

BARDA DRIVE Portfolio Companies

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Susan obtained a Master's degree in Library Science (MLS) from UNC Chapel Hill in August 2012 and a Master's of Management in Clinical Informatics (MMCi) from Duke University in August 2018. While at UNC, she worked as a library intern with the Environmental Protection Agency Library in RTP. Prior to that, she graduated from the University of Mississippi with degrees in English and French and minors in mathematics and chemistry.

Note about authorship

All sources, such as Pitchbook Venture Capital database, are fully cited in the footnotes. Because of the nature and intended use of this report by the client and to save time, much of the text in this report was extracted directly, word-for-word, from the cited sources without the use of quotation marks. In other words, we are not claiming authorship of this information. Notes from the analyst are typically formatted in italics and/or highlighted. Anything summarized or re-written by the analyst is cited as such, to show that distinction.

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Executive Summary

To date, BARDA DRiVE has provided funding to six companies. EnLiSense, Spire and Biobeat are part of the ENACT focus area, while InnaMed, Prenosis and CytoVale are part of the Solving Sepsis focus area.

The companies funded through the ENACT focus (EnLiSense, Spire and Biobeat) are developers of wearable sensors of biomarkers (cytokine levels) or bio-signals (heart rate, breathing variability, changes in body heat, etc.) through sweat or movement. Spire has raised money through multiple funding rounds and has products on the market. EnLiSense's products are still in development and they do not have a profile in Pitchbook venture capital database, but have received funding from the National Institute on Alcohol Abuse and Alcoholism (NIAAA) in 2017. The federal funding that EnLiSense and Spire have received have been from either NIAAA or the National Institute on Drug Abuse (NIDA). Biobeat has received funding from several venture investors and has a relationship with several accelerator or incubator groups such as Plug and Play Tech Center.

The companies funded through the Solving Sepsis focus (InnaMed, Prenosis and CytoVale) have distinct products. InnaMed provides a rapid blood test for a sepsis-associated biomarker. Prenosis develops algorithms to help doctors predict the progression of sepsis in a patient. CytoVale develops low-cost diagnostics that use microfluidics, high-speed imaging, computer vision and machine learning to test blood samples for changes that occur when a person is getting sick. InnaMed has received funding from several incubator and VC groups, while Prenosis has raised money from incubator groups and venture competitions as well as the NSF and CDC. CytoVale has received funding from various sources including venture capital groups, agencies like NSF and companies like Becton Dickinson (BD). CytoVale has also been included in several notable incubator/accelerator programs, including Breakout Labs and Google Developers Launchpad. While InnaMed and Spire are in separate BARDA DRiVE focus areas, they have both received assistance through Y Combinator, an accelerator based in Cambridge, MA.

Each company has a 30% cost share, excluding CytoVale at 46% and Biobeat at 37%. There is not much information available around what the cost share is covering; for InnaMed, Prenosis and CytoVale, the cost share is going towards "development costs" according to the BARDA press releases.

Overview of Cost Sharing

Portfolio Company	DRiVE Investment	Cost Share	Total	% Cost Share
Spire	\$62,200	\$26,660	\$88,860	30%
InnaMed	\$200,000	\$85,750	\$285,750	30%
Prenosis	\$749,000	\$322,552	\$1,071,552	30%
EnLiSense	\$550,909	\$236,104	\$787,013	30%
CytoVale	\$749,000	\$648,200	\$1,397,200	46%
Biobeat	\$599,000	\$355,800	\$954,800	37%
Total	\$2,910,109	\$1,675,066	\$4,585,175	37%

Company Profiles

EnLiSense

<https://enlisen.com/>

Allen, TX

Size: 2-10 employees

Year founded: 2014

BARDA DRIVE focus: ENACT

Products

EnLiSense's Wearable Point-of-Need SWEATSENSOR Dx Platform is an easy-to-use, cost-effective sensor technology (i.e. No needles, No punctures) offering real-time, continuous reporting from passively expressed sweat with no external stimulation and works with varying skin types and varying environments for early warning of changes to body's physiological state.

EnLiSense's non-invasive SWEATSENSOR diagnostics (Dx) Platform could become an easy-to-use wearable sensor to quickly detect or rule out infections. The sensor, which may resemble a wrist-watch, works by detecting and tracking multiple biomarkers, including cytokine levels in sweat; these levels may be an early warning of changes in the body.

The SWEATSENSOR could be used in a hospital setting or in the community to identify an influenza infection or other illness related to chemical, biological, radiological, or nuclear disasters.

Currently, EnLiSense does not sell their product and it is still in development.

EnLiSense has authored or co-authored [16 publications](#) in PubMed since September 2015.

Previous funding

- None listed in Pitchbook
- Received \$242,389 from National Institute on Alcohol Abuse and Alcoholism (NIAAA) in 2017 for project, "AWARE (A wearable awareness with real-time exposure): rapid wearable alcohol diagnostics"

Strategic partnerships

- UT Dallas (technology spun out of UT Dallas through Dr. Shalini Prasad).

Cost share

This EnLiSense and DRIVE announcement is a true public private partnership with DRIVE providing just over \$550,900 and EnLiSense picking up a share of the cost.

Spire

<https://spire.io/>

San Francisco, CA

Size: 25 employees

Year founded: 2013

BARDA DRIVE focus: ENACT

Products

Developer of a fitness sensor designed to monitor sleep, stress, and activity. The company's sensor is wearable that tracks both physical and psychological fitness to lower stress and increase productivity, enabling users to lead a healthy life and improve their performance.

The Spire Health Tag is a small washable device that attaches to clothing to monitor and report activity and detect changes in the body. The device can send messages to the user's cell phone to report findings and alert the wearer to real-time bio-signals, like heart-rate and breathing variability, changes in body heat, stress levels, and other changes in the unique health signature of the user. It is designed to be easy to use, can be worn while the person sleeps, and does not need to be recharged.

Currently the Spire Health Tag is available for consumer health and wellness use, including to help monitor sleep, stress and activity. Now with funding for DRIVE, Spire will further develop the product, aiming for U.S. Food and Drug Administration (FDA) 510K clearance. FDA clearance is required to ensure medical devices are safe and effective before they can be marketed for clinical applications.

Spire is backed by 7 years of research from Stanford's Calming Technology Lab, their consumer products are sold globally in Apple Stores, and their Spire Health Platform is in use by Fortune 100 medical device companies, large apparel retailers, and health professionals worldwide.

Previous funding¹

- In 2018, Spire received \$209,276 from the National Institute on Drug Abuse (NIDA) for the project, "A clothing-adhered wearable to monitor biomarkers of cognitive/emotional state and deliver just-in-time behavioral interventions."
- The company graduated from Y Combinator as a part of the Winter 2015 class and received \$120,000 in funding on March 24, 2015.
- The company raised funding from Tigerlabs Health, StartX and Dan Sutera on an undisclosed date.
- The company raised an undisclosed amount of convertible debt financing from Scrum Ventures on October 28, 2014.
- The company raised \$100,000 of seed funding from Scrum Ventures, Lee Linden and Rock Health on August 21, 2013. Mayo Clinic, University of California, DN Capital, San Francisco, Bert Navarrete also participated in the round.

Strategic partnerships

In 2018, Spire partnered with Swim.com to design a smart swimsuit.²

¹ Retrieved from Pitchbook.

² <https://www.wareable.com/sport/spire-smart-swimsuit-release-date-price-specs-5577>

Cost share

Spire and DRIVE, as a true public private partnership, are sharing costs to increase the chances of success. The total project cost is \$88,860, with the DRIVE contributing approximately \$62,200 and Spire funding the remaining costs.

InnaMed

<https://www.innamed.com/>

Philadelphia, PA

Size: 4 employees

Year founded: 2016

BARDA DRIVE focus: Solving Sepsis

Products

Developer of a smart, at-home blood testing device designed for the early detection of deterioration and automation of therapy in chronically ill patients. The company's device utilizes patented DNA-driven assay technology, aptamer reagents and signal processing hardware, enabling rapid, ultra sensitive blood testing at the home.

InnaMed will develop its proprietary electrochemical proximity assay (ECPA) technology to rapidly test blood for the sepsis-associated biomarker, a recently identified peptide that has shown increased sensitivity, specificity and prognostic ability compared to currently used sepsis indicators. The ECPA platform will be combined with analytics to determine a “sepsis score” to triage and monitor patients. InnaMed products are currently available for investigational use.

The company has [one publication](#) indexed in PubMed.

Previous funding³

- The company raised \$735,000 of venture funding from Arab Angel, Data Collective, and Matadero Ventures on March 20, 2017. GWC, Cheng Hu, Dong Hai, and Dorm Room Fund and other undisclosed investors also participated in the round.
- The company joined Y Combinator as part of the Winter 2017 class on March 20, 2017 and received \$120,000 in funding
- In January 2017, the company joined California Institute for Quantitative Biosciences
- In May 2016, the company joined Boomtown HealthTech Accelerator on May 23, 2016 and received \$20,000 in funding. Wharton Venture Initiation Program also participated in this round.
- The company received \$10,000 of grant funding from Publicis Groupe on an undisclosed date.

Strategic partnerships

- InnaMed co-authored a study in 2018 with NeoVentures Biotechnology of Ontario.
- Their website claims that they are partnering with “payers, health systems, skilled nursing facilities and pharmaceutical companies” but I haven’t been able to find any news articles naming specific entities.
- InnaMed was a finalist in the 2016 Accenture HealthTech Innovation Challenge.

³ Retrieved from Pitchbook.

Cost share

DRIVE and InnaMed are committed to a true public private partnership, with DRIVE contributing \$200,000 of the \$285,750 estimated project costs. InnaMed will fund the remaining development costs.

Prenosis

<http://www.prenosis.com/>

Formerly known as ElectroCyt

Chicago, IL

Size: 6-13 employees

Year founded: 2014

BARDA DRIVE focus: Solving Sepsis

Products

Prenosis' ImmunoMatch™ technology uses machine learning algorithms trained by its proprietary dataset (NOSIS) which combines critical biological information with existing electronic medical record data, to perform intelligent patient matching. With technology to predict how a sepsis patient's condition will progress, doctors can determine more quickly what is needed to improve outcomes over the continuum of sepsis care.

Prenosis is developing analytic systems that may help doctors predict the progression of sepsis in a patient. With DRIVE funding, Prenosis will develop a precision-medicine technology that could transform the clinical management of sepsis.

The first product, planned for early 2019 release, is a platform agnostic software system for use in Emergency Departments, in-patient populations, and ICUs. The second product, a combined handheld device with accompanying analytics, will be released by early 2021.

The company has [one publication](#) indexed in PubMed and co-founder Rashid Bashir has a [few additional publications](#) that are not affiliated specifically with Prenosis.

Previous funding⁴

- The company received \$ 704,525 of grant funding from National Science Foundation in 2018: SBIR Phase II: Point of Care Device for High Frequency Stratification of Patient Populations at Risk of Sepsis.
- The company received \$150,000 of grant funding from CDC in 2017: Point of Care Device for Reducing Overuse of Antibiotics in Potentially Septic Hospital Populations.
- The company received \$150,000 of grant funding from National Science Foundation in 2017: SBIR Phase I: Point of Care Device for High Frequency Stratification of Patient Populations at Risk of Sepsis.
- The company raised \$1.5 million of angel funding from undisclosed investors on September 7, 2016.
- The company received \$5,000 of grant funding from VentureWell on July 13, 2016.
- The company received \$10,000 of prize money from Technology Entrepreneur Center as a part of 14th Annual Cozad New Venture Competition on June 14, 2016.

⁴ Retrieved from Pitchbook.

- The company raised \$65,000 of angel funding from undisclosed investors on March 18, 2016. The deal also includes an undisclosed amount of convertible debt financing.

Strategic partnerships

- Prenosis is a spinout of University of Illinois and Carle Foundation Hospital in Urbana, IL.

Cost share

DRIVE and Prenosis are committed to a true public-private partnership, with DRIVE contributing \$749,000 of the total \$1.07 million estimated project cost. Prenosis will fund the remaining development costs.

Cytovale

<http://cytovale.com/>

San Francisco, CA

Size: 5-15 employees

Year founded: 2013

BARDA DRIVE focus: Solving Sepsis

Products

Cytovale's low-cost diagnostic holds the potential to provide the quick information emergency room healthcare providers need in the critical first hours and days of this often-deadly disease.

The Cytovale technology takes advantage of advances in microfluidics, ultra-high speed imaging, computer vision, and machine learning to rapidly quantify immune cell dysregulation from a blood sample in minutes. It uses deformability cytometry to measure immune cell changes, like inflammation and other changes that occur when a person is getting sick.

Previous funding⁵

- The company raised \$7.25 million of Series B venture funding from Baidu Ventures, Blackhorn Ventures and Breakout Ventures on July 1, 2018, putting the company's pre-money valuation at \$25 million. Pactolus Ventures also participated in the round.
- The company joined Google Developers Launchpad in October, 2017. The startups "get what Google deftly described as 'equity-free support,' and access to Google mentors, community engagement as well as datasets and testing environments for prototyping, as examples."⁶
- The company received \$2.97 million of grant funding from U.S. Department of Health and Human Services and National Science Foundation in September 2016.
- The company received \$25,000 of grant funding from Becton, Dickinson and Company (NYSE: BDX) on April 6, 2015. This was in partnership with Breakout Labs.⁷
- The company raised \$4.3 million of Series A venture funding from NetScientific, IT-Farm Corporation and undisclosed investors on June 10, 2014, putting the pre-money valuation at \$8.1 million.

⁵ Retrieved from Pitchbook.

⁶ Google powers up AI, machine learning accelerator for healthcare. November 1, 2017.

<https://www.healthcareitnews.com/news/google-powers-ai-machine-learning-accelerator-healthcare>

⁷ Breakout Labs and Becton, Dickinson and Company Partner to Provide Capital and Expertise to Biomedical Startups. April 6, 2015. <https://www.businesswire.com/news/home/20150406005695/en/Breakout-Labs-Becton-Dickinson-Company-Partner-Provide>

- The company raised an undisclosed amount of venture funding from Breakout Labs and Dolby Family on November 15, 2013

Strategic partnerships

- Cytovale has partnered with various academic institutions and healthcare systems on their publications, including UCLA, California NanoSystems Institute, Louisiana State University, Baton Rouge General Medical Center

Cost share

DRIVE and Cytovale are committed to a public-private partnership, with DRIVE contributing \$749,000 of the total \$1.397 million project cost. Cytovale will cover the remaining development costs for this phase of development as a part of a cost share.

BioBeat

<https://www.biobeat.cloud/>

Petach Tikva, Mehoz HaMerkaz, Israel

Number of employees: 10-20

Year founded: 2012

BARDA DRIVE focus: ENACT

Products

Biobeat's Wrist Watch is an FDA-cleared monitoring device that continuously measures blood pressure, heart rate, heart rate variability, oxygen saturation, respiratory rate, stroke volume, cardiac output and index, systemic vascular resistance, sweat, skin temperature, and more. With funding from DRIVE, Biobeat will further develop the technology to track bodily changes that signal the user has potentially been exposed to an influenza virus or other pathogen.

Biobeat's technology is based on reflective photoplethysmography, a low-cost technique to detect blood volume changes in the smallest blood vessels of human tissue and often used non-invasively to make measurements at the skin surface. The data is recorded and analyzed to produce alerts and recommendations of clinical significance. This also potentially allows prediction and early warning before severe physiological emergencies occur. Information can be transmitted via the cloud to a cell phone application or database

Previous funding⁸

- The company raised \$3 million of venture funding in a deal led by Oxford Sciences Innovation on August 14, 2018. White Cloud Capital, IQ Capital Partners, Future Positive Capital, and inovia Capital also participated in the round. The new investment will support the company as they focus on delivering their cutting-edge wellness solutions to a global audience.
- The company joined Plug and Play Tech Center as a part of its Batch 4 of Health & Wellness Accelerator on March 21, 2017.
- The company raised \$2.28 million of venture funding in a deal led by White Cloud Capital Advisors and Oxford Sciences Innovation on April 22, 2016. Samsung NEXT Ventures, AXA Strategic Ventures and IQ Capital Partners also participated in this round.

⁸ Retrieved from Pitchbook.

- The company raised \$299,000 of Seed funding from Raptor Group, Slow Ventures, Italian Angels for Growth and other undisclosed investors on November 1, 2014, putting the company's pre-money valuation at \$2.25 million.
- The company received an undisclosed amount of grant funding from the UK's Innovation Agency on June 27, 2013.
- The company raised \$750,000 of seed funding from ENIAC Ventures, Zhen Fund and K5 Ventures on May 1, 2013. 11 individual investors also participated in this round.
- The company raised seed funding from BE Great Partners, Zynik Capital and individual investor: Nadeem Kassam, Cantora and other undisclosed investors on May 15, 2012.

Strategic partnerships

Biobeat lists their clients on their website, including

- Ministry of Health (Israel)
- Tel-Aviv Sourasky Medical Center
- Tri-logical Technologies Ltd.
- Rambam Health Care Campus
- Medison
- Amgen
- Magen David Adom
- Femi Premium
- Israel Defense Forces
- GE Healthcare
- Elbit Systems
- D-MARS (Desert Mars Analog Ramon Station, Israel)
- U.S. Department of the Air Force
- The Chaim Sheba Medical Center at Tel Hasomer

Cost share

DRiVe and Biobeat are committed to a public-private partnership, with DRiVe contributing \$599,000 of the total \$954,800 project cost. Biobeat will provide the remaining development costs.

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