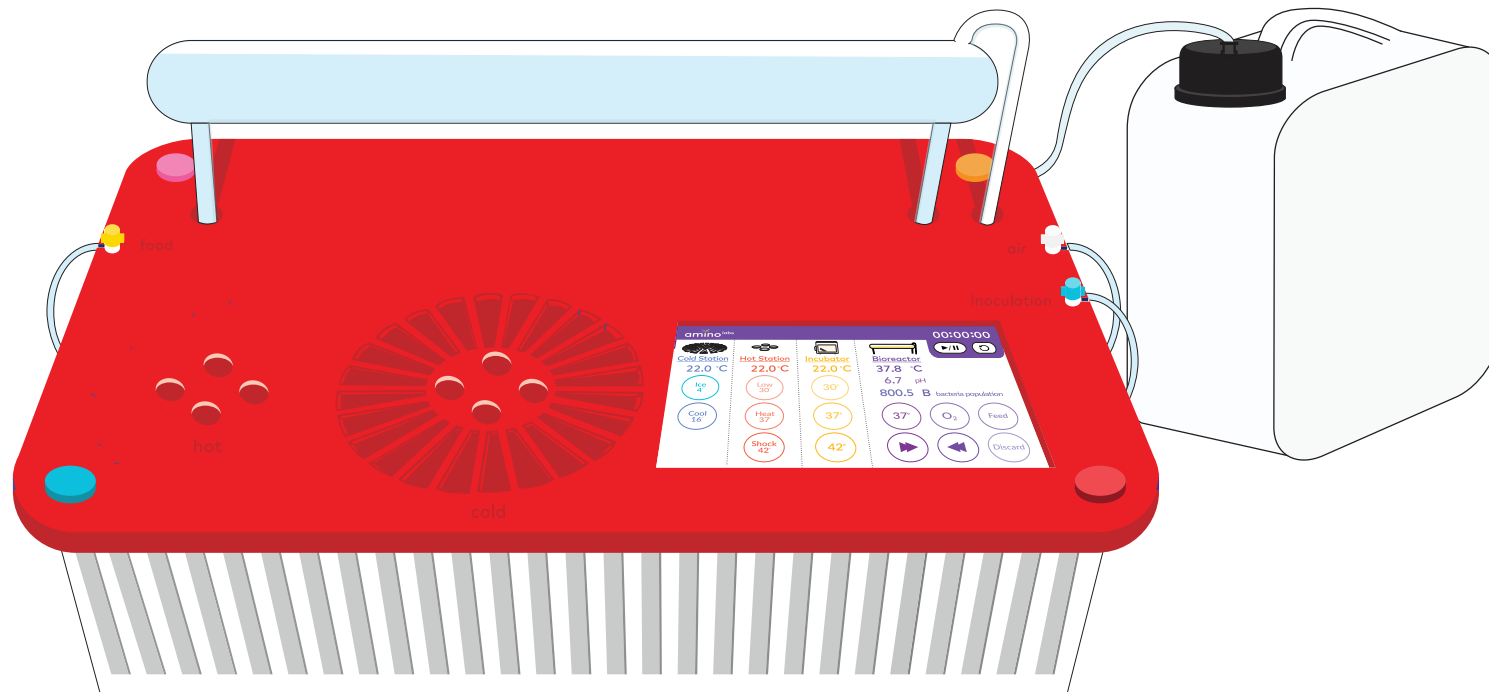


Quick Start

BioExplorer Minilab

Guide



Welcome to Friendly Biotechnology!

This User Guide was created to help you get the most out of your BioExplorer Experience. **Even if you are familiar with genetic engineering, life science or other Amino Labs™ products, please take the necessary time to read through this quick guide.** This will ensure you practice safe science, setup, maintenance and store your BioExplorer™ system the optimal way.

Amino Labs is very excited to welcome you to the world of biotechnology with the BioExplorer™, the Biomanufacturing Kit Pack and the entire ecosystem of easy-to-use, easy-to-succeed products!

In this guide:

Safety notice	-3-
Overview	-4-
BioExplorer map	-5-
Using the incubator	-8-
Using the touchscreen controls	-9-
Tech Specs	-9-
Setting up your BioExplorer	-10-
Running an experiment	-13-
Maintenance & Troubleshooting	-14-
Contact Us	-15-

Safe Science Practices

Biotechnology and life sciences are safe activities when you follow guidelines. Read on to ensure you adopt safe practices.

The BioExplorer is designed for biosafety level 1 (RG1) activities only. This is the most benign level and therefore the safest. With the ingredients, no special containment or training is required in North America*. However, you must follow these safety guidelines for your safety and the success of your experiment(s)!

We recommend the system and kits for ages 12+, under adult supervision, and 14+ unsupervised.

We recommend that the discard container be emptied by an adult and that the cleaning instructions be strictly followed for safety and experiment success. Make sure to store the ingredients in accordance with the instructions found in this booklet. Eye-wear is not provided but can be worn.

- **Set your BioExplorer in a space that is separated from food by at least 10 feet.** Under no circumstances should you consume any of the ingredients or touch them with your bare hands.
- **Immunocompromised persons:** While the ingredients in these kits are non-pathogenic, some persons, such as immunocompromised persons, can be affected by large numbers of bacteria. It is recommended that immunocompromised persons consult their physician prior to using Amino Labs kits.
- **Wash your hands before and after** manipulating your experiment, the ingredients, or the hardware.
- **Wear gloves**, even when cleaning your station or handling the consumables (petri plates, loops, etc). This will protect you from your experiment, and your experiment from you. Any latex, nitrile, or general purpose gloves you can find at the pharmacy will do. Also, after you put your gloves on, be aware of what you touch. **Try not to touch your face, scratch itches with your gloved fingers!**
- **Place your BioExplorer on a stable work surface.** Keep it level at all times.
- **Clean up your station, spills and work surface before and after use.** Use a chlorinated cleaning spray or wipes or a 10% solution of chlorinated bleach generously sprayed onto a paper towel to clean any contaminated surfaces. (Careful! This can discolor your clothes).
- **Find a container to discard used consumables during the experiments.** An old 1L yogurt container, large plastic cup or the like will do. Used consumables will be loops, any tube or used petri dish. You will then transfer the waste to the inactivation bag. Follow inactivation instructions at the end of the manual to clean up and discard the waste.
- **Avoid using Isopropyl alcohol on the hardware.** This can cause the plastic to become brittle and crack.

Discover your BioExplorer™

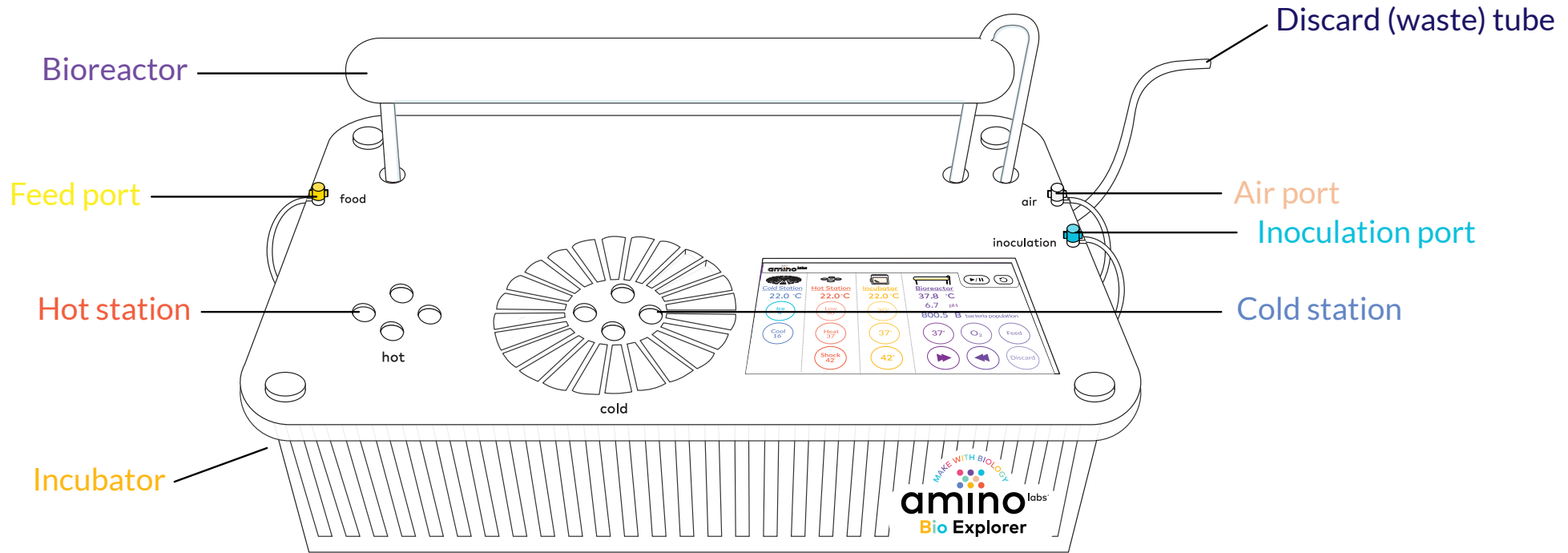


The BioExplorer™ is a simple and engaging science station that enables you to genetically engineer bacteria, incubate, grow and culture your bacteria in liquid. Small and contained, this station is the adventurous bioengineer's must!

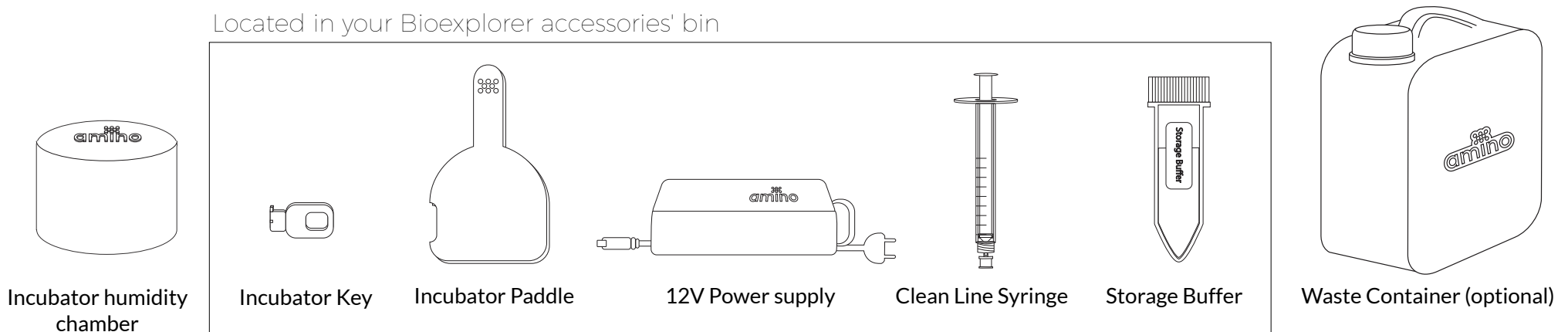
It can be used at home or by educators in schools as a personal and engaging alternative to traditional and messy lab equipment. With a setup time of under 10 minutes, the BioExplorer allows you to get started with biotechnology right away! The BioExplorer can help you do a bacterial transformation and allows for biomanufacturing in liquid using the continuous bioreactor part of the system (the glass tube). This replaces the need for heated water baths, ice buckets and ice, incubator, timer, thermometers, shaker incubators, spectrophotometer, and pH sensors.

This system complements the Next Generation Science Standards (NGSS). The next pages will introduce you to the different stations of your unit.

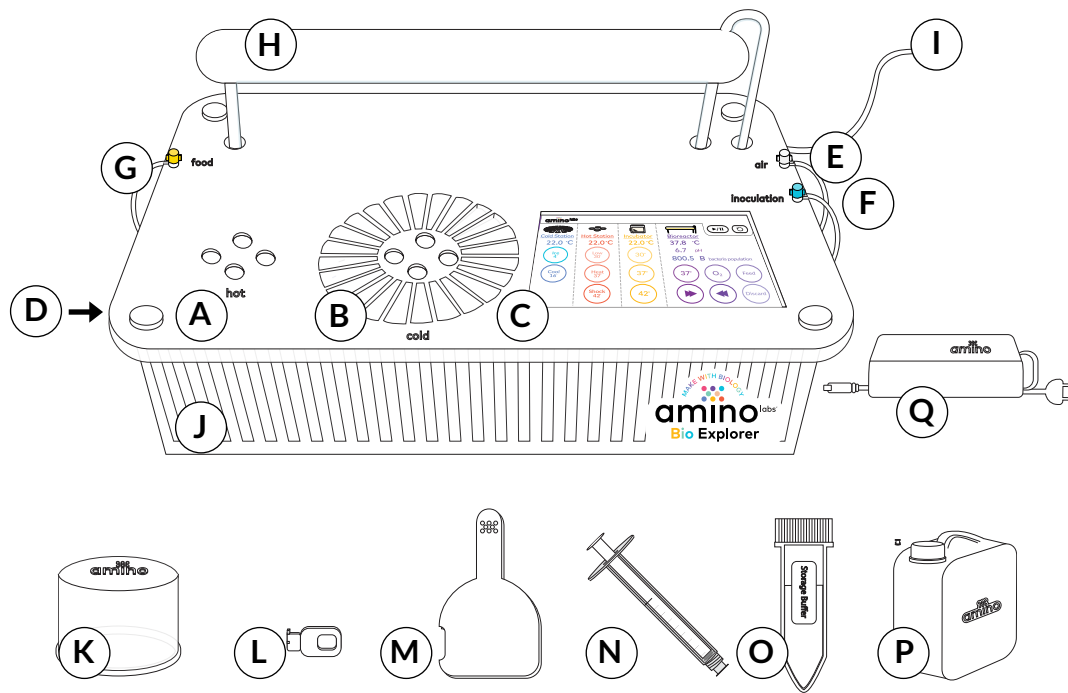
Discover your BioExplorer™



Located in your Bioexplorer accessories' bin



BioExplorer Map



D- Incubator To grow optimally, bacteria need contained environments with regulated temperature. This internal incubator regulates the temperature to 30°C, 37°C, or 42°C.

E- Air port This port allows you to inject cleaner and rinse into the air line to make sure the aeration system is sterile

F- Inoculation port This port allows you to inject the transformed bacteria into the culture chamber. It connects to a syringe used to insert the bacteria in order to prevent leaks and contamination.

G- Feed port Supply your bacteria with food through this port by connecting the sterile food containers with the food connector provided. Keep this connector sterile by placing it in boiling water 5 minutes before and after use. Store in a clean bag.

H- Bioreactor The bioreactor glass chamber has temperature control, aeration, and sensors to help you take care of your bacteria as they multiply. When bacteria are grown in a liquid, this is called a liquid culture.

I- Discard waste tube As you fill the system with food and run experiments, waste liquid may pass through this tube into a waste container. If you've just received your unit, this discard tube will have a plug in it. Remove it to connect your waste container.

J- Airflow vents Keep these clear - they allow the cold and hot station to function properly.

K- Humidity chamber Keep your bacteria at the right moisture level with this humidity chamber. Slip them on top of your plate stack when incubating. You will find the humidity chamber in the incubator.

L- Incubator key You can lock the Incubator to keep your experiment safe!

A- Hot station To genetically engineer, you need to use heat for several things: 1) to keep ingredients warm; 2) to heatshock bacteria to get the DNA program to go through the cell membrane; 3) to recover cells 4) to incubate cells for optimal growth. The BioExplorer's hot station allows you to heat up four tubes of reagents. Using the touchscreen, you can set the hot station to "Low" ~30°C, "Heat" ~37°C, and "Shock" ~42°C.

B- Cold station To transform bacteria you need to both keep certain ingredients "on ice" and to "ice" bacteria. We've replaced the need for ice in the BioExplorer with tube coolers that reach near freezing 1-6°C.

C- Touchscreen The BioExplorer has a touchscreen that allows you to control the stations and let you know what's going on inside. This data will help you make the most out of your experiment.

M- Incubator paddle Use this paddle to take your petri dishes in and out of the incubator, like a pizza oven paddle!

N- Feed / Clean Line Syringe Sometimes, if your BioExplorer is unused for a longer period, the feed line can become 'stuck' to itself since it is pinched shut when the BioExplorer is turned off. To un-stick it, turn the feed port on, and inject some air into the port using the clean line syringe.

O- Storage Buffer Use this buffer to keep your fluidic system in good health if you are storing your BioExplorer away for longer than 2 weeks. The instructions on how to use the Storage buffer are found in the *Setting up your BioExplorer* section of this manual.

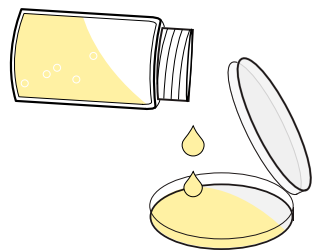
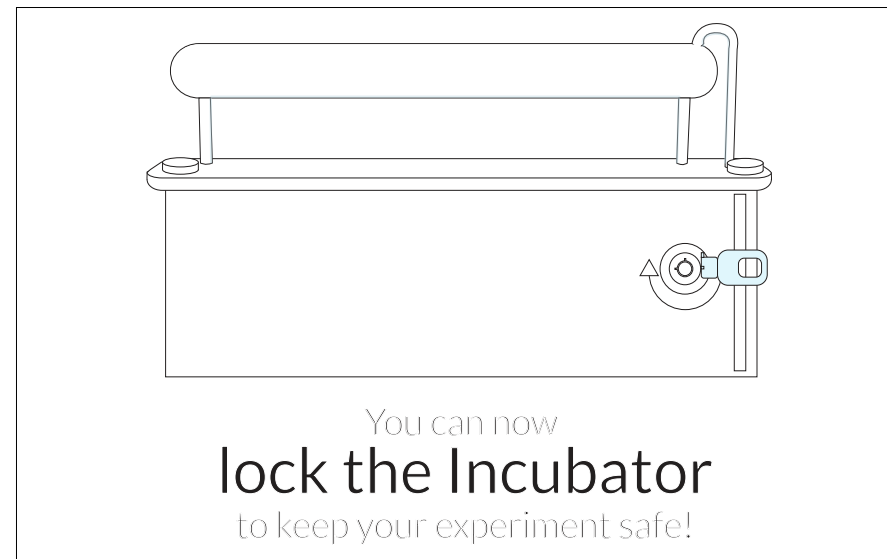
P- Waste Container You may have received a ~5L plastic container with your BioExplorer. This is to collect the waste that will exit your bioreactor system when you grow organisms in liquid culture. This container connects to the Discard tube (I). Learn how to connect it in the *Setting up your BioExplorer* section of this manual.

Q- 12V Power Supply Your BioExplorer runs on a 12V power supply. This power supply provides the requires 7 Amps of power to run your machine. This power supply works on both 115 V and 230 V power.

Using the incubator, humidity chamber, key and paddle

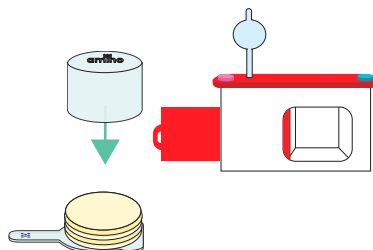
The incubator controls the environment your cells will grow in, incubate. The temperature and moisture level needs to be regulated. For this, you will find three different temperature settings on the touchscreen along with the sensor information. You will also find a humidity chamber inside the incubator when you first receive it. This is to control the humidity. Use the humidity chamber as follows :

Tip: during long incubations 48+ hours, it is best to shuffle the order of the plates in the stack every 48 hours.



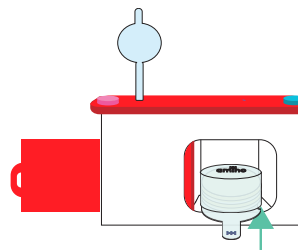
1. Pour your plates according to the protocol.

Make sure that the bottom part of the dish is at least half full.



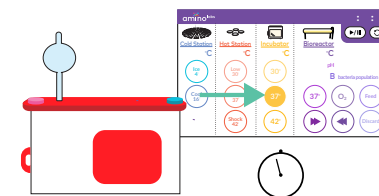
2. Flip your plates so the lid is down and stack **up to two plates** in a pile and place the humidity chamber over them. Place the stack on top of the incubator paddle.

For easy lifting of the paddle with plates, it is easiest to place the paddle on the edge of your work area with the handle over the ledge.



3. Slide the plates into the incubator using the paddle. Check to make sure the humidity chamber is fully over the plates and has not lifted up.

Remove the paddle by angling it upwards or by holding the humidity chamber in place and pulling out the paddle.



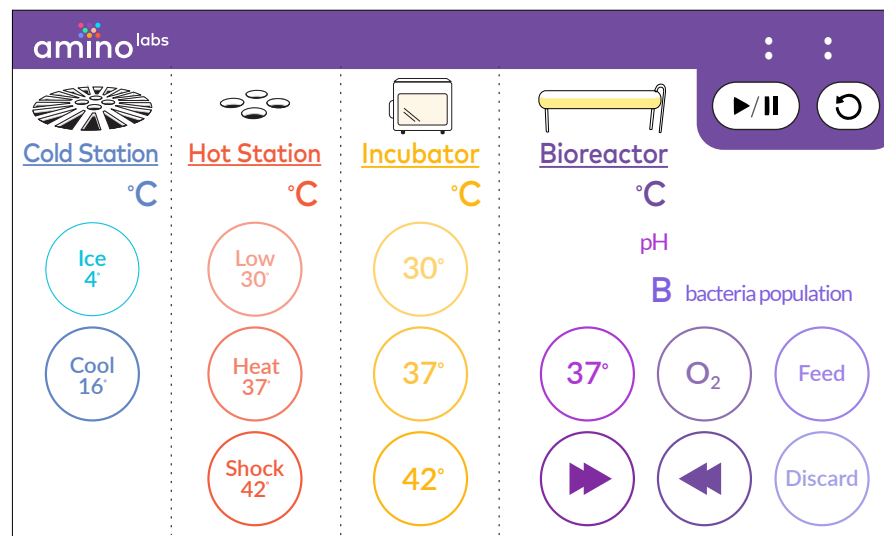
4. Close the incubator door, and lock it. Turn on the incubator using the touchscreen and your timer. You are now incubating!

Using the Touchscreen

The BioExplorer's touchscreen allows you to control the different system parts and let you know what's going on inside—you will see the temperature, number of grown cells (in billions!), and the pH level. These data points will help you take care of your bacteria and experiment further... What happens if you lower the pH? Feed your bacteria pure sugar? The sensors will enable you to see the results in real time. It also has a timer module at the top to time your experiment according to the protocol. Press a button to activate it, and press again to turn it off.

The Cold Station, Hot station and Incubator can be set to different temperatures by pressing the relevant button.

For the Bioreactor's control, the O_2 turns the aeration of the system, $37^\circ C$ warms the reactor, $>>$ and $<<$ control the pump's flow and direction. **Feed** activates the pull into the system from the feed port, and **Discard** empties the system.



The Bioreactor sensors allow you to know the pH level of the solution, the current temperature of the liquid flowing through and the Population (in billions) in the reactor. The Population reflects the number of bacteria present.

Technical Specifications

Physical Dimensions

Dimensions: 14 x 10 x 8 in
Weight: 3.6 Kg
Chamber Volume : 150mL

Operating environment

Temperature: 16 - 25 °C
Humidity: 20 - 90 %
Altitude: 3,000 m

Power

Voltage: 110-250
Frequency: 50-60 Hz
Average power: 40 W
Peak power: 84 W

Connectivity

Screen: 5.0 inch, capacitive

Temperature Stations

Cold Station: 1-6°C
Heat Station: 30/37/42 °C
Plate Incubator: 30/37/42 °C

Culturing

Chamber: Tempered Glass
Population: 0 - 1000 B cells
Temperature: 37 C +/- 0.5 °C
Filtered aeration: Yes

Real-time Sensor Accuracy

Temperature sensors (4) :
Bioreactor +/- 0.1 C @ 37 °C
Tube Coolers +/- 0.1 C @ 1°C
Tube Heaters +/- 0.1 C @ 42°C
Plate incubator +/- 0.1 C @ 37 °C

pH: 0-14 +/- 0.1 @ 37 °C
O.D.(~600nm): +/- 1 nm @600nm

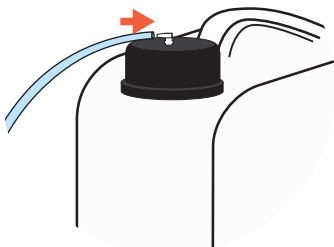
Setting up your BioExplorer™ - Make your own Waste Container

Location /surface : Setting up your BioExplorer™ is easy. Find a level, non-porous surface near an electrical outlet. Make sure the surface is bleach safe, and wipe it down with a standard chlorinated spray cleaner or wipes. A solution of 10% chlorinated bleach is also good. Set down your unit and make sure it is visibly level. Keep some working space around your unit so that you can work comfortably (2' x1' at a minimum). In some instances, you will need to let your experiment incubate and/or culture overnight or for multiple days and the unit must remain powered on the entire time; you can move it to an out-of-the-way location when incubating and/or culturing overnight. Plan ahead!

NEVER PLACE LIQUIDS ON TOP OF or POUR LIQUIDS OVER YOUR BIOEXPLORER when completing your experiments or cleaning. Your experiments should be completed beside the unit, and any liquid containers connected to the BioExplorer should be set at its sides.

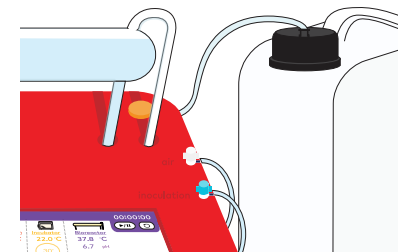
Consumables Discard Container: Find and place a container of about 500ml-1L to collect your experiment waste: used loops, ingredient tubes, contaminated wipes. We suggest an old yogurt container or similar. You can also use the inactivation bag we sent you to collect the waste as you go. The experiment manual explains how to safely inactivate and dispose of it all after your experiment.

Culturing: The BioExplorer contains a continuous bioreactor that you will use to grow your engineered organism in liquid culture. This is the glass part of the system, and you will learn more about what liquid culturing is and what it is used for in the BioManufacturing kit manual. For now, you need to know that a bioreactor creates waste in the form of liquid and air, and that because the bioreactor will be continuously culturing, the waste will exit the system periodically. Therefore, a Waste Container must be connected to collect this waste. If you did not receive the ~5L BioExplorer Waste Container with your BioExplorer, you can make one using a 2L /4L bottle. (See the next page for instructions on making your own Waste Container).



Connecting your liquid Waste/Discard Container:

1. Upon arrival, your BioExplorer will have a connector+cap at the end of the discard tube. Remove the connector+cap so that your tube end is open. Then, securely insert the end of the discard tube onto the Amino Labs' Waste Container's lid by sliding it onto the connector. If you are making your own liquid discard container, slide the tube into the hole you will prepare according to the instructions below.



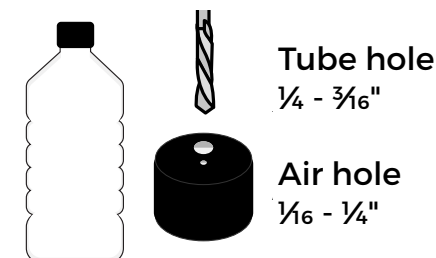
Make sure that air can escape the container since air from the system will be channeled there and the container could burst due to pressure build-up. On the Amino Labs' container, an air vent is prepared and located near the handle. To test the air vent, once the waste tube is connected, squeeze the container to see if pressure is building up. If you cannot squeeze air out, make sure the air vent hole is clear or create a small air vent near the top of the container with a drill, or other sharp item.



2. When you are ready to start your first liquid culture, you will need to add the inactivation tablet from the BioManufacturing Clean-it Kit into your Waste Container. This will kill any bacteria inside the container. **Wear gloves when you manipulate any cleaning solution!**

Creating your own Liquid Waste/Discard Container:

To create a liquid waste container find a ~2L to 4L bottle with a secure lid, like a 4L water jug. You will need to create holes in your bottle to fit your discard tube inside securely, plus a hole for air to escape the system. We suggest drilling holes in the lid of your bottle: one for the tube (~1/2"), one for the vent (~1/4"). Fasten the lid to prevent accidental spills.

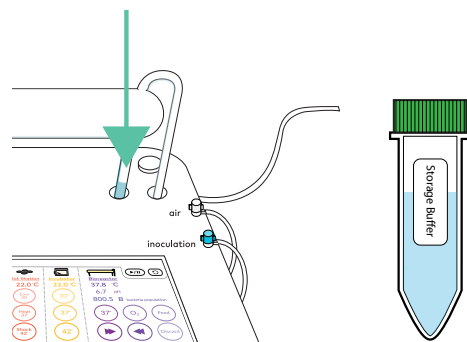


Power up: Connect the provided power supply and turn on the unit. Verify that the temperature sensors on the screen display a value near your room temperature after ~10 seconds. If any temperature reads "---" visit the Troubleshooting section of this manual. If the sensors are accurate, you can now turn on the hot, cold and incubator to test the station. Depending on room temperature, the hot and cold stations achieve set temperature between 1-10 minutes, and the incubator taking up to 45 minutes. You can start incubating before the temperature is reached.

Population Sensor The population sensor has been calibrated in our manufacturing facility but will benefit from a check/recalibration from you before each culture. A good time to calibrate it is within the first 1-3 hours of growth, once you have filled the system with LB media and inoculated it. It should, at this point read 0.0. It can jump around very slightly when air bubbles pass through it. No worries, as this will be a very minor jump (0.0 - 50.0 B) If you see it say "---" or a non-zero value, you can adjust it by using a population sensor tool or a small flat head screwdriver (an eyeglass screwdriver work very well) and turning the screw that is visible through the small hole at the back of the machine, just below the incubator keyhole. To decrease the number towards 0, when facing the back of the machine, turn clockwise. To get out of the "---" zone and back to 0.0, go counter-clockwise.

The sensor is quite sensitive and you should only need to turn the screw a very small amount. Prior to starting the culture, the cleaners, water and bubble may change the value from 0.0 to --- or higher values. This will not impact your experiment and does not matter until you load the liquid media from
Contact us if you are having trouble! help@amino.bio

pH Sensor: The pH sensor is precalibrated and immersed in a storage buffer when you receive the unit. When you will perform the initial clean and rinse of the sterilization section (before you culture), this buffer will dilute and disappear.



Storing your system with the Storage buffer:

When you store your BioExplorer away, you want to have the pH sensor immersed in liquid (distilled water, or some of the Storage Buffer included in your order). To add the buffer or distilled water before storing, simply use Feed to pull in some of the storage buffer, and fill until you see some of the liquid come up the "middle leg" on the right side of the bioreactor. It will require about 10 mL of liquid. This will mean your pH sensor is immersed. Do not circulate.

Running an Experiment

Amino Lab's all-in-one kits make it easy to add a DNA program into living cells, grow and take care of those cells so that they can produce something for you!

All ingredients in the kits are pre-measured and labeled for ease-of-use. The kits can be combined to get bioengineering experience.

Here is an overview of how the kits can work together:



- 1 take a color-generating DNA program (inspired by corals) and insert it into bacteria,
- 2 culture the bacteria in liquid to obtain a 150 mL solution of pigment-producing bacteria,
- 3 extract and purify the pigments grown in the bacteria, getting rid of the bacteria
- 4 so you can paint or dye things!

Maintenance

Maintaining your system is easy: simply make sure you clean the exterior of your station after use with a chlorinated cleaning solution and **never Isopropyl Alcohol** (rubbing alcohol). The touchscreen can be cleaned with phone/screen cleaning wipes. Make sure you always perform the cleaning cycles, as explained in the BioManufacturing manual when you use the bioreactor.

Never perform any manipulations on top of your BioExplorer. The touchscreen should never become wet, and it is always best to avoid dropping chemicals, bacteria and DNA on your BioExplorer. **NEVER PLACE LIQUIDS ON TOP OF or POUR LIQUIDS OVER YOUR BIOEXPLORER** when completing your experiments or cleaning.

Always verify that the sensors are accurately reading the room temperature before turning on cold or hot station. If something doesn't seem to be performing correctly, turn off or unplug the machine, and contact us. Note that different parts of your BioExplorer may have slightly different temperatures, this is normal.

Troubleshooting the hardware

If the screen freezes, turn the BioExplorer™ off and on again. Note that it will not remember where you are in your procedures; turn on all the functionalities you need when restarting it (make a note before you turn it off!)

If the temperature sensors show "---", it means they are not working properly. This means that you should **not turn on the station in question as it could overheat and cause fire/melting/danger**. In this event, please contact us immediately. *If the population sensor shows -- this is normal, refer to page 10 of this manual.*

If the hot or cold station do not reach the necessary temperature but hovers above or below it, you may be in a room that is too cold, or too hot. Please move to a more suitable location between 18 - 25 °C.

If the feed line does not pull liquid in, it may be 'pinched' internally from storage. Use the clean line syringe, or any clean syringe, to slowly inject air into the tube line while the Feed function is turned on.

If anything else causes you issues or you need any help, don't hesitate to contact us : help@amino.bio

More Information



Made in Canada

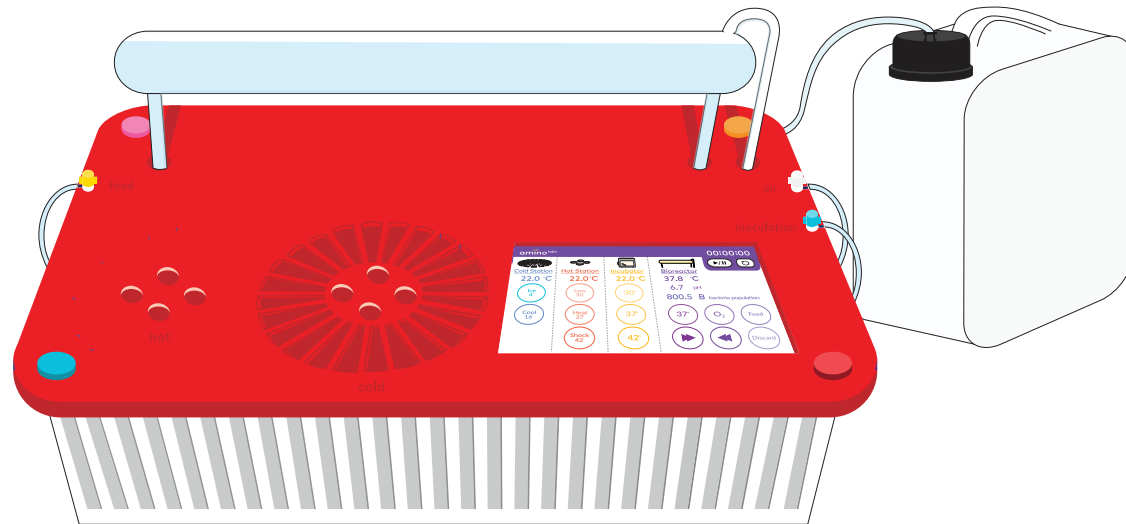
All Amino Labs products, from the hardware to the DNA are developed, designed, manufactured and packaged by us in our laboratory and workshop in Canada. We love to hear your thoughts, feedback and suggestions so that we can continue to make our products better, and fitting to your needs. Answers to your questions and help are also just an email away:

Help and General inquiries: help@amino.bio

Feedback, Suggestions, Comments: info@amino.bio

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