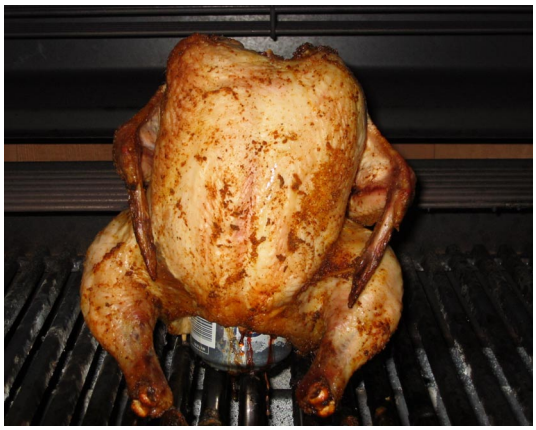
Who Really Broke the Turkey Wishbone?

Each Thanksgiving, there is a contest for who can break the turkey wishbone. Traditions vary as to whether the short side is the winner or the loser. But does one person really exert a stronger force over another?

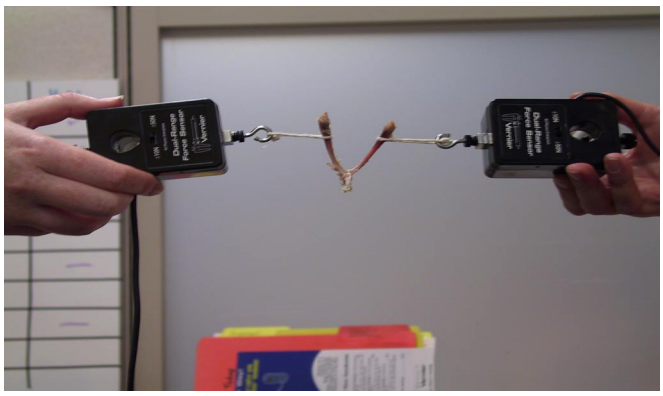
According to Newton, the answer is emphatically "no." Newton's Third law states that for every reaction there is an equal and opposite reaction. So who's correct – Isaac Newton or Grandma Bunny? You will use two Force Sensors to record the forces required to break a turkey wishbone.

In this experiment, students will calibrate the Force Sensors, observe the relationship between force pairs, and demonstrate Newton's third law. Two Vernier Force Sensors, a 0.5 kg mass, a dried turkey or chicken wishbone, two short pieces of string, an interface and a data-collection program are needed.



Set the switch on the Force Sensors to the ±50 N range. Connect the Force Sensors to the interface and start the data-collection program. If two force sensors are not automatically identified, set up the two channels for the Force Sensors. Since you will be comparing the readings of two different Force Sensors, it is important that they both read force accurately. Calibrate the Force Sensor in Channel 1 by entering into the calibration section of your data-collection program. Hold the sensor vertically with no mass suspended from the sensor and use **0 N** for the first calibration point. Hang the 0.50 kg mass from the sensor and use **4.9 N** for the second calibration point. Repeat the procedure for the calibration of the second sensor, but enter **–4.9 N** for the second calibration point. The minus sign changes the direction for the second sensor. You have now calibrated both sensors to read the same magnitude under the same force, but with opposite signs. A pull on one sensor will be positive but negative on the other.

Since you will be using the sensors in a different orientation than that in which they were calibrated, you will need to zero both sensors. Hold both sensors with the measurement axis horizontal and no force applied to the hooks. Zero the sensors. Tie the two pieces of string into small loops and use them to attach each side of the wishbone to a Force Sensor. Have each person hold onto a Force Sensor. Note the amount of time



available for data collection. Start data collection and begin pulling on the wishbone. Continue pulling until the wishbone breaks.

After data collection is complete, the graph of force *vs*. time will be displayed. Examine the graph.

1. What can you conclude about the two forces on the wishbone?

2. How much force was needed to break the wishbone?

3. Did either you or your partner pull harder than the other?

4. Was the breaking of the wishbone due to one person exerting a greater force?

Sample Results: