Proteins Fold in an Aqueous Environment

Water Cup Contents
12 water molecules
1 sodium atom
1 chloride atom
1 two-carbon ethane core with 5 non-magnetic hydrogens
1 non-magnetic hydrogen cap and grey plug
1 hydroxyl group

Activity
1. Pass out one water molecule to each student. Give the chemical formula of water and identify the atoms in a molecule of water. $H_2O$. Hydrogen is white and oxygen is red.
2. Using two molecules of water, identify which regions can interact and which regions do not interact. The hydrogen binds oxygen. Hydrogen does not bind hydrogen, oxygen does not bind oxygen.
   a. Give a reason why the regions are able to interact. Because the electrons are unequally shared between the hydrogen and the oxygen, water is a polar molecule. The two hydrogen atoms have a slightly positive charge and the oxygen atom has a slightly negative charge.
   b. What is the name of this type of interaction? Hydrogen bond.
3. Predict what types of molecules will interact with water and what types of molecules will not interact with water. Polar or charged molecules are able to interact with water.
   a. Sodium chloride? Yes, the positively-charged Na$^+$ will interact with the oxygen in water. The negatively-charged Cl$^-$ will interact with the hydrogen in water.
   b. Ethane? No. Ethane is a non-polar molecule.
   c. Ethanol? Yes, the hydroxyl group in ethanol is polar and will interact with water.
4. Test predictions with the sodium, chloride, ethane, and ethanol models in the water cup.
5. Develop a general statement describing the types of molecules that are able to interact with water and types of molecules that are not able to interact with water. Molecules that are polar or charged will be able to interact with water.
6. The cells in our body are mostly made of water. What prediction would you make about the proteins in the cell that are surrounded by water? The outside portion of a protein in an aqueous environment will be polar and the inside portion of a protein will be hydrophobic.