Proteins can be used to make "vehicles" that can carry other molecules. We've already mentioned the ***motor proteins***. The correct name for this protein is ***kinesin***. ("Kine" is Greek for "motion," and also appears in the word "cinema.") They look like they have little legs and feet and they do something very similar to walking as they travel along the microtubule cables. (Note, however, that their "feet" are actually called "heads.") Their job is to carry loads, often heavy and large loads, from one place to another. We've talked about vesicles traveling around the cell or moving out to the membrane, but we've not said how. This is how. Motor proteins can also drag entire organelles across the cell. If the load is too large, several kinesins will join together and cooperate.

Kinesins (motor proteins) travel in one direction, usually starting from the center and going toward the outside. They know what direction to travel because microtubules are polar. Kinesins will go toward the positive end. A different type of motor protein is required to go the other way. These "reverse direction" motor proteins are called ***dyneins***. (Dyneins are also responsible for the motion of cilia.) Motor proteins that can go both ways do exist but are rare. When a motor protein reaches the end of the microtubule, it releases its cargo then gets off the microtubule. It jumps off and floats back to the starting point. Then it is ready to reattach to another microtubule, take on new cargo, and begin a new journey.

Some cells use proteins to manufacture transportation devices that can be likened to boats because they float along in the bloodstream. Why do we need boats in our blood? Blood is mostly water, which is polar. When a hydrophobic molecule needs to be transported via the blood, it will refuse to get in unless it is safely enclosed in a "vehicle" of some kind. Just think— if you are afraid of water but need to cross a river, would you swim or ride in a boat? Same concept applies to molecules. The most common protein boat you'll find in blood is called ***albumin***. (This word looks similar to albumen, which you find in egg whites. Notice that the egg word has an "e" instead of an "i.") Albumins account for half of the proteins found in blood. Albumins can carry free fatty acids, hormones, ions, calcium, broken pieces of hemoglobin that are in the midst of being recycled, and also some prescription drugs such as the blood thinner ***warafin*** (which we will meet again in a later lesson). Albumins do another job, besides transport things. Their very presence in the blood works to regulate osmosis as water diffuses in and out of the blood. Albumins help to maintain proper blood pressure.

The last major category is "tags." We've seen how sugars can also be used as tags, both inside the cell and at the surface. Protein tags are specifically used as "flags" to mark foreign invaders. These tags can be called ***gamma globulins***, ***immunoglobulins***, or ***antibodies***. All three words are correct and can be used interchangeably. They are Y-shaped, with the upper part designed to stick to the foreign invader, and the base part designed to stick to a cell membrane if need be. Some float around freely and others stick to the outside of a cell. Each Y has a unique shape and can stick to only one type of invader. Your body makes millions of differently shaped antibodies, hoping that a small percentage of them will actually be useful.

YOU WILL NEED THIS STRIP FOR LESSON 52. Don't cut it off right now-- wait until you get to lesson 52.

CUT OFF THIS BOTTOM SECTION ALONG DOTTED LINE

Here are patterns for two action potential sliders. You'll only need one, but the extra is provided in case of multiple students, or in case you make a mistake and need an extra. The blank rectangles fold around the axon (make sure they are loose enough to slide). The action potential rectangle is glued on top. (The video will show you how to assemble them.)