



**CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY**

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| Name(s) Vasiliki S. Courelli | Project Number 31786 |
| Project Title Breaking the Code of Life with Force & Fire: How Extraction Temperature and Mechanical Manipulation Affect DNA Shearing | |
| Abstract Objectives/Goals The purpose of this science project is to investigate the shearing that occurs in DNA as a result of the incubation temperature of the specimen from which it is extracted and as a result of mechanical manipulation. When DNA extraction protocols require immersing the specimen in hot water, how hot should the water be? When DNA is collected, stored, and retrieved with pipettes, what degree of shearing does the force of suction through the pipette impose on the DNA? If DNA shearing is required, would pipettes be a tool to achieve it? Methods/Materials Commercial wheat germ was used as the specimen from which DNA was extracted. A widely used DNA extraction protocol was employed common for home use that requires wheat germ to be manipulated in hot water, with the addition of commercial dishwashing liquid detergent, and very cold isopropyl alcohol. The temperature of the hot water in which wheat germ was initially immersed was varied and the degree of shearing of the collected DNA was evaluated. Similarly, application of mechanical manipulation vs. no application of mechanical manipulation was assessed as it affects DNA shearing. The degree of shearing was evaluated visually, via optical microscope, and computationally, via gel electrophoresis. The distance that DNA traveled in the gel was used as a quantitative measure of the degree of DNA shearing. DNA shearing was evaluated visually by assessing "stringiness" of DNA samples observed through an optical microscope. Results Incubation temperature of the specimen DNA is extracted from plays an important role in DNA shearing. As the temperature increases, the degree of shearing increases too. The degree of shearing, however, increased faster with the application of mechanical manipulation on the DNA sample. It is worth noting that in the range of 90C-100C the applied mechanical manipulation did not increase the degree of DNA shearing. A plausible explanation might be that at that temperature range, protein denaturation had already caused substantial shearing that the subsequent mechanical manipulation did not break the DNA substantially. Conclusions/Discussion The results suggested that increase in incubation temperature increases DNA shearing. The application of mechanical manipulation increases DNA shearing also. A combination of the two makes shearing more pronounced up to a certain level when both procedures produce the same degree of DNA shearing. | |
| Summary Statement The purpose of this science project is to evaluate the shearing occurring in DNA when it is manipulated mechanically or when it is extracted through protocols that require incubation of the specimen from which it is extracted. | |
| Help Received I would like to thank my parents for giving me courage when my experiments did not work, discussing with me what might have gone wrong, and giving me the money to buy the material and the equipment that I needed, and my Science Teacher for his understanding with all the challenges I faced. | |