business leaders who continue to invest in innovation and who continue to push projects forward despite COVID-19 will put their companies in a stronger competitive position post-crisis."

As an example, BD is working closely with the industry to identify and anticipate supply for large COVD-19 immunization campaigns to support vaccine developers in predicting drug-container compatibility before scale-up and in developing regulatory filing dossiers, explains Marie-Liesse Le Corfec, Global Portfolio Marketing Head, BD Pharmaceutical Systems.

In this annual *Drug Development & Delivery* magazine annual report on Injection Devices, we highlight trends in autoinjectors, pen injectors, wearable devices and connectivity, and prefilled syringes.

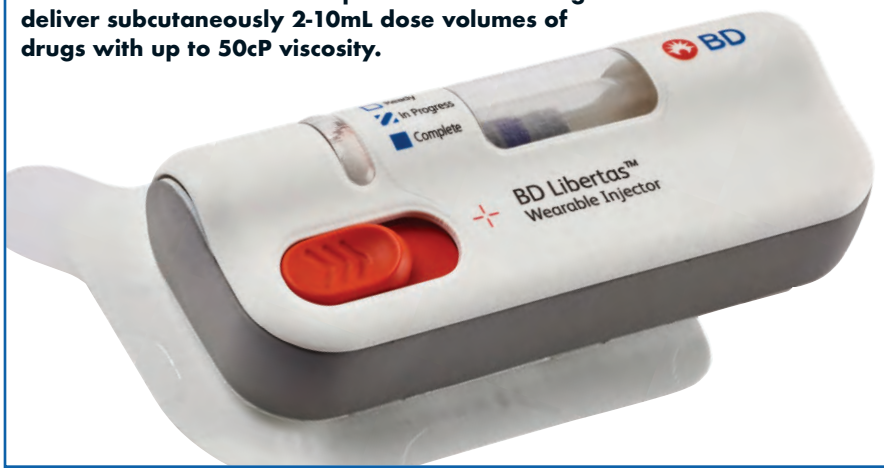
BD Pharmaceutical Systems: Platform Technologies Support Broad Design Space

BD supplies prefillable syringes as well as safety devices, autoinjectors, pens, and wearable injectors, all suitable for delivering medications such as injectable or nasal vaccines, hospital drugs, and chronic disease drugs. BD aims to develop integrated systems to meet customer expectations for smoothly interfacing components and subsystems to enable large-scale industrialization and effective commercial use.

"With our commercialized platforms such as glass or plastic prefilled syringes (BD Neopak™, BD Sterifill™ Advance), BD UltraSafe™ passive needle guard, BD Vystra™ disposable pen, BD Physioject™, and BD Intevia™ 1mL autoinjectors, or products in development, such as BD Intevia™ 2.25mL, BD Libertas™ wearable injector, and BD Evolve™ onbody injector, our customers can start their development choosing from platform technologies that support a broad design space (e.g. volume, viscosity, usage)," says Marie-Liesse Le Corfec, Global Portfolio Marketing Head, BD Pharmaceutical Systems. Customers can narrow their selections over time within those options, as tradeoffs are requiring balancing formulations, volumes, drug-container compatibility, and ergonomics.

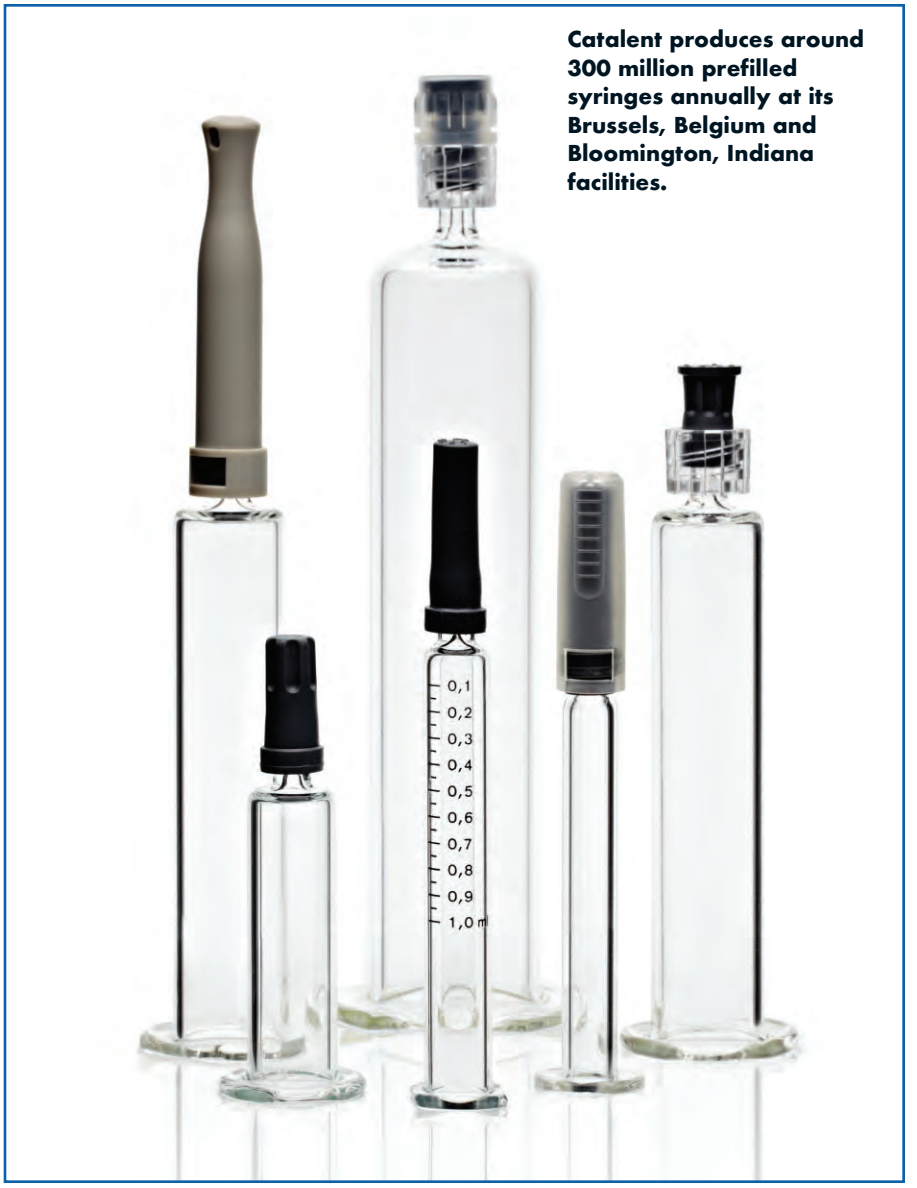
The BD Libertas wearable injector has been designed to deliver subcutaneously 2-10mL dose volumes of drugs with up to 50cP viscosity. BD has conducted >50 pre-clinical and clinical studies to measure its performance, demonstrate feasibility of 2-10mL s.c.

The BD Libertas wearable injector has been designed to deliver subcutaneously 2-10mL dose volumes of drugs with up to 50cP viscosity.



injections, and characterize tissue response. And, BD Evolve onbody injector, a ≤3mL variable dose system, is capable of wear over a multiday period.

BD is also working on digital solutions for traceability in manufacturing and supply chains, all the way up to patient administration. Though the basic technical foundations of device connectivity are now relatively established, secure end-to-end solutions, integrated with existing industrial and clinical monitoring systems, are still not widely available on the market, she says. "We feel BD can contribute significantly here, given our breadth of experience in the digital monitoring of drug delivery systems with our infusion pumps or automated drug cabinets as well as our familiarity with the collection and reporting of healthcare data by our hospital data management and analysis systems," says Ms. Le Corfec.



Catalent produces around 300 million prefilled syringes annually at its Brussels, Belgium and Bloomington, Indiana facilities.

Catalent Biologics: Demand for Autoinjectors Amid Pandemic

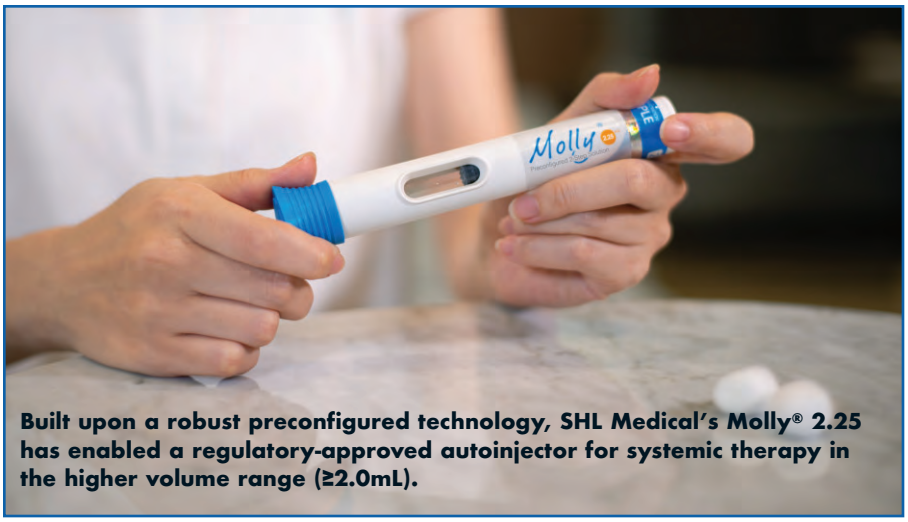
Unlike industry experts' prediction that the injectable drug delivery devices market is expected to decline as a result of COVID-19, Catalent Biologics is not seeing such a decline, and specifically not in the subset market for autoinjectors. "Instead we have observed steady autoinjector demand from our customers since the start of the pandemic," says Brian Galliher, Lead Process Engineer, Catalent. "This is possibly due to the fact that autoinjector products are typically administered in-home by the patient themselves. Patients using autoinjectors do not need to leave their homes to receive health care, which is helpful when trying to social distance during the pandemic."

One of Catalent Biologics' core businesses is the filling of vials, syringes, and cartridges, while also providing safety device and autoinjector assembly for its partners. Many of its partners are transitioning their therapeutics into autoinjectors or safety devices to increase patient compliance and healthcare-provider safety.

"The usability of an autoinjector positively changes the patient experience by allowing them to administer the medicine in their own home safely and reliably," says Mr. Galliher.

SHL Medical: Preconfigured Autoinjector Technology Supports Customization

SHL's Medical's Molly® autoinjector has seen various commercial launches in the past few months. As a combination product, Molly has recently enabled therapeutics for diseases such as diabetes, Rheumatoid Arthritis, osteoporosis, and atopic dermatitis, to name a few. In hindsight, this reflects the increasing development and approval of complex biologics made available for patient self-administration, says Magnus Fastmarken, Director of Marketing at SHL



Built upon a robust preconfigured technology, SHL Medical's Molly® 2.25 has enabled a regulatory-approved autoinjector for systemic therapy in the higher volume range (≥2.0mL).

Medical. Case in point, a 2.25mL autoinjector built upon the Molly technology is the first regulatory approved and commercially available combination product in the higher volume range (≥2.0mL), he says.

First offered to pharma partners as a preconfigured solution, the Molly technology has since supported various customized device iterations due to the mature infrastructures that support it. From device design and engineering, process development through to ensuring quality and facilitating regulatory approval – various elements have been built upon the Molly technology, enabling industrial design customizations as well as manufacturing flexibility and scalability.

SHL Medical aims to improve patients' lives by providing them with innovative technology-enabled health solutions. "The circumstances brought about by COVID-19 have been a strong driver for the industry to continue developing connected devices," says Mr. Fastmarken. "For us, investing in connected devices and digital ecosystems to support remote services, as well as remote monitoring, is a cornerstone," he says. "This supports our endeavors to enable remote medication treatment encompassing patient onboarding, engagement, adherence, as well as retention. It is our belief that such a fully developed digital ecosystem must support our existing portfolio of commercialized as well as upcoming devices."

To make this happen, SHL has been actively collaborating with digital healthcare companies to develop and establish connected devices and remote care services that will help improve disease management. At present, SHL partners with Innovation Zed to develop connected solutions for pen injectors.

One connected device solution that SHL launched on the market is the InsulCheck Connect add-on device. "Our commitment to creating enhanced services in the drug delivery market, along with the expertise and quality systems in place, enabled the commercialization of this device," Mr. Fastmarken says.

Further, SHL has acquired Weibel CDS, expanding its portfolio with solutions like the Mini Bag system – a primary packaging technology and wearable delivery system for high-volume parenteral drugs. "This puts SHL in a unique position to offer a primary container solution for drugs in the range of 2- to 30/50mL, while addressing the need for wearable solutions that outline usability, compactness, and flexibility," he says.

Mitsubishi Gas Chemical: Multilayer Syringes & Vials Ensure Drug Stability

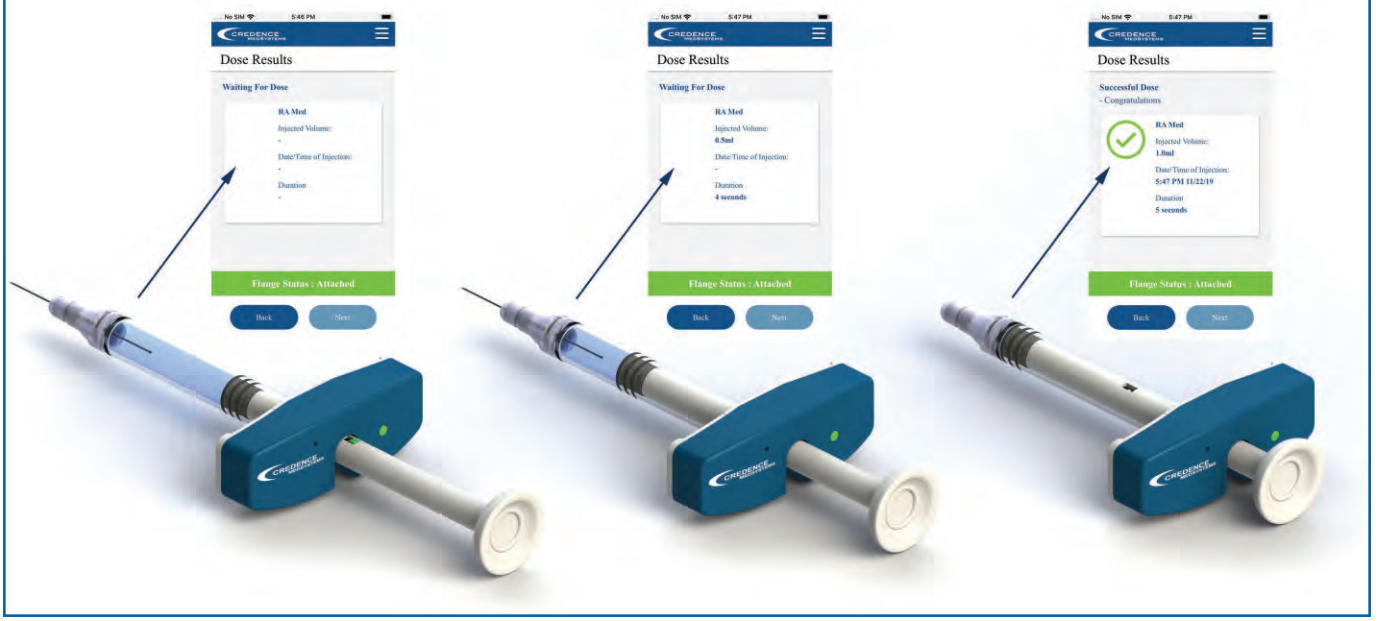
Mitsubishi Gas Chemical has been focusing on developing staked needle multilayer plastic syringes for autoinjectors. The targeted applications are biologics and regenerative medicines that are sensitive to oxygen and ultraviolet light.

OXYCAPT™ multilayer advanced material integrates plastic and glass for plastic syringes and plastic vials. The material features a water vapor layer made from Cyclo Olefin Polymer and a glass-like oxygen barrier layer with an oxygen absorbing polymer.

OXYCAPT plastic syringe features reduced leachable impurities and low extractables made possible by the PTFE stopper coated with slight silicone oil, a Polypropylene (PP) plunger rod, and the silicone-oil free OXYCAPT syringe barrel. OXYCAPT plastic vials are suited for parenteral pharmaceutical liquid medication storage. The multilayer construction preserves drug stability and shelf life in plastic vials, with reduced oxidation.

"By replacing a glass syringe with our OXYCAPT, pharmaceutical companies can solve problems such as glass breakage, pH shift caused by inorganic extractables from glass, and protein aggregation by silicone-oil on

The Credence Connect™ captures information about the injection and provides user feedback in real-time.



the glass barrel," says Tomohiro Suzuki, Associate General Manager, Mitsubishi Gas Chemical.

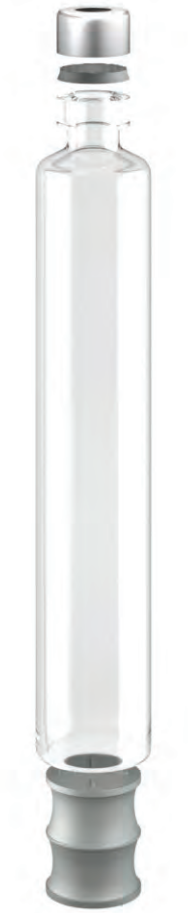
Credence MedSystems: Digital Connectivity Benefits Commercial & Clinical Settings

Credence MedSystems introduced the Credence Connect™ Auto-Sensing Injection System at the Pharmapack conference in Paris this past February where it was awarded Best Innovation in Drug Delivery Devices.

The Credence Connect brings digital connectivity to any prefilled syringe, explains John A. Merhige, Chief Commercial Officer, Credence MedSystems. The system is compatible with the Credence Companion® Safety Syringe System or any other standard prefillable syringe. The automatic or 'passive' function of the system allows the seamless capture and communication of injection information without requiring additional actions by the user to verify administration. Injected volume, time and date of administration, and duration of injection are measured, automatically transmitted, and recorded as dose history. The Connect provides real-time monitoring of an injection while it is taking place, allowing automatic measurement and communication of the volume injected over time. This allows the user to receive critical real-time feedback on the injection as it occurs.

The Connect embeds the connectivity in a reusable ergonomic finger flange that enhances usability and minimizes the environment footprint of the system. In addition to measuring data about the injection, it links to an app on a smartphone via Bluetooth Low Energy. The system will integrate with customer-specific or third-party platforms. The user can track the progress of the injection by viewing a counter or meter that provides the user visual confirmation and feedback. The meter advances when the injection is occurring and pauses when the injection is paused, providing positive reinforcement to the user. If the injected volume and duration/time match the prescribed parameters, the injection is determined to be a success. The app allows reminders, alarms, instruction, and guidance.

While the Connect has applicability to the commercial-use setting, the immediate shorter-term impact is likely greater in the performance of clinical studies, says Mr. Merhige. "Most significantly, the Connect can help allow the results of a study to be a true measure of a drug's safety and efficacy, as opposed to a potentially misinformed result stemming from poor or unknown compliance," he says. "The Connect can trigger early intervention when non-compliance is observed and allow safety and efficacy data to be mapped to dose history. These capabilities can minimize the risk of losing the development cost associated with a failed study and the revenue that could have come from an otherwise missed approval. Further, the Connect provides remote monitoring, enabling more efficient performance of these studies and allowing studies to be executed within the confines of social distancing."



Datwyler's NeoFlex™ plungers offer an optimized extractables and leachables profile to secure the integrity and safety of the customer's drug.

Datwyler: Coated Plungers for Compatibility and Protection

Datwyler has produced a range of cartridge components, such as plungers and combiseals, to seal the cartridges used in insulin pens. Offering the same rubber compound for both the plunger and the septum helps pharmaceutical companies when analyzing extractable and leachables, says Carina van Eester, Global Platform Leader, Prefilled Syringes and Cartridges, Datwyler.

"Datwyler offers very clean, uncoated compounds that guarantee good compatibility with injectable drugs like insulin," she says.

Pen injectors are used increasingly for multi-dose therapies requiring the injection of a fixed dose, she says. "Due to the rise of biologic drugs being delivered in pens, we have seen more demand for coated plungers to protect these highly sensitive large-molecule drugs."

In addition to pen injectors, other devices for subcutaneous self-injection continues to grow to accommodate biologicals and biosimilars. To meet this growing demand, Datwyler offers NeoFlex™ coated plungers for 1- and 2.25mL prefilled syringes. "With biologics being costly to manufacture and highly sensitive to extraneous contaminants, it is essential that packaging suppliers provide coated solutions that protect the drug product at all costs," says Ms. Van Eester.

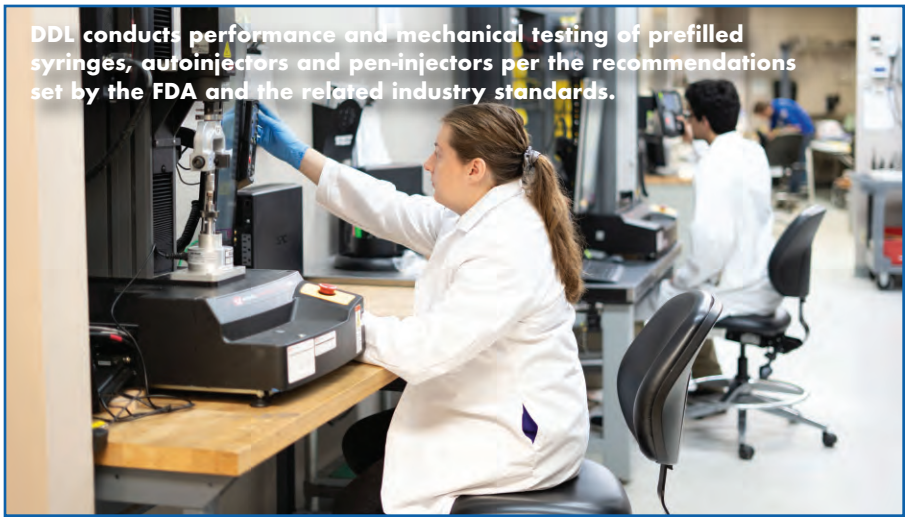
DDL: Injection Device Tests Mimic Real-Use Conditions

In the last year, DDL has grown its testing capabilities for prefilled syringes, autoinjectors, and pen injectors. Matt Pasma, Test Engineer, DDL, says there has been a shift from the use of vials and single-use syringes for a drug product to either prefilled syringes that have a set dose in the syringe that gets fully injected or to a pen or autoinjector.

"These devices allow the user to set the dose and then inject it much like the traditional vial and single-use syringe method," Mr. Pasma says. "These unique devices have very specific FDA requirements that need to be met. We have expanded our testing capabilities to handle these requirements."

DDL has the capability to perform the preconditioning in various environmental conditions, drop testing, and vibration testing prior to dose accuracy testing requirements. Mr. Pasma says "We have equipment and expertise needed to perform each test, and we have also installed an Instron universal tester that is designed to test all of the components of an autoinjector in one setup, which is more in line with how the product is used. This will allow our customers to feel more confident in the results when testing their pen and autoinjectors."

DDL's most recent initiative to serve the rapidly growing injectable market is the launch of the company's Container Closure Integrity (CCI) program. This program offers a suite of



DDL conducts performance and mechanical testing of prefilled syringes, autoinjectors and pen-injectors per the recommendations set by the FDA and the related industry standards.

All Sonceboz devices are intended to be body-worn and feature integrated connectivity.

deterministic testing technologies that include electrical conductivity and capacitance (high-voltage leak detection), laser-based gas headspace analysis, helium tracer gas detection in vacuum mode, and vacuum decay to help meet USP-NF<1207> deterministic CCI requirements for virtually any product-package system, including injectables.

Sonceboz: Accurate Dosage of High-Volume Drugs

The Sonceboz platform technology delivers high volumes of biologics, such as checkpoint inhibitors and other immune-oncology treatments. The technology enables patients to receive large volumes of biologics in a home setting, in a convenient way, by adhering an easy-to-use patch pump to the skin and until dosage is complete. "This way patients do not have to necessarily go to a hospital or clinic, can save time, and avoid potential exposure to disease such as COVID-19," says a Sonceboz spokesperson.

All Sonceboz devices are intended to be body-worn by either an adhesive patch or by the use of a belt-clip or strap. All devices come with an integrated connectivity interface that provides data such as delivery status, time of injection, potential error messages, etc. In some cases, the device provides the patient with data, in other cases data needs to be collected by a CRO during clinical trials.

Depending on the lifecycle of a drug product, and the customer's specific needs, the spokesperson says. Sonceboz can provide a matching solution with its interface. "We are helping pharma companies deliver very high volumes of drugs in excess of 25mL," the Sonceboz spokesperson says. "For such volumes, an electromechanic device that connects directly to vials is an optimal solution because the electromechanic drive mechanism offers consistent dosing accuracy and performance across the whole delivery cycle."

Owen Mumford Pharmaceutical Services: Platform Suited to Range of Drugs

At Owen Mumford Pharmaceutical Services the focus has been on creating and marketing a platform based on UniSafe®, an intuitive passive safety device for prefilled syringes. UniSafe uses the same technique as a standard syringe, and the safety shroud – which completely covers the needle – is deployed automatically. With a 1mL device on market, a 2.25mL soon to be available, and an autoinjector in development, this platform will be used for a variety of drugs and biologics for a range of diseases that require treatment by subcutaneous administration, explains George I'ons, Head of Product Strategy & Insights –

UniSafe® safety device for prefilled syringes is a spring-free device delivering safety and simplicity (Owen Mumford Pharmaceutical Services).

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"Our UniSafe passive safety device for prefilled syringes is the first device of its type to have a design that is spring-free," says Mr. I'ons. "This provides a clearer view of the dose in the syringe, is less intimidating for patients, and prevents pre-activation of the device."

The design also helps to prevent removal of the plunger and helps to eliminate reuse, drug wastage, and spillage. He says there will be increasing demand for reusable products so Owen Mumford is developing a reusable autoinjector based on its UniSafe platform. This device will have the option of connectivity where the electronic components, often containing precious metals, are housed in the reusable part of the device. "We have seen growing concerns around the use of plastics and challenges with the ability to recycle them," he says. "The addition of electronics for connected devices presents an even greater sustainability challenge."

Enable Injections: On-Body Infusor Incorporates Connectivity

Enable Injections continues to be focused on the development of the enFuse® platform and its biopharma partner combination product programs, and has completed two clinical studies with its biopharma partners.

The enFuse on-body infusor is a small wearable device capable of delivering large volumes of medicine subcutaneously in a single administration, currently in the investigational stage. Once approved, it will accommodate infusion of high-viscosity biopharmaceutical and pharmaceutical therapeutics from 3-50mL. The platform is designed to leverage existing primary container closure systems, which eliminates the need for additional drug compatibility testing, additional filling and manufacturing lines, and additional stability testing risk.

The enFuse® On-Body Infusor by Enable Injections is designed for patient self-administration of high-volume drugs from 3-50mL.

Jennifer Estep, Associate Director, Marketing, Enable Injections, says that enFuse is designed to offer several benefits to patients, including the potential for at-home self-administration by the patient or caregiver. This allows the potential to reduce the risk of exposure, the time and inconvenience of travel to and from administration in a healthcare facility, and the need to have home infusions administered by a healthcare provider.

"Our partners also appreciate the benefits the enFuse platform offers such as product differentiation through an improved patient experience, while minimizing development costs and time," she says. "The next generation enFuse is in development to incorporate connectivity for patients to communicate treatment information and track infusions on their smartphone."

West Pharmaceutical Services, Inc.: The Growing Trend of Self-Injection, Less Frequent Dosing

West is working with customers to ensure supply of the right components and solutions to help resolve the COVID-19 pandemic. "The process for selecting the best high-quality packaging components and devices for use with injectable medicines, including vaccines, is a complex one driven by years of science that West has pioneered," says Aileen Ruff, Vice President, Services and Solutions, West Pharmaceutical Services, Inc. "We help customers in the selection, testing, and verification of components and devices to prepare for future commercial scale-up and launch of successful vaccine candidates."

In the biologics space, there is a clear trend toward higher delivery volumes, less frequent dosing, and the conversion from intravenous to subcutaneous delivery. Ms. Ruff says this is driving demand for wearable technologies. West's wearable solution is the SmartDose® drug delivery portfolio, which includes 3.5mL and 10mL user loaded injectors, as well as a 3.5mL preloaded injector.

The SmartDose 3.5 injector is commercialized with Amgen's Repatha, to provide a single, monthly dose delivery option. "Our SmartDose devices can address multiple disease states from oncology and autoimmune to CNS, and empower patients to treat themselves in the comfort of a clinic or their own home vs. a hospital setting, with fewer injections than a multiple autoinjector alternative," says Ms. Ruff.

scPharmaceuticals Inc. announced its intent to go to market with West's 10mL SmartDose 10 injector for FUROSCIX®, a proprietary, subcutaneously delivered furosemide solution, for the treatment of worsening heart failure due to congestion. West's SmartDose wearable injector provides an outpatient alternative for the treatment. The FDA accepted scPharmaceutical's New Drug Application resubmission of FUROSCIX in July 2020.

Alexion has also announced its adoption of the SmartDose injector for two blood disorder products. ULTOMRIS® utilizes the SmartDose 3.5 injector to help facilitate at-home self-administration for ease of use. The SmartDose platform helps to provide patients confidence in their therapy and help reduce and prevent frequent visits to infusion centers, she says.

"To further strengthen the offering to our customers, West is partnering with Swissfillon for an integrated solution for clinical filling of the SmartDose Platform Cartridges," says Ms. Ruff. "Taking away possible challenges in the supply chain around upscale of fill-finish activities help simplify the journey to approval for our pharma clients."

West also partnered with Accord Healthcare Limited to develop a delivery device for a weekly single-dose injection of its drug Methofill™ (methotrexate) SELF INJECT. The incorporation of West's SelfDose™ injector supports the required dosing level and ergonomic design, which allows Rheumatoid Arthritis patients with dexterity issues to self-inject outside of a healthcare setting. West's SelfDose patient-controlled injection technology is for volumes lower than 3.5mL.

West's SmartDose® portfolio and SelfDose™ injector have options to partner with customers and help enhance the self-injection experience for patients while mitigating risk.

Bespak by Recipharm: Autoinjector Technology is Customizable

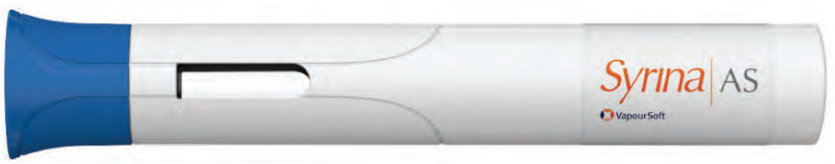
Over the last year, Bespak's injectables unit has been largely focused on autoinjector technology due to its ability to improve patient experience and increase treatment adherence. The increasing number of treatment options for chronic diseases involving biologics has shifted towards reducing injection frequency, which often leads to increased concentration and higher viscosities.

With this in mind, the company has been scaling up the Vapoursoft®-powered Syrina® AS autoinjector to commercial-scale manufacturing. In parallel, Bespak is engaged in a number of client programs developing Syrina-based delivery devices.

"As we transfer to the manufacturing stage, we leveraged our design for manufacturing capabilities to develop robust processes and tools," says Reenal Gandhi, Business Development Director, Bespak. "Multi-cavity tooling and an assembly line equipment have been installed and are being validated to support clinical studies and low-volume commercial supplies. As we transition from design and development to validation and manufacturing, our experience of high-volume medical device manufacturing and process design creates robust and repeatable processes."

The Syrina AS is ready for low-vol-

Powered by VapourSoft® technology, the Syrina® AS is Bespak by Recipharm's most advanced autoinjector, featuring automatic needle insertion and audible end-of dose-indication.



ume manufacturing, and design verification testing has been completed with delivery of 2mL 50cP fluid with a 27G STW needle in less than 10 seconds. This verification is one variation of the Syrina AS platform, which is designed to be customizable to 2.25mL and 1mL syringes, as well as different fill volumes, viscosities, and needle gauges. "We selected this configuration based on the market trend toward 2mL injection and higher viscosity drugs, while maintaining a thinner needle for patient comfort," says Ms. Gandhi. Our devices can work with multiple therapeutic areas and are suitable for a range of biologic drugs and immunology/autoimmune drugs. The device also works with high-concentration, small-molecule formulations and covers a range of viscosity drugs."

Bespak by Recipharm has several customer programs leveraging the Vapoursoft technology moving through the development and scale up process. One example is a drug delivery requirement for a 2mL product with viscosity of 30-40cps. Working with a traditional autoinjector demanded a larger needle and a stronger spring that introduced other risks to the device, explains Ms. Gandhi. Having already performed stability studies with a 27G syringe, there was a strong preference to avoid changing the primary container. Moving to a larger needle also meant impacting patient comfort. "By leveraging the Syrina AS platform product, the need to evaluate a new syringe configuration could be eliminated, saving time and avoiding the risk of reformulating down to a lower viscosity," she says. The autoinjector is currently being evaluated and compatibility tested with the product.

Bespak by Recipharm can also develop bespoke devices based on customer requirements. A global biopharma company had a unique formulation, which, due to its ultra-high viscosity, could not be administered using conventional autoinjectors. Bespak by Recipharm partnered with the company to develop a VapourSoft-driven autoinjector based on an adaption of the Syrina AS platform. "This allows the company to offer users a simpler and easier option to deliver the drug than with a traditional syringe and manual injection process," she says.

To meet the industry's growing demands for "connected devices," Bespak by Recipharm is developing a connectivity option for its autoinjectors. The option can sense and transmit data to a patient's smartphone, such as when an injection was taken and if the injection was completed. The connectivity module is designed to allow integration with customers' preferred connected health systems by using an open architecture compatible with technical solutions offered by a range of connectivity solution providers.

DALI Medical Devices: Bringing Clinical Trials to the Home Environment

DALI Medical Devices develops a variety of injectable drug delivery devices, and has spent the last year focusing on the Synnect® Smart Injection Solution. Synnect transforms a standard syringe into a smart syringe by replacing just the plunger rod, explains Ziv Cahani, Vice President of Business Development and Marketing, DALI Medical Devices.

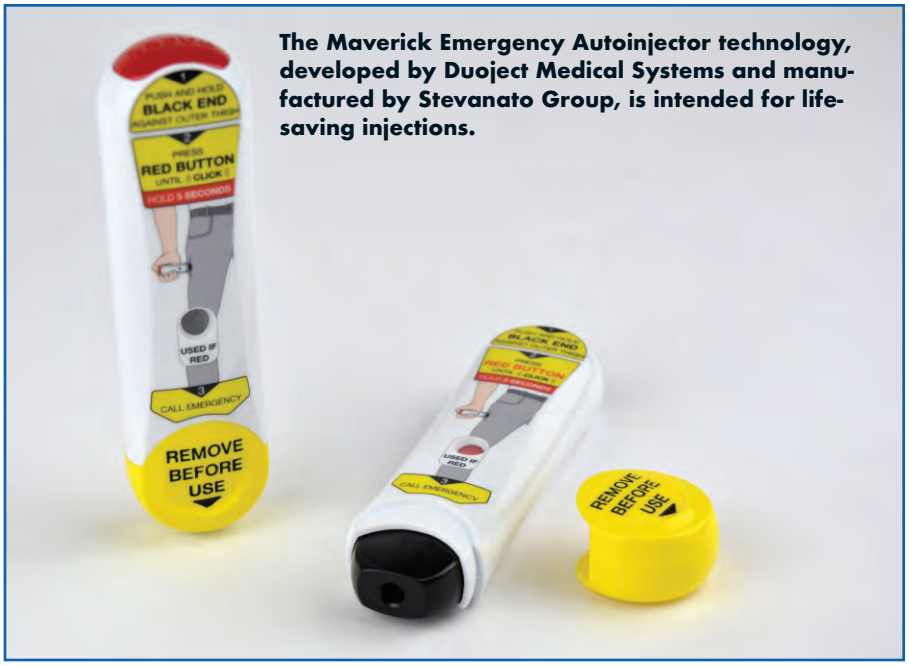
Synnect connects to a dedicated mobile device app and transmits injection data to a secure cloud in real

The Synnect® Smart Injection Solution from DALI Medical Devices transforms a standard syringe by just replacing the plunger rod.

time. Including sensing and connectivity technologies, the Synnect enables accurate and continuous measure of injected drug volume, tracking the start and end of the injection, and integrates with existing data management platforms (reimbursement evidence, adverse events, product, and training improvements).

Among other relevant usages, the Synnect is suited for an injectable drug's clinical trials happening in the home environment. "The COVID-19 pandemic has underscored the need for reliable at-home treatments as one way to prevent overwhelming hospitals and other healthcare facilities," says Mr. Cahani. "In addition to improving patient convenience, self-administration of injectable drugs at home protects high-risk patient populations and improves compliance. These are all relevant needs of clinical trials, especially in times a pandemic when, for example, older people want to eliminate visits in hospitals due to the risk, when there is a quarantine."

Synnect allows pharma companies and CROs to remotely monitor the clinical trial's process at different sites, which can reduce the costs of the clinical trial, he adds.

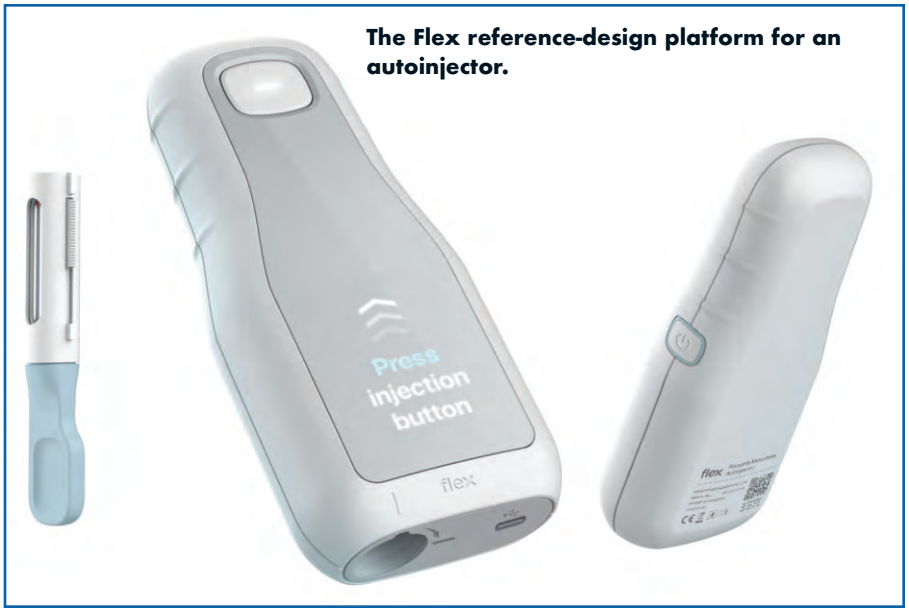


The Maverick Emergency Autoinjector technology, developed by Duoject Medical Systems and manufactured by Stevanato Group, is intended for life-saving injections.

Duoject Medical Systems: Autoinjector Lessens Risk, Saves Lives

Duoject has continued developing its Maverick Emergency AutoInjector in collaboration with Stevanato Group. This device offers higher levels of reliability and user-friendliness to patients who find themselves in a life-threatening situation, says William Fortina, Business Development Director, Duoject Medical Systems.

"It is well documented that patients have had issues with marketed epinephrine autoinjectors: struggling to take them out of their casing; triggering the system in the wrong orientation; or simply having to carry bulky systems with them at all times," he says. "When someone's life depends on receiving their injection, pharma companies and patients should expect a system that is designed with the primary goal of minimizing the chances of misuse. We developed the Maverick Emergency AutoInjector after careful evaluation of existing systems' shortcomings. We believe its patented sequential activation, ergonomic design, and robust automated injection mechanism will make it a strong alternative to current market offerings."



The Flex reference-design platform for an autoinjector.

Flex Health Solutions: Wearability & Connectivity Go Hand in Hand

Amy Boyle, Vice President Strategy, Planning and Marketing, Flex Health Solutions Segment, sees the injectables market growing with new biologics and a trend to personalized medicine that is delivered only through wearable injectors. Wearability, she says, is multifaceted, from biocompatibility, to device shape, to user interface, to connectivity.

"We have extensive expertise in connectivity and sensor technologies that drive form, function, cost, and data capability as well as the software to support it," she says.

She adds that connectivity strategy needs to match the data set and clinical constraints. "Connectivity can drive significant real estate demands and power demands of a product, but often a better strategy is available to suit the data packet and use case," she says.

With connectivity comes concern about cybersecurity and the remote connection between medical devices and backend application. Flex has developed a team of cybersecurity experts to ensure that, as a contract design and manufacturing organization, it is addressing any concerns, and fulfilling compliance requirements in design, development, and verification.

"Our expertise in connectivity and power management facilitates the transition to smart and communicative devices," says Ms. Boyle. "We have created smart inhalers, autoinjectors, connectivity modules for existing injection pens, and new innovative platforms."

The SG Alina® Pen, a new user-friendly self-injection device for diabetes care, is based on intellectual property and technology licensed from Haselmeier.

Stevanato Group: Providing Optimized Primary Containers & Integrated Solutions

Primary containers are at the heart of what Stevanato Group offers. It is a leading supplier of cartridges to the pen injector market for insulin and the second largest glass syringe producer globally. In recent years, it has become recognized as an integrated solution provider for drug delivery systems, offering contract manufacturing of devices as well as a growing portfolio of its own proprietary and licensed devices. Expanding its US presence is also a key strategy with a Technical Excellence Centre opening Boston this year to provide testing and analytical services related to drug, primary container and device.

To help fight the COVID-19 pandemic, Stevanato Group offers a range of glass primary packaging solutions for vaccines and drugs under development by its pharmaceutical customers, primarily vials and syringes, some with integrated safety systems, which can be used in hospitals and in some cases for self-administration. The possibility to use these solutions at home allows patients to be treated in more comfortable and familiar surroundings, says Steven Kaufman, Vice President, Drug Delivery Systems at Stevanato Group.

In the past year, Stevanato Group signed agreements with two key players in the medical device sector. First, a partnership and collaboration agreement with Duoject Medical Systems for the promotion and contract manufacture of Maverick™, an emergency-use autoinjector for overcoming life-threatening situations. Maverick is designed to be an intuitive, user-friendly cartridge-based device that provides full dose delivery visual, audible, and tactile feedback with no exposed sharps throughout the injection process. Maverick integrates Stevanato Group's highly resistant Nexa® glass cartridges as the primary container of choice, providing greater robustness, making the device even more reliable when an emergency intramuscular injection is required, explains Mr. Kaufman.

Additionally, Stevanato Group has an exclusive licensing agreement with Haselmeier related to its Axis-D intellectual property and technology to be the basis of the SG Alina® pen injector for diabetes care. In this framework, Cambridge Design Partnership is working closely with the R&D team of Stevanato Group to develop and bring the pen injector to market for clients looking for alternatives to existing devices.

"Due to a number of upcoming

patent expirations and other new injectable drugs coming to market, there is a growing demand by pharma clients for robust and user-friendly pen injectors," says Mr. Kaufman. "The SG Alina pen injector features an appealing and functional design, including an easy-to-dial mechanism, optimized injection force for patient comfort, and a readable display."

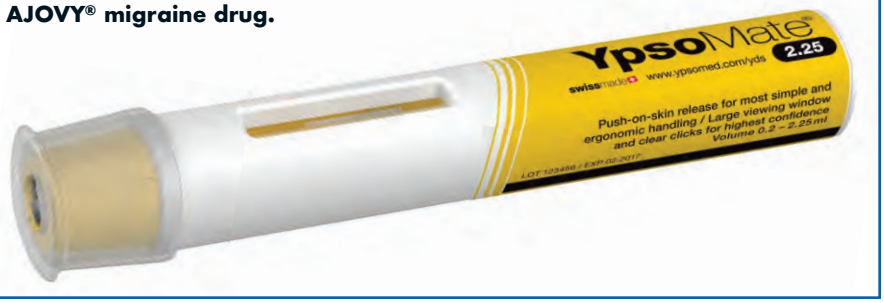
Stevanato Group is strengthening its drug delivery systems' portfolio by also developing EZ-be POD®, a discreet and comfortable wearable device for adjustable regimens, such as for diabetes treatment, pain management, and others. The company is also active in the respiratory therapeutic area with ICOcap®, a capsule-based inhaler used for asthma and COPD, licensed from partner Iconovo.

Ypsomed: Focusing on Devices so Partners Can Focus on Therapy

Ypsomed's main focus is in the areas of large-volume patch injectors and smart connected reusable add-ons. The company is is focused on developing the large-volume 3-10mL YpsoDose prefilled patch injector, which is being industrialized for clinical trials. The main benefit of the YpsoDose patch injector is to allow users to perform infrequent injections in an efficient and convenient way, saving significant costs for the healthcare system, explains Ian Thompson, Vice President Business Development, Ypsomed.

The electromechanical, cartridge-based, connected device is centered around a versatile platform customized into product-specific variants to provide a reproducible injection for each drug. YpsoDose automatically inserts the injection needle at the start and retracts the needle at the end of the injection process.

Ypsomed's YpsoMate 2.25 is the first approval and launch of a ready-to-use autoinjector compatible with a 2.25mL prefilled syringe for Teva's AJOVY® migraine drug.



"As YpsoDose illustrates, connectivity will become instrumental in effective self-management of chronic diseases," says Mr. Thompson. For instance, the reusable add-on SmartPilot for YpsoMate with built-in sensor technology and wireless communication capabilities, transforms the standard two-step YpsoMate autoinjector into a fully connected digital health system. SmartPilot monitors device use and provides therapy-relevant injection data to providers, caregivers, and healthcare stakeholders, as well as patients, through the self-injection process. "SmartPilot for YpsoMate is being industrialized for first customers, allowing our partnering pharmaceutical firms to rapidly develop therapy solutions that address non-adherence in clinical trials and post-market introduction," he says. "In short, Ypsomed addresses the device-oriented challenges so that our pharmaceutical partners can focus on the therapy-oriented challenges."

In March 2020 Teva announced the launch of its drug product AJOVY® in the prefilled YpsoMate 2.25 autoinjector for the preventive treatment of migraine in adults. The collaboration with Teva marks the first commercial market entry of Ypsomed's larger 2.25mL autoinjector YpsoMate 2.25, says Mr. Thompson. AJOVY (fremanezumab-vfrm), a humanized monoclonal antibody, is the first and only anti-CGRP treatment for the prevention of migraine with monthly and quarterly dosing options, he says.

"To date, Teva had marketed AJOVY in a standard syringe," says Mr. Thompson. "With the launch of the drug in an autoinjector, Teva now offers AJOVY in a format that is more convenient for patients. This was the first approval and launch of a ready-to-use autoinjector compatible with a 2.25mL prefilled syringe." ◆

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