

MAKE A MOTOR PROTEIN PEN

The ball on the top will represent a protein that is being carried. At the bottom of the motor protein will be two things that look like legs. They have globular proteins that act as feet, walking along a microtubule as you would walk on a sidewalk. The model will contain many plastic beads that will represent the structural proteins from which the motor protein is made. The nice thing about this model is that it is also useful, as it is a pen. You can have a lot of fun making people guess what it is while you write.



You will need the following for each student:

- a ballpoint pen (the kind with the cap that comes off)
- a handful of assorted colored beads for each student (miscellaneous sizes, shapes and colors)
- chenille stems (3 per student)
- floral tape (the green tape florists use—it doesn't feel very sticky) One roll will be enough for up to 20 students.
- some kind of ball (You will have to determine what kind of ball will work best for your situation. We found very inexpensive hollow plastic Christmas tree balls that worked very nicely. You could also use a Styro-foam™ ball, or any lightweight plastic ball. If you can't find any suitable balls, just improvise. You could use heavy card stock paper to make a cube or a dodecahedron. (If you need a pattern, you can use the virus dodecahedron pattern at: www.ellenjmchenry.com/homeschool-freedomdownloads/lifesciences-games/virusmodels.php) Just make sure the ball is not too heavy. A heavy ball will make writing with the pen difficult.

How to assemble the pen:

1) Take the cap off the pen and put it on the other end, as if you were going to write with the pen. Press it on as firmly as you can.

2) Drill or punch a hole in the ball. The hole must be just the right size so that it fits onto the cap at the halfway point. (see drawing at right) Adhere the ball to the pen with appropriate glue. (Recommendation: "Quick Grip" or a similar all-purpose hobby glue that is clear, has a thick texture, and dries quickly. This type of glue is often a bit smelly, but not dangerously so.)

3) Drill or punch two more holes in the ball. These should be very small holes—just large enough to accommodate the end of a chenille stem.

4) Take two of the chenille stems and secure a bead to one end of each stem. Just loop the chenille stem around, give it a twist and tuck the end back into the bead. Make sure there isn't a sharp metal end sticking out. Then thread some beads onto them until you've covered about 5 cm (2 inches) of the chenille stem. The measurement does not have to be exact.

5) Lay the chenille stems alongside the pen so that the yet-to-beaded part is flush with the pen tip. (see drawing for clarification) Wrap some floral tape around at the tip, to secure them, then wind the tape up the pen about 4 cm (1.5 inches). The measurement does not have to be exact. Tear off the tape and continue wrapping until the end of the tape is sealed on. Press firmly. Floral tape won't seem very sticky so you may think it won't hold, but surprisingly, it will adhere very well and will stay in place even while the pen is being used to write with. The floral tape won't stick to fingers, just to itself. (For further clarification, look at the color pictures in the appendix.)

6) Thread some more beads along those two chenille stems until you reach about 2 cm (3/4 inch) from the end. Those two ends will fit into the small holes you drilled or punched in the ball. (Look at color picture in appendix.) You may want to glue the ends of the stems into these holes. (Ours stayed secure even without glue.)

7) You may need to make adjustments for your particular situation, depending on what you are using as a ball and how large your beads are. Use the color pictures in the appendix as guides for the general concept, then make necessary adjustments according to the materials you are working with.

8) Secure a third chenille stem to one of the side stems right at the top of the floral tape. Begin a pattern in which you alternate winding with threading a few beads on. Wind tightly. Once again, look at the color photo in the appendix to see how it will look. (Yours doesn't need to look exactly like this one.)

9) After you have wound to the top, right under the ball, secure the chenille stem to one of the beads (or the stems) right under the ball.

10) To use the pen, move the "legs" upward, out of the way of the paper. When not writing, move them back down so they look like legs again.

