THE AWARD-WINNING CREDENCE CONNECT™ AUTO-SENSING INJECTION SYSTEM

In this article, John Merhige, Chief Commercial Officer of Credence MedSystems, explores the benefits provided, questions raised and challenges presented when bringing digital connectivity to a prefilled syringe – and explains how connectivity that is universally applicable to any existing prefilled syringe platform adds value throughout the ecosystem, both including and beyond the "compliance business model".

When the team at Credence MedSystems performed its first brainstorming sessions that resulted in the award-winning Credence Connect™ Auto-Sensing Injection System, it leaned heavily on the company's philosophy of delivering *Innovation Without Change*. The challenge was to produce a highly innovative system that would deliver value across the drug delivery ecosystem, while achieving broad compatibility of the technology with existing processes and prefilled syringe systems.

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The application of digital connectivity in drug delivery devices continues to be a very important topic, especially so in light of the coronavirus pandemic's impact on remote clinical trial monitoring and the greater acceptance of telemedicine. The business case supporting connectivity is evolving rapidly to include applications in clinical study and commercial use. After being introduced at this year's Pharmapack conference in Paris, France, the Credence Connect received the Best Innovation in Drug Delivery Devices award. This honour reflects the value that the Connect can deliver across the drug delivery ecosystem to users, biopharma manufacturers, payers, providers and contract research organisations (CROs) by bringing connectivity to any prefilled syringe.

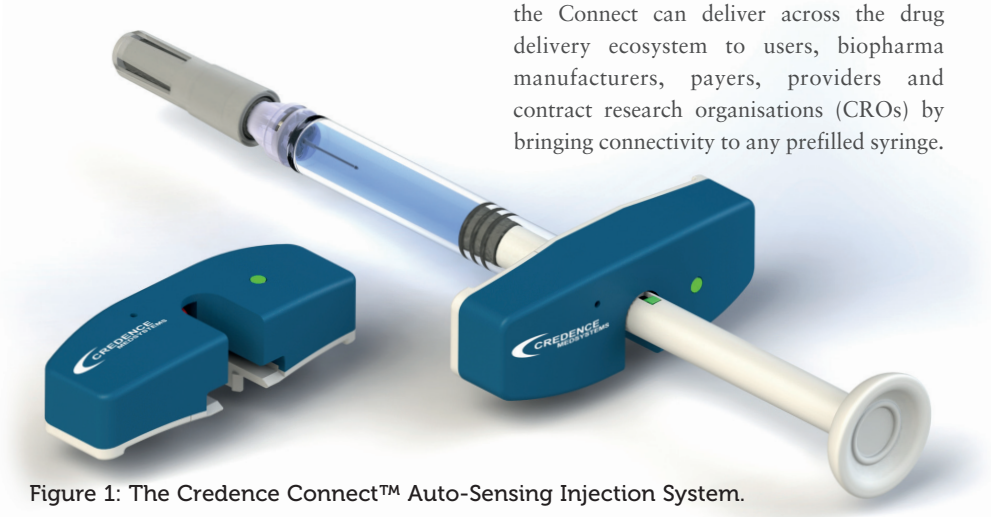

Figure 1: The Credence Connect™ Auto-Sensing Injection System.

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THE CREDENCE CONNECT AUTO-SENSING INJECTION SYSTEM

The Credence Connect (Figure 1) incorporates automatic monitoring of critical injection data and real-time user feedback into a reusable ergonomic finger grip. By embedding the "connectivity engine" in a comfortable grip that enhances usability, the Connect transforms any prefilled syringe into a connected delivery system via a ubiquitous ergonomic feature that users already prefer to use. The reusability minimises the environmental footprint, which is especially important when electronics are included, and helps biopharma companies meet corporate sustainability and cost objectives.

The automatic or "passive" function of the system allows the seamless capture and communication of injection information without requiring any additional actions by the user to verify administration. The Connect uses Credence's proprietary technology to measure the distance travelled by the plunger rod during the injection. The volume injected is determined based on the known syringe configuration and fill volume.

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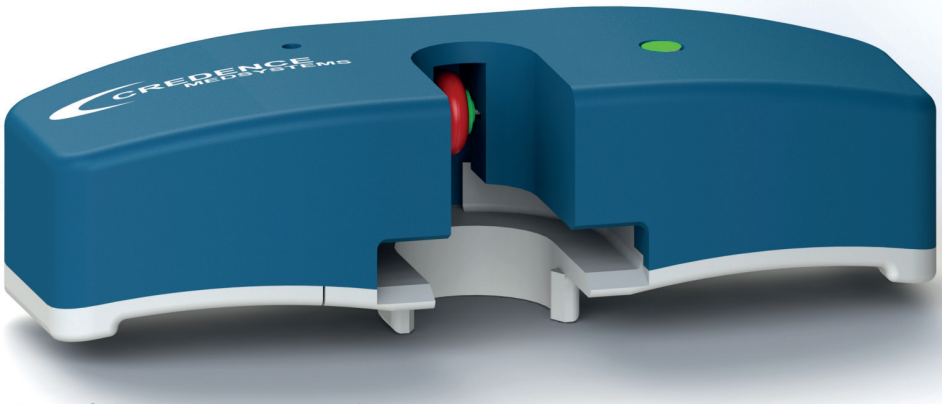

Figure 2: The elegant method of measuring injection volume enables visualisation of injection progress and broad applicability to prefilled syringes.

This elegant, straightforward method of measuring injected volume allows progress of the injection to be captured as the injection occurs and, critically important, provides the user with real-time feedback on the injection. The user can track the progress of the injection by viewing a counter or meter on an associated app; the meter increments as the injection occurs and the meter pauses when the injection is paused. This real-time feedback system empowers and reassures the user – an important aspect of supporting proper administration.

If the appropriate dose volume has been injected within the predetermined time duration, the injection is marked as a success. If too little volume is injected – or if the injection is not completed within the predetermined time – the injection is marked as a failure. Either way, the injected volume, time and date of administration, and duration of injection are recorded in dose history (Figures 2 and 3).

The Credence Connect links to an app on a smartphone via Bluetooth Low Energy. Credence has developed a demonstration app, although the Connect will be able to integrate with customer-specific or third-party platforms. The app provides the opportunity for further important interaction with the user, including reminders and alarms, instruction and guidance – and, of course, the feedback and dose history previously mentioned. The app also provides the medium for an information exchange amongst members of the healthcare ecosystem that can deliver value and enable innovative new business models. Features and benefits of the system are summarised in Table 1.

THE ROLE OF CONNECTIVITY IN THE DRUG DELIVERY COMMUNITY

There is ample discussion and debate in the drug delivery community about the role digital connectivity can play and the

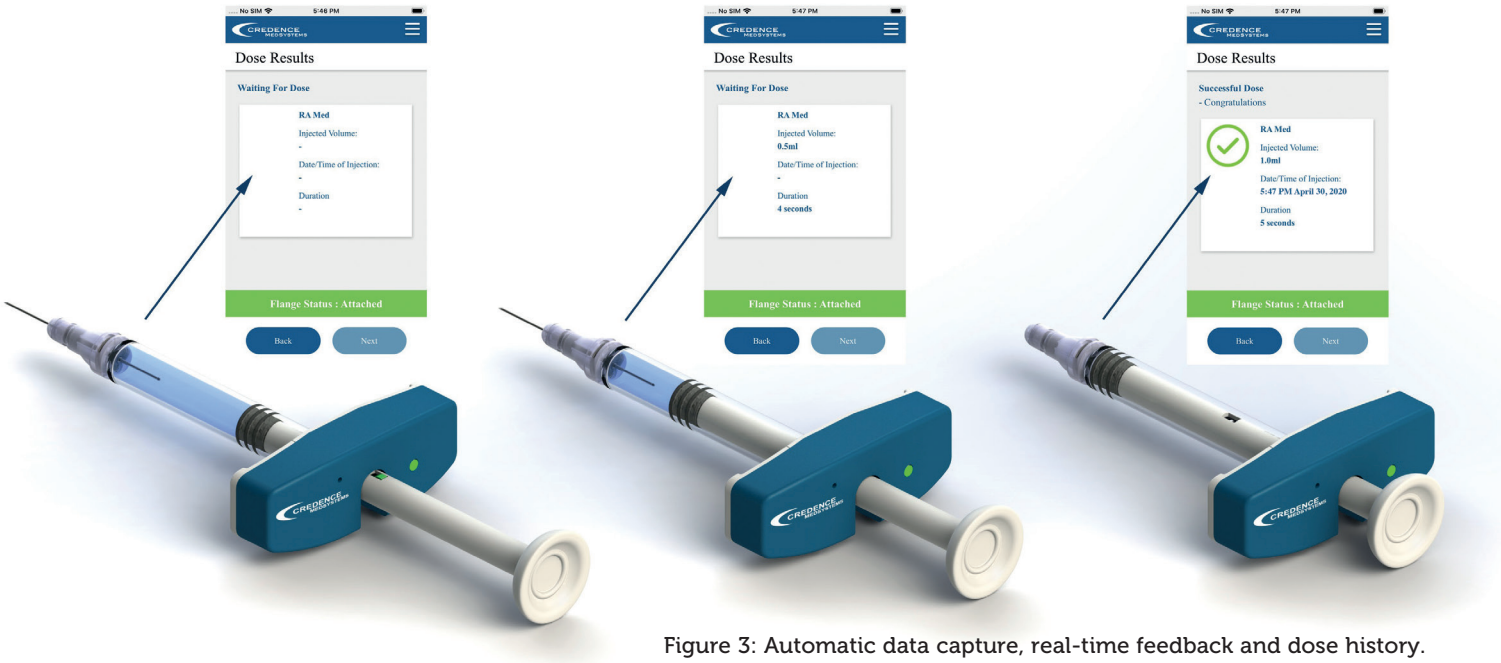

Figure 3: Automatic data capture, real-time feedback and dose history.

business case that supports it. Those value and business drivers differ in a clinical study application compared with the commercial use setting. Still, the discussion seems overly weighted on what can be described as "the compliance business model" for the commercial use setting.

Discussions around the compliance business model are accompanied by oft-quoted statistics describing poor patient compliance and the resulting economic impact. For instance, the WHO reported in 2015 that chronic disease patients in developed nations exhibit adherence of approximately 50%[1] and that avoidable costs associated with this poor adherence range up to US$290 billion (£235 billion) in the US alone.[2] The idea is that connectivity can help improve compliance, which should lead to better outcomes and therefore reduce healthcare spending. This is of course logical but leads to a series of questions.

Will connectivity result in improved compliance? Perhaps a better way of framing this question is: What should a system provide to users to motivate engagement and retention so that compliance improves? What will then be required to demonstrate that improved compliance results in better outcomes and reduced spending? And, further, will this wonderful result provide the proper motivation for pharma manufacturers to pursue widespread implementation? While some claim that increased compliance is not a driver for pharma, others identify a major opportunity to recover lost revenue that results from non-adherence. The opportunity to recover that lost revenue is significant – estimated to be $637 billion in 2015.[3]

Certainly, other challenges exist when it comes to the implementation of connectivity. A non-exhaustive list includes: privacy and security issues; potential distrust of the pharma industry; new usability requirements and the potential for increased complaints; the infrastructure that will be required to support digital systems; the conflict that arises between the rapid pace of technology development juxtaposed with the slow pace of pharma/device development; regulatory challenges; and many, many others. These challenges provide ample opportunity for sceptics to present obstacles – but these obstacles are certainly addressable if the upside in doing so is compelling.

The challenge lies in the fact that the compliance business model will take time to play itself out. This allows sceptics to ask whether developing digital connectivity is the act of developing technology solely for technology's sake. But compliance is not the only value driver of connectivity. Too often in our industry, the value that can be obtained is abandoned due to the challenge of implementing innovation due to the fear it involves too much change. It is the role of the innovative entrepreneurs amongst us to advance technology so that its implementation is manageable and its value is too compelling to be ignored. This brings us back to Credence's guiding philosophy of enabling *Innovation Without Change*, and the Connect's universal applicability to existing prefilled syringes.

Feature	Benefit
Automatic or "passive" data capture	Eliminates additional actions by user
Real-time transmission and feedback	Enhanced usability and feedback; promotes compliance; remote monitoring for clinical trials
Reusability	Environmental sustainability and cost containment
Ergonomic design	Enhanced usability
Universal applicability	Facilitates implementation for pharma in clinical studies and commercial use
Method of injection measurement	Reliability and universal applicability
Multiple modes of user communication	Enhanced usability
Guidance, feedback and injection history	Enhanced usability; promotes compliance
Enables communication within the drug delivery ecosystem	Patient support; promotes compliance; new innovative business models
Captures important usability data	Informs patient care for improved outcomes

Table 1: Features and benefits of the Credence Connect Auto-Sensing Injection System.

VALUE-ADD FROM CREDENCE CONNECT IN CLINICAL TRIALS

Stepping away from the commercial use setting for a moment, there is clear value the Credence Connect can bring in the performance of clinical studies. As CROs move towards a risk-based approach to data collection and methods of addressing the inherent flaws of manual journaling, there has been an ongoing trend towards remote monitoring. This trend has been made more acute by the recent pandemic as CROs search for methods of enabling decentralised studies. The Connect can enable more efficient performance of these studies and allow CROs a differentiated offering to their pharma customers so that studies can continue to be executed in the "new normal" of social distancing.

> "The most significant element in the clinical study value equation is the potential impact the Connect can bring to clinical study success."

But the most significant element in the clinical study value equation is the potential impact the Connect can bring to clinical study success. The cost to develop a drug is well debated but undeniably large, with estimates ranging from $1 billion to $3 billion.[4] While the cost of clinical trials that support US FDA approvals is a modest portion of that overall expense, with a median cost of $19 million,[5] a failed study jeopardises the full development expense and the revenue that could have come from approval.

The Connect can: promote proper compliance via benefits such as real-time feedback, reminders and injection guidance; enable targeted intervention in cases of non-compliance; and, collect dose history that can justify data inclusion/exclusion decisions. These can all allow the results of the study to be a true measure of a drug's safety and efficacy, as opposed

to a potentially misinformed result due to poor or unknown compliance. Further, the universal applicability to existing prefilled syringes will allow pharma companies to perform studies with the Connect as soon as their preferred prefilled syringe configuration is ready for implementation.

VALUE-ADD IN THE COMMERCIAL SETTING

Returning to the commercial setting, the ability of the Connect to capture opportunities will be contingent on delivering enough ongoing value to the user to promote engagement and retention. This is the case whether the opportunities come from driving improved compliance or from other innovative business models that are made possible. The real-time feedback, reminders, guidance, instruction and dose history that the Connect provides are all part of that user value.

Beyond these, facilitating user access to support groups via social networking platforms and relevant education can prove to be compelling drivers of retention. Tangible rewards for good compliance, in a mutually agreeable exchange between users and payers, can drive retention and achieve economic benefit for both parties. As we migrate towards outcome-based healthcare, this value applies to provider networks as well. Another well-discussed topic is the integration with electronic health records and the visibility that can bring to providers – but overburdening healthcare professionals needs to be considered.

Opportunity also exists for a mutually beneficial exchange between users and pharma manufacturers. Pharma spends significantly on patient outreach and direct-to-consumer advertising, the latter reaching $9.6 billion in 2016.[6] The Connect can provide insight into the daily relationship users have with their medications and an understanding of true use patterns, allowing pharma to embed insights into drug and delivery device development.

It also provides a platform for targeted messaging directly to user cohorts with education regarding common comorbidities and associated therapies, as well as messaging from third parties. This user cohort outreach will need to be executed in compliance with the EU General Data Protection Regulation 2018 (GDPR), the US Health Insurance Portability and Accountability Act 1996 (HIPAA), and other relevant requirements, and be offered to users with the appropriate incentive to motivate user acceptance. Nonetheless, the value is significant in its potential impact on the business model supporting connectivity.

SUMMARY

Implementing digital connectivity into drug delivery devices is not a simple endeavour and the business models supporting it continue to be discussed. It is critical to understand the value opportunities that exist both in the short term as well as the long term, and the role that can be played in both clinical trials and ongoing commercial use. It is equally critical to understand that any change brings obstacles but that the right technology can reduce those obstacles and facilitate implementation to achieve value throughout the ecosystem.

The Credence Connect Auto-Sensing Injection System has been designed in line with the company's philosophy of *Innovation Without Change*, to allow universal functionality with conventional prefilled syringes and to employ an elegant method of injection measurement that enables automatic data capture and real-time feedback to the user.

Credence MedSystems has a history of successful collaboration with its pharma customers and within the greater supply chain serving them, and we look forward to continuing that approach for the successful implementation of the Credence Connect in clinical studies and commercial uses alike.

AWARD WINNER

Credence MedSystems received the 2020 Pharmapack Best Innovation in Drug Delivery Device Award for its Connect™ Auto-Sensing Injection System, at Pharmapack (Paris, France, February 4-5, 2020).

ABOUT THE COMPANY

Credence MedSystems is an innovator of drug delivery devices that solve unmet market needs. Its Companion family of syringes includes proprietary needle retraction technology in Staked-Needle and Luer formats, and its portfolio has expanded to include Dual Chamber configurations, metered dose applications, connected devices and other novel systems.

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ABOUT THE AUTHOR

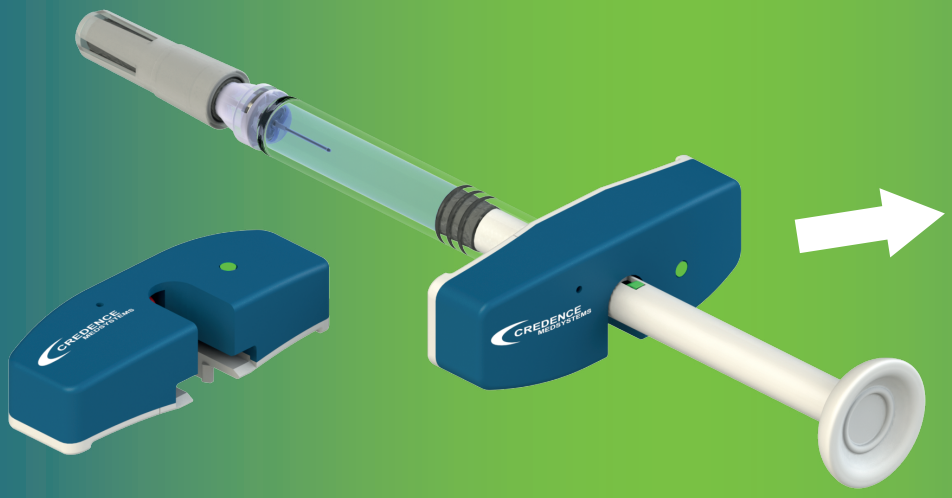
John A. Merhige is Chief Commercial Officer at Credence MedSystems. Previously, he was Vice-President, Market Development at Sanofi BioSurgery. Mr Merhige came to Sanofi upon its acquisition of Pluromed in 2012, which he joined in its early stages and where he was a member of the executive management team. He led the commercial activities at Pluromed, which developed and commercialised rapid transition polymers for cardiovascular and other surgical procedures. Prior to Pluromed, he founded Prelude Devices to target early-stage medical device technologies for development and commercialisation. Mr Merhige is a member of PDA, MassMEDIC, MassBio and has served on the board of directors of the MedDev Group

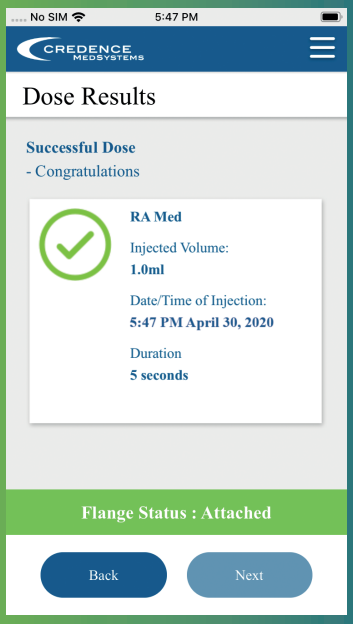
CREDENCE MEDSYSTEMS

CREDENCE CONNECT™

AUTO-SENSING INJECTION SYSTEM

Bringing connectivity to any prefilled syringe





Remote monitoring for clinical studies
Automatic capture of injection data
Real-time user feedback
Reminders, instructions & guidance
Reusable flange for sustainability & comfort

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These products have not been evaluated by FDA

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