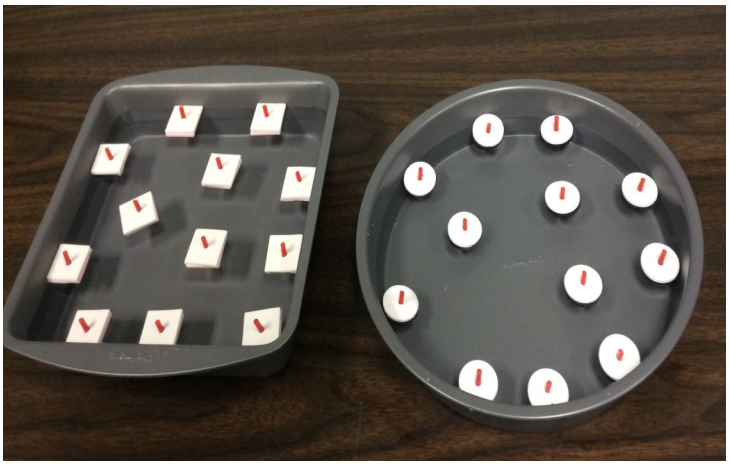
NNCI—Nanoscale Science and Engineering Exploring Self-Assembly

Explore!

1. Pick up a foam circle/square and place it into the container of water. Place circles in round pan; squares in square pan.
2. Slowly add more of the foam circles/squares to the water. Make sure you add them with the same side up.
3. Once done, what type of pattern can be seen? Is it the same for the round and square pans? Does it change as you add more foam pieces?
4. Pick up one of the foam pieces and turn it over and place it back in the water. What happens?



What is happening?

Each foam piece represents an atom and the distribution of the pieces in the water shows how atomic forces can repel atoms from one another. The pieces arrange themselves in patterns that represent the most stable state — produces minimum energy. When all the diploes are in the same direction, the pieces move as far away as possible. But when a dipole is switched, the pieces form clusters— they self-assemble into these clusters.

For the circles in the round pan, a hexagonal lattice will allow the most pieces in the space. For the squares, it is a cubic lattice. These represent the most efficient distribution of the “atoms” in the confined space.

Electromagnetic forces pull opposite charges together such as the negative and positive forces of protons and electrons.

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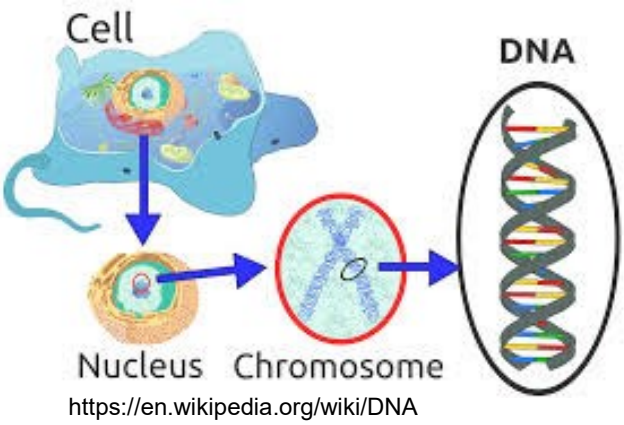
Self assembly is when particles are attracted to each other to make an organized shape. Self assembly is spontaneous — it occurs without external intervention. For self assembly to happen certain conditions must be present— the "building blocks" must have the correct shape, charge, composition and the environment must be must be suitable (concentration, temperature, polarity etc.)

Soap molecules self- assemble into bubbles when air is blown through them. The molecules form two layers with a water layer between them. Each soap layer is a self-assembled monolayer.

Image: Pixabay.com CCO Public Domain



https://en.wikipedia.org/wiki/DNA

The replication of DNA is an excellent example of self assembly.

Self-assembled monolayers (thin films) are important coatings on many materials like this RubberMaid Clean and Dry Plunger.® SMAs control surface properties such as wetting, chemical sensitivity, adhesion, bio-compatibility, etc.

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