

Genomics Analogy Model for Educators (G.A.M.E.)

LEGO® Activities

There are two activities for students to take part in, using LEGO®s, that will demonstrate the process of sequencing DNA. The first activity is to build stacks of LEGO®s using special “topless” LEGO®s. In the second activity, students will “run a gel” with their stacks of LEGO®s, and decide the sequence of colors.

Building Stacks:

Materials:

- 3 buckets of red, blue, green, and yellow LEGO®s
- 1 bucket of red, blue, green, and yellow LEGO®s with half of the blocks inside without connectors (they can be sanded off, or taped over)
- A sheet of paper or stack of LEGO®s with a sequence (see below for an example of a sequence)

Procedure:

Explain to students that the process they are about to begin happens in a solution, and is not visible to the scientists. Scientists use a process like this one to determine the sequence of DNA.

1. Divide students into four groups, and assign each group a different color.
2. Each group will be given buckets of the four different colors of LEGO®s (red, yellow, blue, and green), but the red group’s bucket of red blocks will contain some red blocks without tops, the blue group will have some blue blocks without tops, etc.
3. Provide each group with a sequence to build. For older groups, a longer sequence may be more appropriate. For example, give the students the sequence:

R-G-Y-R-B-G-Y-R-Y-G-B-G-B-R-Y-B

Each group of students will construct towers of blocks. If they randomly pick a colored block without a connector, their tower stops, and gets set aside. Over time, they should end up with four or five different sizes of stacks. For example, the red group would have five different stacks:

1. R
2. R-G-Y-R
3. R-G-Y-R-B-G-Y-R
4. R-G-Y-R-B-G-Y-R-Y-G-B-G-B-R
5. R-G-Y-R-B-G-Y-R-Y-G-B-G-B-R-Y-B

When the students are finished, each group should have a set of LEGO® stacks. It's time to "run" them in a gel!

Running a Gel:

Materials:

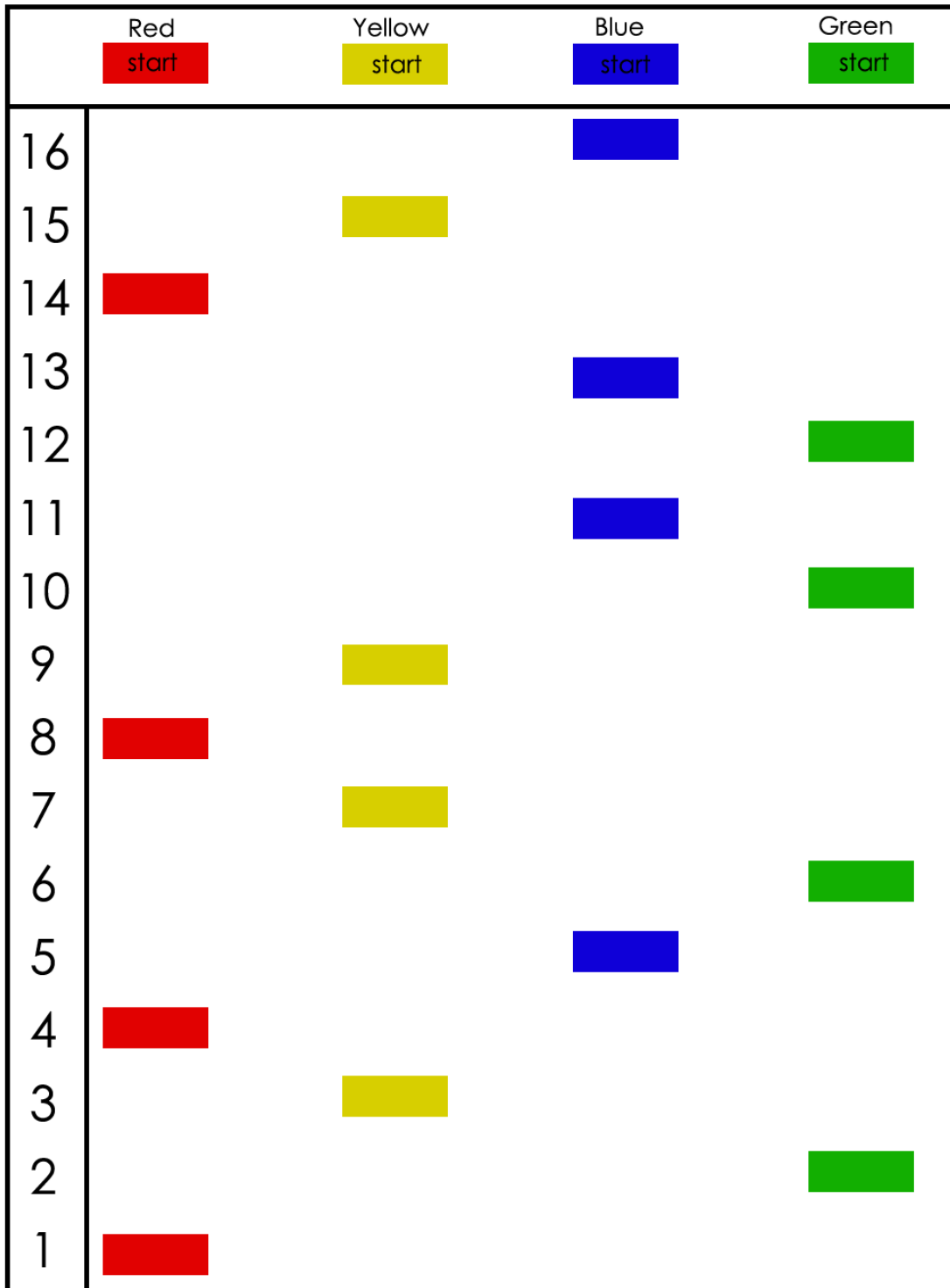
1. LEGO® stacks
2. Tape or markers and cardboard or butcher paper

This activity can be as "fancy" or as simple as you are willing to make it. Students need to work both within their group, and collaborate with other groups, to create a gel using their LEGO® stacks. (If groups are very large, students can choose a spokesperson to run the gel, and give advice and suggestions to help them.)

Procedure:

You will need four "lanes," one for each color group to run their fragments. These lanes should be close together so students can compare their fragments with other groups. This process can be done many ways, several of which might be by making tape markings on the floor, or by drawing a large empty gel on a large sheet of cardboard or butcher paper.

Students must use their knowledge of gel electrophoresis to correctly place their stacks on the board. The single block (**R**) should be in the farthest lane from the start, then **R-G**, then **R-G-Y**, and so on, until the students have arranged their stacks in their lane to create a pattern. Students should arrange the stacks of LEGO®s in such a way that they stand upright, so that the top color is visible.



When all four groups agree that they have correctly placed their fragment LEGO® stacks, ask them to “read” the code for you and write it down. (Start from the “bottom” of the gel, and read up, one by one, noting the color in each slot.) See if the code the students have created matches the code they used to build the stacks.

Explain that scientists who sequence DNA do not know the sequence to start with, and use the process they have gone through to learn what order the bases are in. They do it by using chemicals and gels, but they read the resulting gel in the same way the students have read their stack of blocks.