

FIRST® LEGO® League Challenge BIOGLOW™ Building Instructions

Mission 14: Seeds of Renewal

This build is 128 pieces, and 21 building steps.

Welcome to text-based instructions from Bricks for the Blind. Before you start building, here are some terms we'll be using:

- In Front of/Front: towards you.
- Behind/Back: away from you.
- Up: towards the ceiling.
- Down: towards the floor.
- Stud: the bump on a LEGO brick. Example: A 2x1 brick has two studs on it.
- Vertically: going from front to behind.
- Horizontally: going from left to right.
- Upright: pointing up towards the ceiling.
- That one/ppp: previously placed piece.
- Plate: piece with studs.
- Tile: smooth piece without studs (unless otherwise specified)
- Symmetrically: a mirror image. Example: If you place a 2x1 brick with technic connector on the front wall at the right, connector to the front, and then place another such piece symmetrically on the back wall, at the right, the technic connector of the second piece should point to the back, since it will be placed symmetrically.
- Centered-vertically: even amount of space in front of and behind the piece
- Centered-horizontally: even amount of space left and right of the piece.
- Row: studs lined up horizontally (left to right/side to side).
- Column: studs lined up upright or vertically (top to bottom/back to front).
- Standing upright: the piece is perpendicular to the ground, like a wall.
- Lying flat: the piece is parallel to the ground, like a piece of toast which fell off the table.
- Anti-stud: the portion of a piece which accepts studs, like the bottom of a plate.
- Jumper plate: a 1x2 plate with a single stud on top, or a 1x3 plate with only two studs on top.

For builders with low vision, or a sighted building partner who may want to follow along with the printed visual instructions that come with each set. As low vision users may benefit from viewing the instructions on a personal device where they can zoom in on content and use assistive technologies to enhance the visuals.

A note on LEGO Technic™ part names. These parts are somewhat different from regular LEGO bricks. I'll include some definitions in case the builder or helper is not familiar with LEGO Technic™.

Axles - An axle is a connector which has an X shaped cross-section. Because their cross section is not round, anything connected to an axle using an axle-hole will rotate with that axle. Axles are longer than they are wide, and the length of an axle corresponds with how many bricks long it is. Aka a 3L axle is three bricks long. Axles come in a variety of lengths, with a 2L axle being the shortest available. They may be combined with pins, or have circular stops on them. A stop prevents the axle from sliding through an axle-hole at a specific point on the axle.

Pins - A pin is a connector which has a circular cross section and a flanged notch out of one or both ends. This flanged notch allows them to click into bricks with a pin-hole. Pins come with and without friction ridges, which are small bumps on the pin which prevent them from rotating freely. For standard pins, black is a high friction pin, and gray is a low friction pin. A standard length pin is two brick lengths long, with a stop in the middle. This prevents a brick from being pushed from one side of the pin to the other. A 1L pin is one brick long and still retains the stop, however it also includes a hollow stud at the other end. A 3L pin is three bricks long, and only contains a stop at one side, allowing two bricks to be pushed onto the other side of the pin. Pins may also have one side which is an axle.

Lifarms - A lifarm is a basic structural element, similar to a brick or a plate, but usually without any studs. It is a beam with rounded ends and with holes in it, with the same spacing as the studs on a LEGO brick. lifarms come in a variety of lengths, including a 1x1 lifarm which looks like a cylinder. Thick lifarms are as wide as a LEGO brick, and thin lifarms are half as wide as a LEGO brick, but not the same thickness as a LEGO plate! The holes in a lifarm arm may accept axles or pins. They also come in a variety of shapes, including tees, els and triangles.

Gears - A gear is a functional element. They are typically discs with teeth on the outside, there are also worm gears which look like a spiraling cylinder! Gears connected by axles transmit or even transform rotational motion!

Axle and Pin Connectors - These elements are typically smaller than lifarms, and are used to connect some combination of pins or axles. They might have pins or axles, as well as axle or pin-holes. They have a lot of different angle combinations! The simplest just connects two axles or pins together in a straight line.

Bushes/Bushings - LEGO Technic™ uses bushes largely as spacers, but they also can reduce friction between rotating parts, or can form useful elements such as handles. Bushes are typically light gray, generally cylindrical, and have an axle-hole running through the middle. They have a flange at the front and back to make them easier to pull on and off.

Sorting Instructions:

This LEGO set comes in the bag labeled 21 and some large pieces from bag 0. Sort the pieces into groups as described below. Note that where there are multiple colors of the same brick in a step, the colors will be split across two groups to make telling the difference easier for the builder! LEGO includes a few spare parts in case you lose something. Set these into their own group away from the rest, in case you need them later.

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Group A contains all of the black 2L pins from this bag. These pins have friction ridges.

Group B contains all of the blue 3L pins from this bag. These pins have friction ridges.

Group C contains all of the blue 2L axle/pin combos from this bag. These pins have friction ridges.

Bag 21 (6 groups of bricks)

Main Build

Group 1 contains the pieces for steps 1-7. Include a black 7x11 hollow frame from bag 0.

Group 2 contains the pieces for steps 8-17. Include a black 7x11 hollow frame from bag 0.

Group 3 contains the pieces for step 18. Include two brown 15L lifarms from bag 0.

Group 4 contains the pieces for step 19.

Group 5 contains the pieces for step 20.

Group 6 contains the pieces for step 21. Include a dark gray 11x15 hollow frame from bag 0.

Building Instructions:

Groups A and 1. You will use the pins from group A throughout the build.

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Main Build

1.1. The first part of this build is a large rectangle. We'll start by building one end. Find a black 7x11 hollow frame. This looks like two 11L lifarms connected by two 5L lifarms on the ends, forming an open rectangle. Place this horizontally and upright in front of you, with the 7L sides upright.

1.2. Push a black 2L pin from group A, from the back, into the left corner hole and third hole from the right on the bottom liftarm of the previous piece.

2. Push a green 1L liftarm, from the back, onto each of the previous two pieces.

3.1. Find a dark gray 3x3x1 square liftarm. This piece is shaped like a square with five holes forming a cross on the flat sides. Two sides are rounded, and the other two sides have two holes each. Place this piece, laying flat with the rounded sides on the left and right, in front of you.

3.2. Push a black 2L pin from group A, from the front, into the left and right holes on the front side of the previous piece.

3.3. Rotate the square liftarm so it's upright with the pins at the bottom. Push the two pins into the right two holes on the top side of the bottom liftarm of the hollow frame. This piece will go to the left of an upright liftarm and you'll have to push it in from inside the hollow frame.

4.1.1. Next, we'll add a small assembly on top of the hollow frame. Place a light gray 1x2 brick with two pins on one side, horizontally with the pins at the front, in front of you.

4.1.2. Place a yellow 1x2 tile, horizontally, on the previous piece.

4.2. Find a lime green 3L axle and pin connector with two perpendicular pin holes. This looks like a 3L liftarm, except that the hole on one end is an axle hole that is perpendicular to the two pin holes. Push the pin holes of this piece, horizontally with the axle hole at the left facing up and down, on the pins of the previous piece.

4.3. Push a brown 5L axle with a stop on one side, with the stop on top, from the top into the leftmost axle hole on the top side of the previous piece.

4.4. Slide the axle, from the top, through the second hole from the left on top of the hollow frame. The 1x2 brick with tile should be at the back and the assembly should be free to rotate away from you.

5. Push a red thick bushing, from the bottom, onto the bottom side of the axle. Push it all the way up until it touches the top liftarm of the hollow frame, but don't push it too hard! We want the axle to be able to spin.

6.1. Push the axle side of a green 2L liftarm with one axle and one pin hole, horizontally with the axle hole on the left facing up and down, onto the bottom side of the axle. Push it up until it touches the previous piece.

6.2. Push the top side of a brown 2L axle connector, from the bottom, onto the axle so it touches the previous piece.

7. Push a brown 3L axle with a stop on one side, with the stop at the bottom, from the bottom into the second hole from the left on the bottom liftarm of the hollow frame. The top side will attach to the bottom hole of the previous piece.

Group 2.

8.1.1. Next, we'll build one of the sides. Set the first end aside. Place a green 9L thick liftarm, horizontally with the holes facing front and back, in front of you.

8.1.2. Push a black 2L pin from group A, from the back, into the left two holes on the back side of the previous piece. Repeat symmetrically on the right side.

8.2. Push the right two holes on the bottom liftarm of a green 3x5 L-shaped liftarm, with the 5L liftarm horizontally at the bottom pointing to the right and the 3L liftarm upright on the left pointing up, from the back onto the left two pieces from the previous step. Repeat symmetrically on the right side.

8.3. Push a black 2L pin from group A, from the front, into the top left and bottom left holes on the front side of the left piece from the previous step. Repeat symmetrically on the right side.

8.4. Place the first end, vertically and upright with the two 1L liftarms at the bottom on the left side, in front of you. Push the two pins on the front side of the left L-shaped liftarm on the side assembly into the bottom two holes on the back side of the back upright liftarm on the first end.

9.1. Now we'll build the other end. Set the first end and first side aside for now. Place a black 7x11 hollow frame horizontally and upright in front of you, with the 7L sides upright.

9.2. Push a black 2L pin from group A, from the back, into the right corner hole and third hole from the left on the bottom liftarm of the previous piece.

10. Push a green 1L liftarm, from the back, onto each of the previous two pieces.

11.1. Place a dark gray 3x3x1 square liftarm, laying flat with the rounded sides on the left and right, in front of you.

11.2. Push a black 2L pin from group A, from the front, into the left and right holes on the front side of the previous piece.

11.3. Rotate the square liftarm so it's upright with the pins at the bottom. Push the two pins into the left two holes on the top side of the bottom liftarm of the hollow frame. This piece will go to the right of an upright liftarm and you'll have to push it in from inside the hollow frame.

12.1. Next, we'll add a small assembly on top of the hollow frame. Place a light gray 1x2 brick with two pins on one side, horizontally with the pins at the front, in front of you.

12.1.2. Place a yellow 1x2 tile, horizontally, on the previous piece.

12.2. Push the two pin holes of a lime green 3L axle and pin connector with two perpendicular pin holes, horizontally with the axle hole at the right facing up and down, on the pins of the previous piece.

12.3. Push a brown 5L axle with a stop on one side, with the stop on top, from the top into the rightmost axle hole on the top side of the previous piece.

12.4. Slide the axle, from the top, through the second hole from the right on top of the hollow frame. The 1x2 brick with tile should be at the back and the assembly should be free to rotate away from you.

13. Push a red thick bushing, from the bottom, onto the bottom side of the axle. Push it all the way up until it touches the top liftarm of the hollow frame, but don't push it too hard! We want the axle to be able to spin.

14.1. Push the axle side of a green 2L liftarm with one axle and one pin hole, horizontally with the axle hole on the right facing up and down, onto the bottom side of the axle. Push it up until it touches the previous piece.

14.2. Push the top side of a brown 2L axle connector, from the bottom, onto the axle so it touches the previous piece.

15. Push a brown 3L axle with a stop on one side, with the stop at the bottom, from the bottom into the second hole from the left on the bottom liftarm of the hollow frame. The top side will attach to the bottom hole of the previous piece.

16. Place the first side and end, horizontally with the first end upright on the right, in front of you. Rotate the second end so it's vertical with the 3x3 square liftarm in the bottom corner at the back. Find the two pins on the front side of the L-shaped liftarm on the right side of the first side. Push these pins into the bottom two pin holes on the back side of the second end.

17.1.1. Now we'll build the second side. Set the rest of the rectangle aside for now. Place a green 9L thick liftarm, horizontally with the holes facing front and back, in front of you.

17.1.2. Push a black 2L pin from group A, from the back, into the left two holes on the back side of the previous piece. Repeat symmetrically on the right side.

17.2. Push the right two holes on the bottom liftarm of a green 3x5 L-shaped liftarm, with the 5L liftarm horizontally at the bottom pointing to the right and the 3L liftarm upright on the left pointing up, from the back onto the left two pieces from the previous step. Repeat symmetrically on the right side.

17.3. Push a black 2L pin from group A, from the front, into the top left and bottom left holes on the front side of the left piece from the previous step. Repeat symmetrically on the right side.

17.4. Place the rest of the rectangle, horizontally with the first side at the back, in front of you. Push the pins on the back sides of the left and right L-shaped liftarm on the second side assembly, from the front, into the bottom two holes on the front sides of both the left and right ends.

Group 3.

18.1.1. Next, we'll make the sides taller! Set the rectangle aside for now. Place a brown 15L thick liftarm, horizontally with the holes facing front and back, in front of you.

18.1.2. Push a black 2L pin from group A, from the front, into the leftmost and rightmost holes on the front side of the previous piece.

18.2. Skip one hole to the right of the left piece from the previous step and push a light gray 2L pin, from the front, into the 15L liftarm. Skip one hole to the right and place another. Keep doing this until you have placed six light gray 2L pins. There should be one free hole between the rightmost 2L pin and a black 2L pin. The light gray 2L pins do not have friction ridges and will spin freely.

18.3. Repeat steps 18.1-18.2.

18.4. Place the rectangle, horizontally, in front of you. Push the left and right pins on one of the assemblies we just made, from the back, into the top free holes on the back side of the left and right ends of the rectangle. Repeat symmetrically on the front side with the other assembly.

Group 4.

19.1.1. Next, we'll make six assemblies that go inside the rectangle. Set the rectangle aside for now. Place a brown 3L thick liftarm, vertically with the holes facing left and right, in front of you.

19.1.2. Slide a brown 5L axle with a stop on one side, horizontally with the stop on the right, from the right into the front hole of the previous piece.

19.2. Push the right hole of a light brown 3L axle connector, from the left, onto the previous piece.

19.3.1. Place the front hole of a brown 3L thick liftarm, vertically with the holes facing left and right, to the left of the left hole of the previous piece. It won't attach to anything.

19.3.2. Push a brown 5L axle with a stop on one side, horizontally with the stop on the left, from the left through the front hole of the previous piece and into the left hole of the 3L axle connector. The two 3L liftarms should be free to slide left and right.

19.4. Repeat steps 19.1.1-19.3.2 five times.

19.5. Now, we'll add these assemblies to the rectangle. Place the rectangle, horizontally, in front of you. Find the six pins that are on each of the horizontal 15L liftarms. Rotate one of the assemblies we just made so it's vertical, with the axle hanging down from the liftarms. Push the top hole of the back 3L liftarm onto the leftmost hole on the front side of the back 15L liftarm. Slide the front 3L liftarm forward and attach its top hole to the leftmost pin on the back side of the front 15L liftarm. Repeat five more times with the other assemblies.

Group 5.

20.1.1. Next, we'll make a couple more assemblies that go inside the rectangle. Set the rectangle aside for now. Place a brown 3L thick liftarm, vertically with the holes facing left and right, in front of you.

20.1.2. Slide a brown 5L axle with a stop on one side, horizontally with the stop on the right, from the right into the front hole of the previous piece.

20.2.1. Push the right hole of a brown 2L axle connector, from the left, onto the previous piece.

20.2.2. Push a red 2L axle, from the left, into the left hole of the previous piece.

20.3. Push the right hole of a dark green 3L axle connector, from the left, onto the previous piece.

20.4.1. Place the front hole of a brown 3L thick liftarm, vertically with the holes facing left and right, to the left of the left hole of the previous piece. It won't attach to anything.

20.4.2. Push a brown 5L axle with a stop on one side, horizontally with the stop on the left, from the left through the front hole of the previous piece and into the left hole of the 3L axle connector. The two 3L liftarms should be free to slide left and right.

20.5. Push a light gray 2L pin, from the left, into the back hole on the left 3L liftarm. Repeat symmetrically on the right liftarm.

20.6. Repeat steps 20.1.1-20.5.

20.7. Place the rectangle, horizontally, in front of you. Rotate one of the assemblies we just made so it's horizontal with the axle hanging down from the liftarms. Push the pin on the left side of the left 3L liftarm, from the right, into the third hole from the back, on the top row of the left end of the rectangle. Push the pin on the right liftarm into the corresponding hole on the right end of the rectangle. Place the second assembly in front of the first.

Group 6.

21.1.1. Next we'll build a frame. Set the rectangle aside for now. Place a dark gray 11x15 hollow frame, laying flat and horizontally, in front of you.

21.1.2. Push a black 2L pin from group A, from the left, into the back hole on the left side of the previous piece. Repeat symmetrically on the right side.

21.2. Skip one hole in front of the left piece from the previous step and push a black 2L pin from group A, from the left, into the hollow frame. There will be two free holes on the left side of the hollow frame in front of this piece. Repeat symmetrically on the right side.

21.3.1. Place a black 3L thick liftarm, vertically with the holes facing left and right, in front of you.

21.3.2. Push a black 2L pin from group A, from the left, into the front and back holes on the left side of the previous piece.

21.3.3. Repeat steps 21.3.1-21.3.2.

21.3.4. Push the pins on the left side of one of the assemblies we just made, from the right, into the front two holes on the right side of the left liftarm on the hollow frame. You'll push this in from inside the frame. Repeat symmetrically on the right side with the other 3L thick liftarm.

21.4. Push the bottom corner holes on the right side of a black 5x7 hollow frame, upright and vertically with the 7L liftarms at the front and back, onto the two pins on the left side of the hollow frame. Repeat symmetrically on the right side. You do not need to combine the two parts of this build.

Congratulations! Now this build is complete!

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