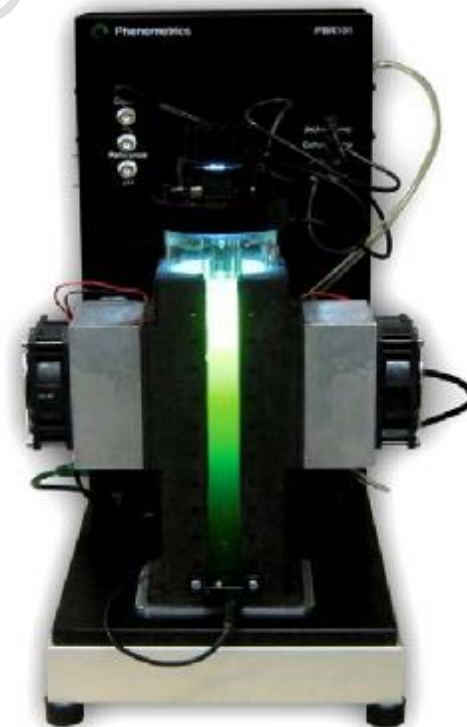




Phenometrics, Inc.

The PBR101 Photo BioReactor

- The most complete system of its kind
- Compact yet powerful
- Fully configurable
- Completely programmable
- Easy-to-use software
- Unprecedented value
 - Accurately mimics scaled production
 - Facilitates selection of optimized strain and production conditions for max yield
 - Affordable price point for fully featured systems





PBR101 – Current Uses

- Microalgae (Eukaryotes; too many to list)
- Cyanobacteria (often called “Blue-Green” algae, Prokaryotes such as Spirulina, Anabaena and Oscillatoria)



Algae



Cyanobacteria



Algae – Current Uses

- Biofuels
- Food (human, animal)
- Nutrition/Supplements
- Pharmaceuticals
- Fertilizer
- Pollution Control
- Pigments/Bioactive Compounds





How *Not* to Grow Algae

- Algae is easy to grow: It grows naturally just about everywhere.
- All kinds of setups have been used to grow it.
- However....Very few of them are useful for optimized strain identification or by-product optimization because they do not reproduce production conditions or the natural environment.





Phenometrics, Inc.

How *Not* to Grow Algae

- But if you are doing algal research, or are in the business of producing algae or algal by-products, you want optimized growth and production.
- Stop cooking your algae in endless flasks, buckets, and aquariums.
- The PBR101 is a professional research and production tool designed to save you time, money, and headaches.





Phenometrics, Inc.

Grow Smarter Not Harder

- You want to optimize algal growth or production
- The PBR101 is the #1 tool to help you do that.

**GROW YOUR ALGAE
SMARTER
NOT HARDER**



Phenometrics, Inc



Why the PBR 101?

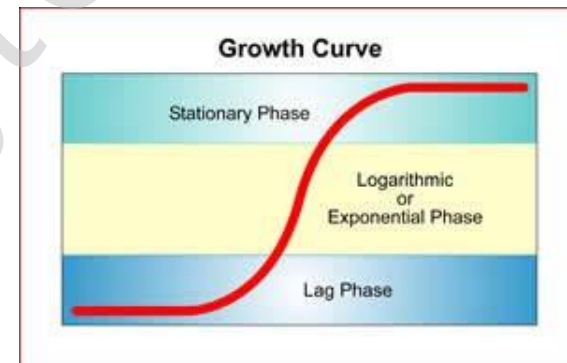
- Phenometrics products are designed **by** scientists, engineers and real-world users for research or production purposes.
- The computer-controlled PBR101 uses breakthrough technology to mimic environmental and/or production conditions such as temperature, light cycles/intensity and CO₂.
- Save time and money (including CAPEX), while producing better results





Algae Growth

- The PBR101 allows you to monitor actual growth (via on-board turbidostat) as your algae progresses through its growth phases, so that you can know what helps and what hinders growth.
- Choose from pre-programmed experiments, or quickly and easily design your own, with the growth variables that are most important to you.





Phenometrics, Inc.

Control and Measurement

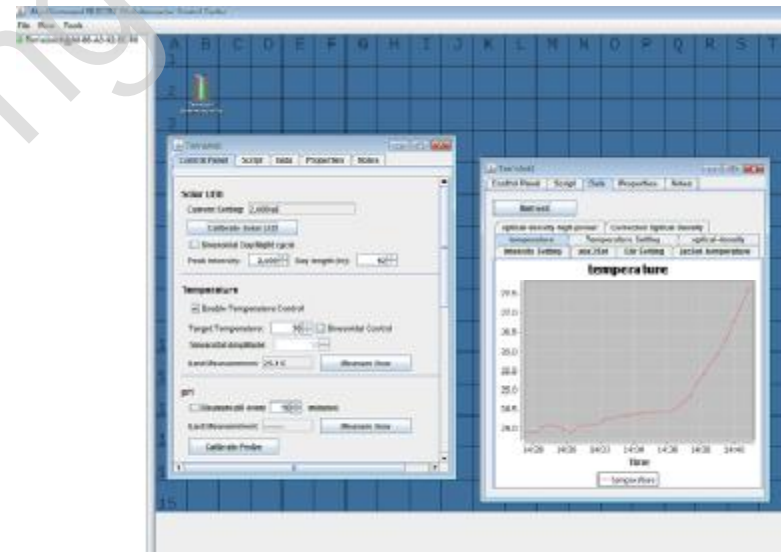
- The PBR101 electronically controls growth conditions and measures resultant growth.
- It is completely customizable to accommodate various probes and sensors that control and monitor algae growth, via our own *Algal Command* software



Algal Command

- *Algal Command* was written specifically for customized experimentation for the optimization of algal growth conditions.
- Many parameters can be controlled and monitored for the PBR101, such as the following:
 - Lighting, including manual or automated Diurnal cycles (Length, peak maximum)
 - Automated temperature control and monitoring
 - Magnetic Stirring speed (RPM)
 - CO₂
 - pH
 - Turbidostat growth measurement

Algal Command is written in open-source Java and is thus completely user-customizable





Phenometrics, Inc.

Multiple Systems: PBR101 Matrix

- Use multiple systems for simultaneous optimization of growth conditions either by condition, algal strain, or both.
- Up to 256 reactors, each with its own programmed experiment, can be controlled simultaneously by a single computer running *Algal Command*.





Phenometrics, Inc.

2-Channel Peristaltic Pump

- Optional 2-channel peristaltic pump that can be completely controlled through *Algal Command* for running in turbidistatic mode or programmed addition of materials to the PBR101.
- Additional pumps can be added and controlled manually.





Autoclavable Reactor Vessel

- The PBR101 Culture Vessel, cap, and related parts are made from polycarbonate and other durable materials, and are Autoclavable (including dry goods setting or liquid cycle if media is in vessel).
- This prevents contamination (other algal strains, bacteria, yeast), a potential significant source of failed experiments and waste of time and money.
- Unlike any other algae reactors, the PBR101 reactor is cylindrical, allowing you to better simulate raceways and tube/bag bioreactors, or even natural environments (marine).

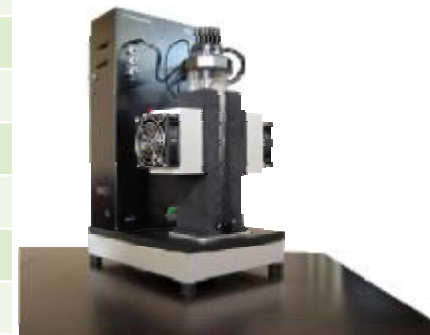




PBR101 System Specifications

The PBR101 is the only system of its kind to come complete with the following:

PHENOMETRICS PBR101 PRODUCT SPECIFICATIONS	
Reactor Vessel	Polycarbonate, cylindrical
Thermal Heating and Cooling	Controlled, from +10 to +50°C
LED	Custom-designed for the PBR101
Magnetic Stirrer	Computer-controlled
Gas Mass Flow Controller	Computer-controlled
Connectivity	Ethernet + USB
Control Software	<i>Algal Command</i>
Logic Control	On-board micro-controller assembly
Temperature Probe	Direct input into <i>Algal Command</i>
Algal Growth Measurement	Custom-designed Turbidistat





Phenometrics, Inc.

You Can't Afford to Not Own a PBR101– or Several!

- Reduce your development time from months/years to days/weeks.
- Develop truly scalable methods; go straight from the reactor to production level.
- Remember, by using multiple PBR101 units, you will compare and develop several different methods simultaneously, saving unprecedented time and money.



Phenometrics, Inc.

Phenometrics' Commitment to Quality

- All Phenometrics products are assembled in the U.S.A. from the finest components sourced in the U.S. and around the world.
- Each PBR101 is thoroughly tested **with all of its sub-components*** at the factory for a minimum of 48 hours just prior to its shipment. This ensures that the entire system will arrive at your facility just as it left the factory – fully operational and ready to operate.

** Each system configuration may vary by order*



Phenometrics, Inc.

The PBR101 is Your Next Go-To Lab Instrument

- The PBR101 was designed specifically for algal research and development.
- Never before has so powerful and versatile a laboratory instrument been so affordable.
- The PBR 101 will pay for itself quickly, and give you the best possible results.

