

# BioReactor Simulator (BRS) III

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Effortless and accurate process simulation



# Simulate biogas production processes with minimal effort



## BioReactor Simulator (BRS) III

The BRS III is a laboratory-scale instrument designed to replicate continuously fed anaerobic fermentation processes. Its user-friendliness, fully automatic operation, and robust reliability make it effortless to use. Featuring 9 parallel channels, it enables the simultaneous evaluation of multiple process operational conditions.

### Accurately simulate continuous processes

Introducing the BRS III, a cutting-edge laboratory instrument engineered for precise measurement of gas production in continuously fed anaerobic fermentation processes. It's dependable and user-friendly tool, tailored for academia and industry, designed to streamline laboratory- and small-scale process simulation.

### Efficiency and automation

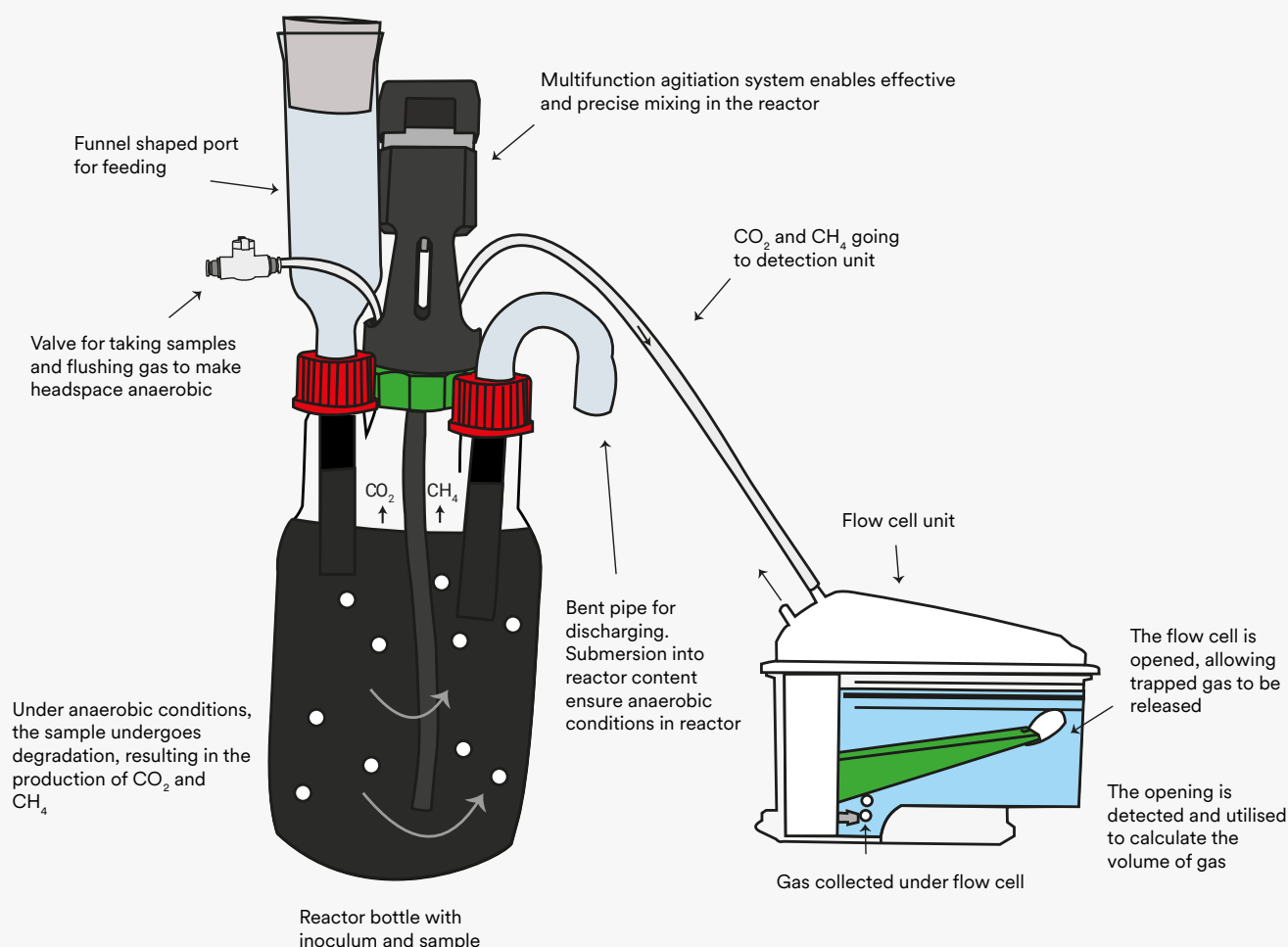
The BRS III operates seamlessly and automatically, integrating sampling, analysis, recording, and report generation for a simplified testing experience. Its key features include:

- **Pre-calibrated precision:** no need for frequent calibrations, enabling outstanding accuracy and precision of measurements.
- **User-friendly interface:** streamlines operation, reducing time and labour requirements, enhancing overall efficiency.
- **Standardized processes:** ensures consistency in measurements, data processing, and reports generation, facilitating data analysis.
- **Intuitive configuration:** simple operation of CSTR (continuous stirred-tank reactor) setup with solutions for feeding and discharging.
- **Versatility:** the BRS can adapt to other reactor configurations with ease.

With its innovative design and numerous benefits, the BRS III is the ideal tool for researchers and industry professionals seeking to analyse and optimise continuously fed anaerobic fermentation processes.



# BRS III working principle



## Real-time monitoring gas flow and gas composition

The BRS III, with its gas-tight enclosed measurement chambers, facilitates the real-time monitoring of gases produced during an anaerobic digestion processes, irrespective of their solubility in water. It ensures independent measurement, adapting seamlessly to variations in gas composition and accommodating gases in both dry and wet conditions without the need for adjustments. Furthermore, when two measurement chambers are connected in series and a specific gas component, like carbon dioxide, is removed, it allows for the real-time estimation of the primary gas composition.

## Attain reliable data with minimal effort and error risk

The BRS III stands as a smart and automated instrument that dramatically reduces the labour required to replicate continuously fed biogas production processes while virtually eliminates the risk of human errors. It outperforms conventional methods and competing solutions. The user's main tasks involve feeding and discharging the continuously operated reactors; the BRS III handles everything else, including real-time monitoring and report generation. This streamlined process facilitates the analysis of experimental data and simplified testing procedures.





## Optimise full-scale plant performance – risk-free

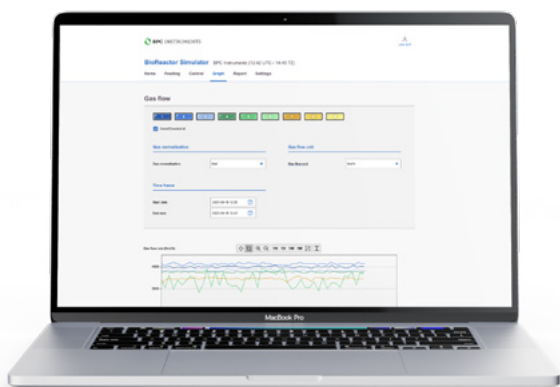
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Consider the possibility of testing various operational solutions to enhance biogas plant operations without jeopardizing downtime or financial losses. BRS III is the solution. This lab-scale instrument simulates the biogas production processes on a smaller scale, enabling users to explore different enhancements. This includes testing diverse loading regimes, feedstock mixtures, the effects of feedstock pre-treatment and additives, and assessing the long-term impact of specific process operations – all without putting the full-scale plant's performance at risk.

The BRS III offers user-friendly operation and provides reliable data, instilling confidence in the results obtained. Once the optimal operating conditions for the biogas plant have been identified, implementing changes at full scale can be done with assurance, as the risk of potential problems has been minimized.

# AURORA Software

## – pre-installed on BRS III



### Enhance process analysis and monitoring with Aurora™ software

Aurora™ embodies BPC Instruments' state-of-the-art software solution for continuous monitoring of biogas production in anaerobic digestion processes. Its user-friendly design simplifies experiment setup, real-time monitoring of gas production as well as retrieval of results and report generation. Aurora™ seamlessly integrates a web-based software, an integral component of the instrument package, offering pre-installed access and eliminating the need for software licenses or external computer installations.

### Tailored for continuous anaerobic fermentation processes

The BRS III software is specifically crafted for the emulation of continuously fed anaerobic fermentation processes, both in laboratory and small pilot-scale settings, over extended durations. This user-friendly application simplifies experiment setup, control of feeding and discharging, process monitoring, and report generation and downloads with minimal effort. The software's Experiment Settings feature allows for customisation of feeding and discharging schedules, complete with corresponding organic loading rate and hydraulic retention times displayed in graphs. Enhanced graph navigation tools and improved processing power facilitate seamless data zooming, enabling both detailed short-term analysis and long-time trend evaluation.

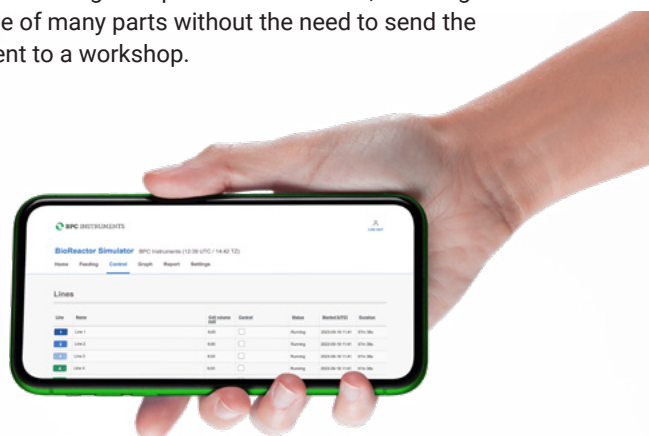


### Durable and reliable with modular design

Designed and manufactured in Sweden, BRS III embodies the finest aspects of Scandinavian design, seamlessly blending form and function for exceptional quality and reliability. Rest assured, BRS III safeguards user's data, even in the event of a power or system failure. Furthermore, the modular design simplifies maintenance, enabling the exchange of many parts without the need to send the instrument to a workshop.

### Access results anywhere, anytime, on any device

BRS is designed for convenient access from any remote location using a web browser on any smart device including computers, tablets, and smart phones. Monitor the experiment from the comfort of office or home using any preferred smart device. Moreover, one can expand the measurement capacity of BRS effortlessly by connecting multiple instruments together with an Ethernet switch.



## BRS III configurations

The standard BRS III configuration consists of nine custom-made 2-liter CSTR glass reactors with ports for easy feeding and discharging, as well as a port for either sample collection or online sensors. The ample diameter of the feeding and discharging pipes accommodates materials with high solid and fiber content.

For those requiring larger reactor volumes, BPC offers a selection of 5 and 10-liter CSTR reactors, as well as other high-rate reactor configurations (UASB, EGSB, and IC) in stainless steel and glass. These reactors provide additional options for feeding, discharging, sampling, and sensor ports.



For more details on standalone bioreactors, please visit the product page at: [www.bpcinstruments.com/bpc\\_products/bioreactors/](http://www.bpcinstruments.com/bpc_products/bioreactors/)



Simplify experiment  
setup, monitoring,  
and data sharing for  
increased efficiency

Flow/Outflow

| Line | Name   | Reactor volume (ml) | Unit of conc. [%]<br>TS VS COO   | Automatic                           | Interval [min] | Next       | Count | Status   |
|------|--------|---------------------|--|-------------------------------------|----------------|------------|-------|----------|
| 1    | Line 1 | 2000                | <input type="radio"/> TS <input checked="" type="radio"/> VS <input type="radio"/> COO | <input checked="" type="checkbox"/> | 1              | 8s         | 8     | Running  |
| 2    | Line 2 | 2000                | <input type="radio"/> TS <input checked="" type="radio"/> VS <input type="radio"/> COO | <input checked="" type="checkbox"/> | 1              | 8s         | 7     | Running  |
| 3    | Line 3 | 2000                | <input type="radio"/> TS <input checked="" type="radio"/> VS <input type="radio"/> COO | <input type="checkbox"/>            | 1440           | 23h 53m 8s | 1     | Running  |
| 4    | Line 4 | 2000                | <input type="radio"/> TS <input checked="" type="radio"/> VS <input type="radio"/> COO | <input type="checkbox"/>            | 1440           | 23h 53m 8s | 1     | Running  |
| 5    | Line 5 | 2000                | <input type="radio"/> TS <input checked="" type="radio"/> VS <input type="radio"/> COO | <input checked="" type="checkbox"/> | 720            | 23h 53m 8s | 1     | Running  |
| 6    | Line 6 | 2000                | <input type="radio"/> TS <input checked="" type="radio"/> VS <input type="radio"/> COO | <input checked="" type="checkbox"/> | 720            | 23h 53m 8s | 1     | Running  |
| 7    | Line 7 | 2000                | <input type="radio"/> TS <input checked="" type="radio"/> VS <input type="radio"/> COO | <input checked="" type="checkbox"/> | 1440           | 23h 53m 8s | 1     | Running  |
| 8    | Line 8 | 2000                | <input type="radio"/> TS <input checked="" type="radio"/> VS <input type="radio"/> COO | <input checked="" type="checkbox"/> | 1440           | 23h 53m 8s | 1     | Running  |
| 9    | Line 9 | 2000                | <input type="radio"/> TS <input checked="" type="radio"/> VS <input type="radio"/> COO | <input checked="" type="checkbox"/> | 1440           | 23h 53m 8s | 1     | Running  |
|      |        | 2000                | <input type="radio"/> TS <input checked="" type="radio"/> VS <input type="radio"/> COO | <input checked="" type="checkbox"/> | 1440           | 23h 53m 8s | 1     | Detached |

## Features

- **Web-based convenience:** user-friendly web-based software runs on an embedded server, eliminating the need for software installation on PC, tablet or smartphones.
- **Remote accessibility:** BRS III can be accessed both locally and remotely from any device with a web browser, ensuring flexibility and convenience.
- **Automated compensation:** automatic real-time pressure, temperature, and moisture compensation for accurate measurements.
- **Calibration-free operation:** BRS III operates without the need for calibration, simplifying maintenance and ensuring consistent performance.
- **Multiplexing potential:** take advantage of the multiplexing capability, allowing simultaneous continuous process monitoring at different start-up times.
- **Easy maintenance:** the modular design of BRS III facilitates easy exchange, making maintenance hassle-free.
- **Local data storage:** all data is stored locally on the instrument, eliminating the dependence on external computer, remote data storage and ensuring data security.
- **Efficient data processing:** easily export data as a spreadsheet for further analysis, complete with a consistent time axis for straightforward processing and interpretation.
- **High data storage capacity:** BRS III boasts a remarkable capacity of 14 400 l of gas per channel, facilitating extensive data collection and analysis.
- **Real-time measurements:** simultaneous monitoring of multiple gas types.
- **Gas composition estimates:** connect in series to get real time estimation of gas composition
- **Effective agitation:** proven strong, reliable, multifunctional agitation.
- **Customized output:** generates data points at various time intervals, from every minute to once daily.
- **Dual measurement resolutions:** option for either 2 and 9 ml (standard) measurement resolution for enhanced flexibility.
- **Effortless feeding and discharging:** tailored ports designed for handling demanding feedstocks.
- **Visualization of operational parameters:** displays OLR and HRT with real-time graphs.
- **Diverse bioreactor configurations:** choose from a wide range of bioreactor configurations, including CSTR and high-rate reactors.
- **Additional process parameter monitoring:** an extra port is available for sampling or online monitoring of other process parameters, such as pH, ORP, temperature, etc

# BRS features comparison

|                                  | BRS III  | BRS  |
|----------------------------------|--|--|
| <b>Number of channels</b>        | 9  | 6  |
| <b>Measurement resolution</b>    | 9 ml (with option of 2 ml)   | 9 ml   |
| <b>Electronic hardware</b>       | New electronic hardware with significantly better performance and more functionalities   | Hardware with more limited processing capacity                                       |
| <b>Volume detection capacity</b> | 130 000 litres   | Limitless (because of cloud application)   |
| <b>Display</b>                   | OLED display   | No display   |
| <b>Software</b>                  | Aurora™: embedded software accessible via web browser on any smart device. Explore the redesigned interface and enhanced features, including the capability to initiate and stop all channels, zoom in on graphs, flexible gas normalisation, phase-specific agitation control, and effortless raw data downloads. | Cloud based software application that require internet connection to the instrument. |
| <b>Internet access</b>           | No internet access needed. All data stored and accessed locally  | IT security promission and internet connection are required for cloud application    |
| <b>Reactor sizes</b>             | 2 L CSTR reactors with the option to use larger size of CSTR and other high rate reactors.   | 2 L CSTR reactors with the option to use 5 and 10 L versions as well                 |
| <b>Tubing</b>                    | Polyurethane tubing with exceptional durability and minimal gas permeability   | Tygon E3603 tubing   |
| <b>Accessories</b>               | Various accessories are included for better tube management and easier operation   | Limited number of accessories  |



# Technical specifications

## Standard sample incubation unit features

**Maximum number of reactors per system:** 9

**Reactor material:** Glass

**Standard reactor volume:** 2000 ml

**Temperature control:** Thermostatic water bath

**Dimensions:** 68 x 56 x 33 cm (Thermostatic water bath)

**Temperature control:** up to 60° C (140° F) with precision of 0.2° C

**Reactor mixing:** multi-function mechanical agitation with brushless DC motors (adjustable interval, speed, and rotation directions), max. speed 220 rpm

## Bioreactors

**Maximum number of reactors per system:** 9

**Reactor material:** Glass and stainless steel

**Standard reactor volume:** 5000 ml, 10000 ml and 20000 ml in various configurations

**Temperature control:** Recirculation water bath with water jacket in reactors

**Dimension:** CSTR-5G: H 38 x W 24 cm; CSTR-5S: H 74.5 x W 28.5 cm; CSTR-10S: H 77.5 x W 32.5 cm; UASB/EGSB-20S: H150 x L 60 x W 60 cm; IC-20S: H 180 x L 50 x W 50 cm.

**Mixing in the CSTR reactors:** multi-function mechanical agitation with manual and automatic speed control via external analogue signal. Manually adjustable speed, rotation directions and time interval, as well as timer function to set time periods for reversal. Modular design for long-life operation and low maintenance.

**Rotating speed range:** 15 - 300 rpm.

## Measurement performance

**Working principle:** liquid displacement and buoyancy

**Number of flow cell units:** 9

**Unit dimension of unit:** 55 x 19 x 17 cm

**Built-in sensors:** temperature, pressure, hall, accelerometer

**Connections:** Ethernet, power supply, USB B, motor control

**Display:** OLED 2.8" 256 x 64 white

**Housing:** Aluminium and plastic

**Power supply:** 12 V DC / 1.0 A with 100-240 VAC

**Usage:** Indoor

**Measurement medium:** Deionised or distilled water

**Operation temperature:** 0 - 50° C

**Operation pressure:** -50 – 50 mbar

**Gas connector diameter:** ID: 2.4 - 2.6 mm; OD: 4.2-4.7 mm

**Recommended tubing size:** ID: 4 mm; OD: 6 mm

**Measuring resolution:** 9 ml and 2 ml

**Detection capacity:** 14400 litres per channel with 9 ml flow cell and 3200 litres per channel with 2 ml flow cell

**Measuring range:** 1 to 6000 ml/h for 9 ml flow cell and 0.2 to 1500 ml/h

**Repeatability:** CV ≤ 1% for 9 ml flow cell and CV ≤ 3% for 2 ml flow cell

**Gases:** Non aggressive gases (e.g. CH<sub>4</sub>, CO<sub>2</sub>, H<sub>2</sub>, N<sub>2</sub>,...)



# From academic know-how to commercial products

Founded in 2005, BPC Instruments AB has become a successful company under the leadership of its co-founder and lead inventor, Dr. Jing Liu, who currently serves as the CEO. Leveraging nearly 20 years of industry-leading research in the development of smart analytical instruments, BPC Instruments has made a significant impact in the market.

BPC's impressive portfolio encompasses a range of exceptional products, including two flagship products. The first is the Automatic Methane Potential Test System (AMPTS®), which has become the preferred analytical instrument for conducting various anaerobic batch fermentation tests. The second is the Gas Endeavour®, a novel analytical platform that enables the determination of materials' biodegradability, analysis of bacteria respiration, and performance of biological batch fermentation assays under both anaerobic and aerobic conditions. BPC® Blue is a novel respirometer based on the Gas Endeavour® platform, specifically designed for assessing the biodegradability of plastics in both aerobic and anaerobic environments.

These automated analytical devices offer an abundance of benefits, significantly enhancing operational efficiency while reducing both time and labor requirements. They boast a remarkably user-friendly interface and can be accessed remotely, allowing for convenient retrieval of meticulously collected data whenever necessary. Moreover, these automated analytical devices provide standardized measurements, data, and reports, supplying clear and comparable information upon which evidence-based decisions can be confidently made.

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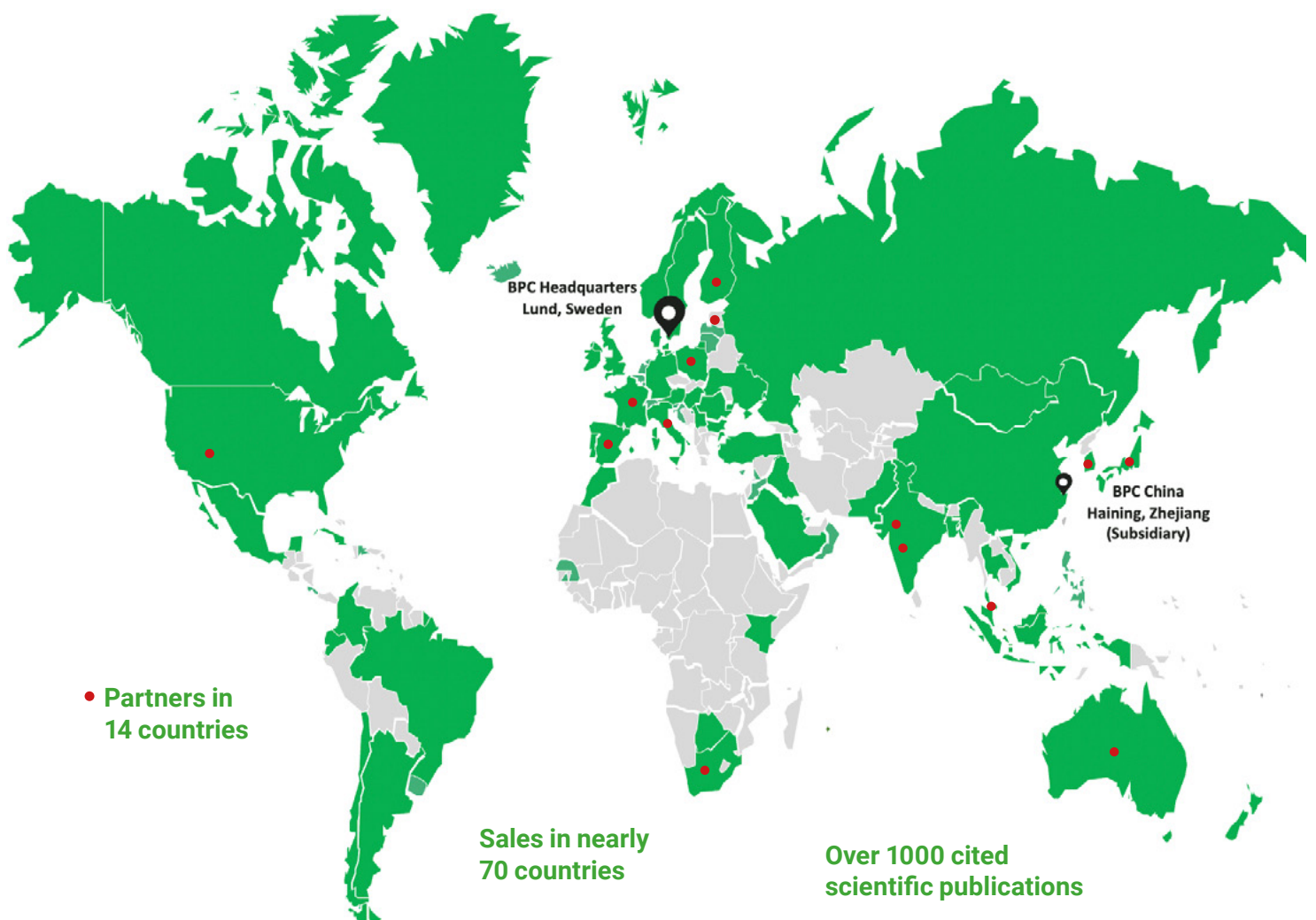
"Our focus is on investing in innovation and developing intelligent instruments, maintaining top-notch product quality across our portfolio, and prioritizing customer service by meeting their needs."

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Dr. Jing Liu, CEO and co-founder of  
BPC Instruments AB

# What we do

BPC Instruments brings to market analytical instruments enabling more efficient, reliable, and high-quality of research and analysis for industries in renewable bioenergy and environmental biotechnology. Our instruments are designed and manufactured in Sweden, incorporating the best elements of Scandinavian form and function for optimal quality and reliability.





## Excellence is built on precision and accuracy

BPC Instruments is a global Swedish-based technology company developing and offering analytical instruments enabling more efficient, reliable, and high quality of research and analysis for industries in renewable bioenergy and environmental biotechnology. The result is not only higher accuracy and precision, but also significant reduction in time consumption and labour requirement for performing analyses. BPC Instruments' innovative products offer high-quality hardware and software based on deep knowledge and experience of target applications. The solutions are the first of their kind, making the company a pioneer in its field. Today, BPC Instruments exports to nearly 70 countries around the world.



BPC Instruments AB  
Mobilvägen 10  
223 62 Lund  
Sweden

Tel: +46 (0)46 16 39 50  
[info@bpcinstruments.com](mailto:info@bpcinstruments.com)  
[www.bpcinstruments.com](http://www.bpcinstruments.com)

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