Heat Map Analysis: Student Worksheet   Name:

UNC scientist Rebecca Fry, PhD, is studying children's health effects related to prenatal exposure to cadmium in North Carolina. Cadmium is a toxic metal that, like arsenic, poses a threat to children's health. Pregnant women can be exposed to cadmium through either smoking cigarettes or inhaling secondhand cigarette smoke, breathing contaminated air or by ingesting cadmium contaminated foods (e.g., shellfish, kidney or liver meats) or drinking water. **"There is evidence that maternal exposure to cadmium may leave marks on the baby's DNA that could be passed on to future generations,"** Fry explains. "We are looking at DNA collected from newborns' cord blood at birth to see if there is a relationship between their prenatal exposure and epigenetic changes to their DNA."

1. In your own words, state the central question guiding Dr. Fry's research.

Next, you will learn how to interpret a *visual representation* of the resulting data, referred to as a **heat map**, by using the following questions as a guide as you view the heat map provided by your teacher.

2. Notice that the map is organized into rectangles that form columns and rows:
   How many rectangles are in a vertical column?
   What do these rectangles represent?

   How many rectangles are in a horizontal row?
   What do these rectangles represent?

3. What is the significance of the blue and the red rectangles?

   Each box below contains a DNA sequence with two methylated cytosines. By adding or crossing out methyl groups Ⓜ, depict hypermethylation, hypomethylation and no change in methylation state in the boxes below and then, using colored pens or pencils, indicate which box would appear red, blue and gray on a heat map by shading in the appropriate box:

hypomethylation	no change in methylation state	hypermethylation

4. What conclusion can you make about the data from the bottom five rows (rows 1-5). How about rows 6-27?

5. Draw a conclusion about this heat map: what does this heat map reveal about infants exposed to high levels of maternal cadmium?

6. Do these data prove that cadmium causes differential methylation *in utero?*

7. Fry and her team have determined that some of the genes that exhibited differential methylation in response to cadmium exposure code for proteins involved in either the inflammatory response or play a role in skeletal development. Where might Fry and her research team direct future research to expand upon these findings?