

# LEGOscopes

Thank you for your interest in building microscopes made from LEGOs (LEGOscopes) such as the ones you saw at a recent outreach of the [Florida State University Biomedical Sciences Graduate Student Association](#)!

This activity was originally published online as an outreach developed by [University of California San Francisco graduate students](#) Harrison Liu (Bioengineering), Michael Sachs (Biomedical Sciences), and Reid Williams (Biophysics).

The website with their original instructions and blueprints is no longer maintained. The instructions in this document were adapted from their original materials and the 3D printing files provided separately are their own work.

*Please note that this is not an official LEGO kit. This document does not construe any affiliation with or endorsement by The LEGO Group.*

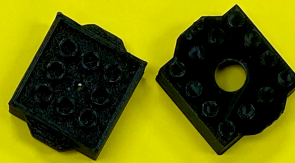
*This manual is merely meant to start you thinking about a fun activity you can build at home!*

# MATERIALS

Assorted LEGOs



3D Printed Pieces



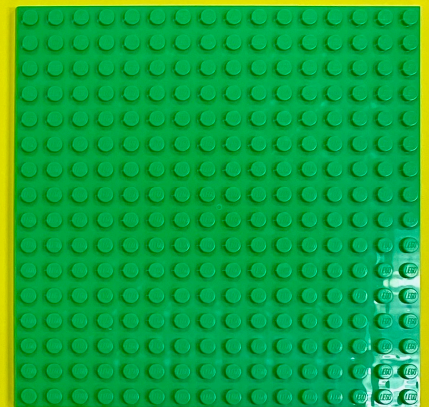
Light Source



Lenses



Base  
(optional)



Dark Construction Paper



# MATERIALS

## Assorted LEGOs

- Pick your favorites and use what you have!

## 3D Printed Pieces (Top and Bottom)

- .stl files provided separately.
- Check with your local library or school to see if they offer free or paid access to a printer.

## Light Source

- Anything bright!
- If you build the base large enough, your phone flashlight is a great option. Or you could use an artist's light table.
- We used [these keychain lights](#), but they're difficult to align because of their shape.

## Lenses (2)

- We used GSPO item #2826 (G-S stock lens GS1027) from [Germanow-Simon Corporation \(G-S Plastic Optics\)](#). As of 2019, they were \$18/each.

## Krazy Glue (aka The Kragle)

- To glue the lenses into the 3D printed pieces.

## Base (optional)

- Convenient if you want to move or store your LEGOscope, but not crucial.
- We used [these](#). They can be cut down.

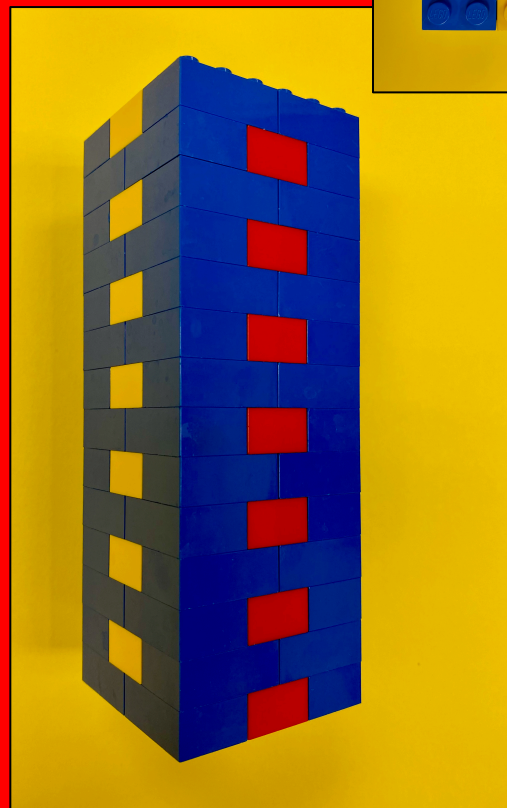
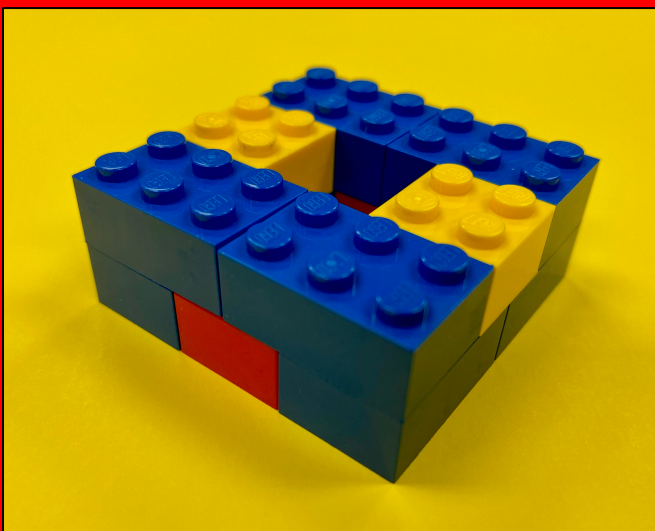
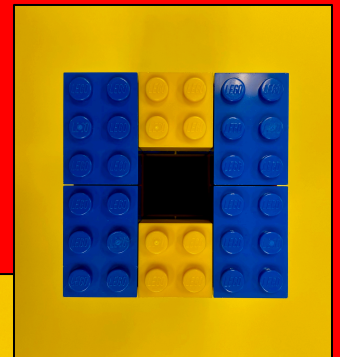
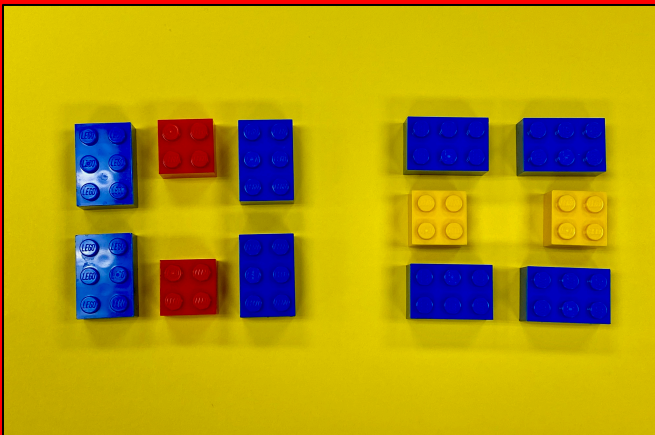
## Slides (optional)

- We used [these](#), but you can look at anything as long as light shines through it and your LEGOscope stage can support it.

# INSTRUCTIONS

## Assembling the TOWER

- We used four 2x3 bricks and two 2x2 bricks per row, alternating the pattern by 90° at each level.
- The finished tower should be a 6 studs x 6 studs square (with a 4x4 hole running the length of the tower) and 14 bricks/rows high.



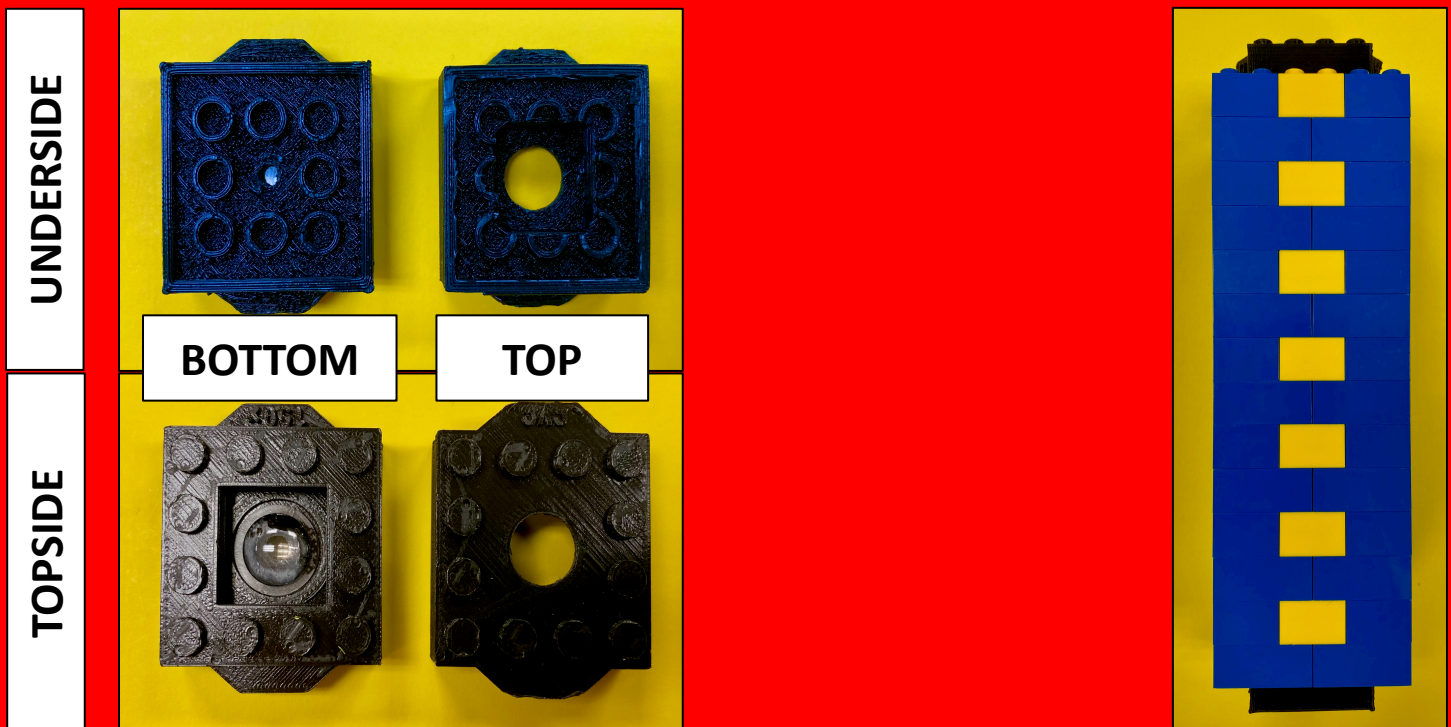
# INSTRUCTIONS

## Assembling the TOWER

- Cut the construction paper to the height of the tower and roll into a tube.
- Insert the paper tube into the 4x4 hollow of the tower.
- This will ensure that no light is scattered off the sides of your LEGOs, which would distort the image you see.

## Assembling the OPTICS

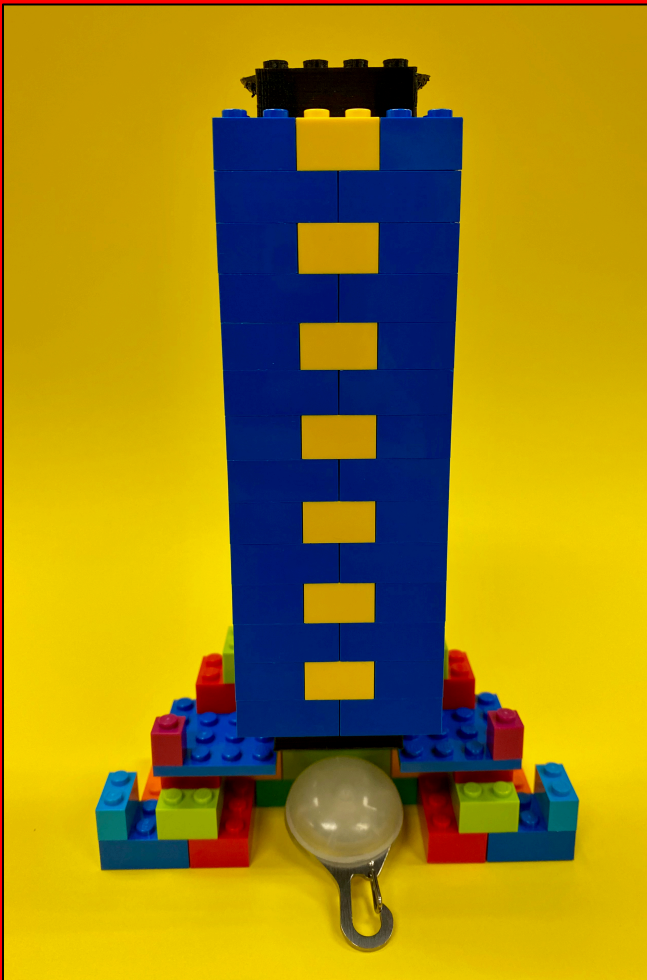
- Using the least amount of glue possible, gently glue the flat side of a lens into each 3D printed piece (e.g., "BOTTOM").
- Once dry, snap the pieces onto the top and bottom of the tower. This may require shaving the 3D printed pieces slightly so that they fit around the LEGO studs.



# INSTRUCTIONS

## Assembling the BASE

- Be creative!
- Make sure to include a place to set your slide/specimen to keep it steady while you look in your LEGOscope.
- And make sure to leave a space large enough for your light source to fit under the slide/specimen.
- Snap the tower onto your base and, voilà, you have a functional LEGOscope!



# HELP

## **I can't see anything!**

- Is your light source lined up with your tower?
- Is light passing through the slide/sample/specimen?
- Is the tower far enough forward on the base so that nothing is obstructing your view?

## **The image is blurry!**

- Did you remember to put the paper tube inside the tower?
- A typical microscope allows you to adjust the stage where your slide/specimen sits so that you can focus the image. However, since LEGOs are static objects, it's best to adjust the slide/specimen. We like to use duct tape pads to raise and lower the height of the slide. Just make sure the sample is level (put even amounts of duct tape on each side) or you will be unable to focus it properly.

## **When I move the slide/specimen, the image moves a different direction!**

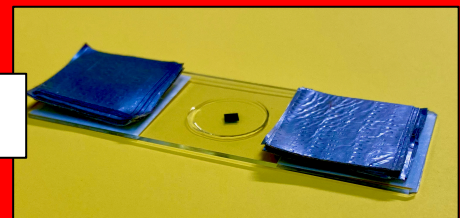
- When adjusting your slide/sample, know that your motions are mirrored.

## **My tower keeps falling off!**

- Build a bigger base and increase the number of connection points from the tower to the base.



**Focusing slides**



# LEGOscopes

**Want to learn more about microscopes and how they work?**

Check out [this great explanation](#) from DK on the basics of light microscopy.

**Did you build a LEGOscoope?**

Show us! [Email us](#) a pic or tag [our Facebook page](#), @FSU Biomedical Sciences Graduate Student Association!

**Have additional questions, comments, or suggestions?**

[Let us know](#) so we can improve this guide for future users!

**Want us to share this activity with your class, after-school program, homeschool co-op, daycare, science fair, etc.?**

[Contact us!](#) We consider all outreach opportunities.

This guide was assembled and written by **Marisa Tillery**, Outreach Coordinator for the FSU Biomedical Sciences Graduate Student Organization. ©2021