Laboratory 10
Extraction of Strawberry DNA

Background:

The human genome, the genetic code in each human cell, contains 24 DNA molecules each containing from 500 thousand to 2.5 million nucleotide pairs. DNA molecules of this size are 1.7 to 8.5 cm long when uncoiled, or about 5 cm on average. You have about 10 trillion cells in your body, so if you stretched the DNA in all the cells out, end to end, they'd stretch over 744 million miles. The moon is only about 250,000 miles away, so all your DNA would stretch to the moon and back almost 1500 times. The sun is 93,000,000 miles away, so your DNA would reach there and back about 4 times!

The cultivated strawberry, Fragaria ananassa , is interesting from a genomic perspective because it's a polyploid hybrid species. Unlike humans, which are diploids (with two sets of chromosomes), a strawberry is an octoploid (with eight sets of chromosomes). How some strawberries evolved from diploids to octoploids is yet to be discovered. Strawberries can reproduce through seed or runners. Daughters produced by runners are genetically identical to the mother plant. Daughters produced from seed will not be identical as they are the result of sexual reproduction.

DNA is found in the nucleus of all plant and animal cells. Regardless of the cell's particular function, the DNA in the nucleus is the blueprint to copy the entire organism, not just that particular cell. You will extract the DNA from a strawberry because it is so plentiful – it contains four times more than an animal cell.

Mashing the strawberry breaks the cell wall and membranes using mechanical action to expose the DNA. Ripe strawberries produce enzymes (pectinases and cellulases) which also aid in breaking down the cell walls. The "mush" produced is the **lysate**, named from the lysed or broken cells. The warm water bath speeds the reaction between the enzymes and the cell membranes. The "Extraction Buffer" contains shampoo (detergent) to help dissolve the phospholipid bilayers of the cell membrane and organelles. DNA is polar – remember it can hydrogen bond – and has an overall negative charge. Adding an ionic compound like NaCl will cause the DNA to clump together.

DNA is not soluble in ethanol. However, solubility of most compounds increases as temperature increases. Therefore, you will isolate more DNA if the ethanol is kept in a freezer or ice bath. The DNA will look like mucus.

Adapted in part from "Biotechnology in the Classroom" UC Davis 2005