

FIRST® LEGO® League Challenge BIOGLOW™ Building Instructions

Mission 13: Keystone Species

This build is 136 pieces, and 37 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, ells 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 19 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.

Mission 13: Keystone Species

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 19 (6 groups of bricks)

Main Build

Group 1 contains the pieces for steps 1-9. Include a black 7x11 hollow frame from bag 0.

Group 2 contains the pieces for steps 10-20. Include a black 7x11 hollow frame from bag 0.

Group 3 contains the pieces for steps 21-29. Include two green 15L lifarms and a black 7x11 hollow frame from bag 0.

Group 4 contains the pieces for steps 30-38. Include a dark gray 11x15 hollow frame from bag 0.

Group 5 contains the lime green 1x1 round plates with three leaves on one side from step 32.

Group 6 contains the red 1x1 round plates with three leaves on one side from step 33.

Building Instructions:

Groups A, B, C and 1. You will use the pins from groups A, B and C throughout the build.

Mission 13: Keystone Species

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 liftarms connected by two 5L liftarms 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 front, into the third hole from the right on the bottom row of the previous piece so it extends 1L to the front.

1.3. Push a blue 3L pin from group B, with the stop ring at the front, from the front into the hole to the left of the previous piece. Push it all the way in so it extends 1L in front of and behind the hollow frame.

2. Push a black 2L pin from group A, from the back, into the bottom right hole on the back side of the hollow frame.

3. Push a green 1L liftarm, from the back, onto each of the pins on the back side of the hollow frame.

4.1. 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 right 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 rightmost axle hole on the top side of the previous piece.

4.4. 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.

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 right 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 right on the bottom liftarm of the hollow frame. The top side will attach to the bottom hole of the previous piece.

8. Push a black 2L pin from group A, from the front, into the third and fourth holes from the left on the front side of the top liftarm of the hollow frame. There should be a pair of pins on the front side of the bottom liftarm that are directly below these.

9. Push the top hole of a green 7L thick liftarm, upright with the holes facing front and back, from the front onto each of the previous two pieces. The bottom holes will attach to the pin on the bottom liftarm of the hollow frame.

Group 2.

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

10.1.2. 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.

10.2. Push the right two holes on the bottom liftarm of a black 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.

10.3. 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.

10.4. Place the first end, vertically and upright with the two 7L liftarms upright on the left side, in front of you. Push the two pins on the front side of the right 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.

11.1. 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.

11.2. Push a black 2L pin from group A, from the front, into the third hole from the left on the bottom liftarm of the previous piece.

11.3. Push a blue 3L pin from group B, with the stop ring at the front, from the front into the hole to the right of the previous piece. Push it all the way in so it extends 1L in front of and behind the hollow frame.

12. Push a black 2L pin from group A, from the back, into the bottom left hole on the back side of the hollow frame.

13. Push a green 1L liftarm, from the back, onto each of the pins on the back side of the hollow frame.

14.1. 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.

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

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

14.3. 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.

14.4. 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.

15. 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.

16.1. 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.

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

17. 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.

18. Push a black 2L pin from group A, from the front, into the third and fourth holes from the left on the front side of the top liftarm of the hollow frame. There should be a pair of pins on the front side of the bottom liftarm that are directly below these.

19. Push the top hole of a green 7L thick liftarm, upright with the holes facing front and back, from the front onto each of the previous two pieces. The bottom holes will attach to the pin on the bottom liftarm of the hollow frame.

20.1. Place the first side and end, horizontally with the first end vertically on the right, in front of you. Rotate the second end so it's vertical with the two 7L liftarms upright on the right. Find the two pins on the front side of the L-shaped liftarm on the left end of the first side. Push these pins into the bottom two pin holes on the back side of the second end.

Group 3.

21.1.1. Now we'll build the other side of the rectangle. Set the rest of the rectangle aside. Place a dark gray 9L thick liftarm, horizontally with the holes facing front and back, in front of you.

21.1.2. 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.

21.2. Push the right two holes on the bottom liftarm of a black 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.

21.3. 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.

21.4. Place the rest of the rectangle, horizontally with the first side at the back, in front of you. Rotate the second side 180 degrees so it's horizontal with the two L-shaped liftarms at the front. Push the pins on the back sides of the L-shaped liftarms, from the front, into the bottom two holes on the front sides of each of the ends.

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

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

22.2. Skip one hole to the right of the left piece from the previous step and push a black 2L pin from group A, from the back, into the 15L liftarm. Repeat symmetrically on the right side.

22.3.1. Push the front hole of a dark green 2L pin connector, from the back, onto the back side of the left piece from the previous step.

22.3.2. Push a green 1L liftarm, from the back, onto the second pin from the right.

22.4.1. Skip one hole to the left of the previous piece and push a red 1L pin with a ball on one side, with the ball at the back, from the back into the 15L liftarm. The ball on this piece is right next to the pin.

22.4.2. Skip one hole to the right of the 2L pin connector and push the pin side of a dark gray 1L pin with a bar and a pin on one side, with the ball at the back, from the back into the 15L liftarm. The ball on this piece is separated from the pin by a bar.

22.5. Repeat steps 22.1.1-22.4.2.

22.6.1. Place the rectangle, horizontally, in front of you. Push the left and right pins on one of the assemblies we just made, from the front, into the top free holes on the front side of the left and right ends of the rectangle. The 2L pin connector should be at the back near the left side.

22.6.2. Rotate the other assembly we just made so it's horizontal with the 2L pin connector at the front near the right side. Push the left and right pins, from the back, into the top free holes on the back side of the left and right ends of the rectangle.

23.1. Now we'll build an insert for the rectangle. Set the rectangle aside for now. Find a light gray 5x11 panel. This piece has five pin holes on each short end, seven pin holes on each long side, and four pin holes on the top and bottom. One side is flat, and one side has a gap between the two long rows of pin holes. Place this piece, horizontally with the flat side at the bottom, in front of you.

23.2. Push a tan 1L pin with a 1/2L pin on one side, with the 1/2L pin on the left, from the left into the center hole on the left side of the previous piece. Repeat symmetrically on the right side. These pieces do not have friction ridges and will spin freely.

24. Push a black 2L pin from group A, from the front, into the center hole on the front side of the 5x11 panel. Repeat symmetrically on the back side.

25.1. Find a black 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. Push the bottom hole on the back side of the cross, with the 3x3 square liftarm standing upright with the rounded sides on the left and right, from the front onto the front pin from the previous step. Repeat symmetrically on the back side.

25.2. Push a black 2L pin from group A, from the top, into the left and right holes on the top side of each of the previous two pieces. You'll place a total of four pieces in this step.

26.1. Find a black 7x11 hollow frame and rotate it so it's horizontal and laying flat. Find the third and fourth holes from the left on the bottom of the front and back liftarms on this piece. Push these holes onto the four pins from the previous step.

26.2. Push a tan 1L pin with a 1/2L pin on one side, with the 1/2L pin on the left, from the left into the center hole on the left side of the previous piece. Repeat symmetrically on the right side. These pieces do not have friction ridges and will spin freely.

27. Push the second hole from the top of a light gray 5L thin liftarm, upright with the holes facing left and right, from the left onto the left piece from the previous step. The bottom hole should attach to another 1L pin with a 1/2L pin on one side. Repeat symmetrically on the right side.

28. Push a light gray 2L pin, from the front, into the leftmost hole on the front side of the 7x11 hollow frame. Push another, from the back, into the rightmost hole on the back side of the hollow frame. These pins do not have friction ridges and will spin freely.

29.1. Let's make a couple small assemblies! Place a green 1L liftarm, with the hole facing front and back, in front of you.

29.2. Push a tan 3L pin, with the stop ring at the back, from the back into the previous piece. Push it all the way forward so it extends 1L in front of and behind the liftarm.

29.3. Repeat steps 29.1-29.2.

29.4. Push the pin on the back side of one assembly, from the front, into the rightmost hole on the front side of the 7x11 hollow frame. Push the other, from the back, into the leftmost hole on the back side of the hollow frame.

Group 4.

30.1. Place a brown 7L thick liftarm, horizontally with the holes facing front and back, in front of you.

30.2. Push the pin of a red 1L pin with a stud on one side, with the stud at the front, from the front into the rightmost and third from the right holes on the front side of the previous piece.

30.3. Repeat steps 30.1-30.2.

30.4. Push the leftmost hole of one assembly, horizontally with the studs facing the front, onto the rightmost pin on the front side of the insert assembly. Push the leftmost hole of the other, horizontally with the studs facing the front, onto the rightmost pin on the back side of the insert assembly. Note that these are NOT symmetrical as the pins on both should face the front.

31.1. Place a brown 7L thick liftarm, horizontally with the holes facing front and back, in front of you.

31.2. Push the pin of a red 1L pin with a stud on one side, with the stud at the back, from the back into the leftmost and third from the leftmost holes on the back side of the previous piece.

31.3. Repeat steps 31.1-31.2.

31.4. Push the rightmost hole of one assembly, horizontally with the studs facing the back, onto the leftmost pin on the front side of the insert assembly. Push the rightmost hole of the other, horizontally with the studs facing the back, onto the leftmost pin on the back side of the insert assembly. Note that these are NOT symmetrical as the pins on both should face the back.

Group 5 contains the lime green 1x1 round plates with three leaves on one side from the next step.

32.1.1. Place a brown 1x3 plate with rounded ends, horizontally, in front of you.

32.1.2. Find a green 3x5 cloud plate. This piece has a bunch of rounded edges so it looks kind of like a cartoon cloud. It has three studs on top. Place this, horizontally and centered vertically, on the previous piece so the right sides are even.

32.2.2. Place a green 1x1 round plate with three leaves on one side, with the leaves pointing to the right, on the right stud of the previous piece.

32.2.3. Place a lime green 1x1 round plate with three leaves on one side from group 5, with the leaves pointing to the left, to the left of the previous piece.

32.3. Repeat steps 32.1.1-32.2.3.

32.4. Rotate one of these assemblies so it's upright with the 1x3 plate with rounded ends at the front and pointing up. Place the bottom row of the assembly on the back two studs on one of the 7L thick liftarms on the left side of the insert. Repeat on the other 7L thick liftarm on the left side of the insert.

Group 6 contains the red 1x1 round plates with three leaves on one side from the next step.

33.1.1. Place a brown 1x3 plate with rounded ends, horizontally, in front of you.

33.1.2. Place a green 3x5 cloud plate, horizontally and centered vertically, on the previous piece so the left sides are even.

33.2.2. Place a green 1x1 round plate with three leaves on one side, with the leaves pointing to the left, on the left stud of the previous piece.

33.2.3. Place a red 1x1 round plate with three leaves on one side from group 6, with the leaves pointing to the back, to the right of the previous piece.

33.3. Repeat steps 33.1.1-33.2.3.

33.4. Rotate one of these assemblies so it's upright with the 1x3 plate with rounded ends at the back and pointing up. Place the assembly on the front two studs on one of the 7L thick liftarms on the right side of the insert. Repeat on the other 7L thick liftarm on the right side of the insert.

34. Now we'll add the insert to the rectangle. Set the rectangle, horizontally, in front of you. Find the upright 7L liftarms that are inside the rectangle on each of the ends. Find the upright 5L thin liftarms that are on the left and right sides of the insert. Slide these liftarms between the pairs of 7L liftarms on the rectangle.

35. Lift the insert up so the cross of holes on the two 3x3 square liftarms is accessible from the gap in between the upper and lower liftarms on the frame.

36.1. We're going to make a couple of handles now. Place a light brown 3L axle connector, horizontally, in front of you.

36.2. Push the axle side of a blue 2L axle/pin combo from group C, with the pin on the right, from the right into the previous piece.

36.3. Repeat steps 36.1-36.2.

36.4. Rotate one of the handles so it's vertical with the pin at the back. Push the pin into the center hole on the front 3x3 square liftarm on the insert. Repeat symmetrically on the back side with the other handle. These handles should be between the upper and lower liftarms on the front and back sides of the frame. If you push them up and down, the insert should move and the four 7L liftarms should pop up and down.

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

37.1. 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.

37.2. Skip one hole in front of the left piece from the previous piece 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.

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

37.3.1. 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.

37.3.2. Repeat steps 37.3 and 37.3.1.

37.3.3. 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.

37.4. 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!

FIRST® is a trademark of For Inspiration and Recognition of Science and Technology (FIRST).

LEGO® is a trademark of the LEGO Group.

FIRST® LEGO® League and BIOGLOW™ are jointly held trademarks of FIRST and the LEGO Group.

©2026 FIRST and the LEGO Group. All rights reserved.

Bricks for the Blind is a registered tax exempt 501(c)(3) corporation.