

Day 10 - Shelter

Project: iGEM 2018

Authors: Jessica Laury

Date: 2018-07-25

WEDNESDAY, 7/25/18

Because of the inhospitable conditions on the Martian surface, it is unrealistic to expect astronauts to build structures to live in using the conventional methods of Earth. The current proposed solution is a giant 3D printer. Unfortunately, the heavy salt materials typically used as "ink" will be too heavy to feasibly transport. Estimated costs are \$300,000 per kilogram of transported material. The proposed solution is cyanobacterium *Arthrospira platensis* which naturally produces a bioplastic called PHB (polyhydroxybuterate) for energy storage. Bacteria would have to be adapted to secrete the plastic freely. This bacteria can be used to create the initial structure for martian homes. Additional airtight casing, radiation protection and strong insulation for temperature regulation would be required. <https://medium.com/@TwistBioscience/how-on-earth-will-we-colonize-mars-use-synthetic-biology-3b2c3895d0e2>

Activities

<https://www.universetoday.com/113346/how-do-we-terraform-mars/>

<https://www.ibiology.org/bioengineering/development-of-new-antibiotics/>

All ages -

Have students practice creating blueprints for a 3-D printed structure. Higher level students can utilize the the free 3D softwares outlined below.

Free 3D modeling software

- **Blender** - open source 3D animation suite. Enable the **3D Printing Toolbox**.
- **OpenSCAD** - free software for creating solid 3D CAD models. Useful for creating models of machine parts.
- **Sketchup** - comes in free or pro versions. Get the **Sketchup STL** from the Extension Warehouse.
- **Tinkercad** - a browser-based 3D design platform, now part of Autodesk (free version available).
- **123D Design** - a free, powerful, yet simple 3D creation and editing tool from Autodesk.
- **List of additional free software packages** from 3ders.com.

Free 3D models

You can search for pre-existing models on the Internet to print as they are, or to modify using 3D modeling software.

- **3D Warehouse** - Sketchup's searchable design library.
- **Instructables** - from the 123D community.
- **Thingiverse** - MakerBot's searchable design library community.

3D modeling tutorials

- **3D modeling for beginners** (Shapeways)
- **How do I make a solid model** (Rhino)
- **How to fix and repair your 3D files** (Shapeways)
- **Tips for designing 3D printed parts** (UT Austin Innovation Station)
- **Other resources for 3D modeling and printing** (3D4U)
-

Final Reflection

Have students reflect on the original projects they created with our closed system lesson. Would this system work? What do they know now and what changes would they make to their system? Where would synthetic biology be a good solution to implementation? Where do we still need more discovery?