We weren’t going to talk about it, but since you asked . . .

- Here’s one of the topics many of you asked about:

  **Bottled water**

- How does bottled water compare to public drinking water in terms of health risks, contaminant levels, and meeting drinking water standards?
first, some definitions:

- **Artesian Water** - bottled water drawn from an artesian well (i.e., one with sufficient internal pressure to bring water to the earth’s surface).
- **Distilled Water** - water produced by a process of distillation (vaporizing and recondensing).
- **Purified Water** - water containing less than 10 mg TDS/L produced by distillation, deionization, reverse osmosis, or other suitable processes.
- **Spring Water** - water obtained from an underground formation from which water flows naturally to the surface where a spring emerges (or would if the water were not collected underground through a bore hole).
- **Well Water** - water that comes from a hole drilled in the ground to tap an aquifer.
more terms:

- **Mineral Water** - water from a source tapped at one or more bore holes or springs originating from a geographically and physically protected underground water source. It contains at least 500 mg TDS/L **without** minerals added.

- **Mineralized Water** - containing 500 mg TDS/L **with** minerals added.

- **Sparkling Water** - underground water that contains CO₂ gas. The gas can occur naturally (“Naturally Sparkling Water”) or be from added CO₂ (“Sparkling Natural Water”).

- **Seltzer** - tap water that is filtered and carbonated.

Note that Gatorade (Water + flavoring and selected salts) does not count.
The United States is the largest consumer market for bottled water in the world.

In 2009, bottled water sales were 29.2% of U.S refreshment beverage market.

In 2011 the average American consumed 29.2 gallons per year. Total U.S. consumption was 9.1 billion gallons.

Bottled water costs 240 to 10,000 times more than tap water! $15 billion spent annually (as of 2011).

More than 700 different brands of bottled water are available in the U.S. Of those 75 are imported.
regulation of bottled water vs. tap water

- In general, tap water quality is mandated by uniform national standards (enforced by the EPA), while bottled and vended water is subject to federal regulation with limited applicability and inconsistent state regulation.

- Federal regulation of bottled water was mandated through the 1938 Food Drug and Cosmetic Act and is administered by the Food and Drug Administration (FDA).

- FDA regulations are only applicable for water bottled in one state and sold in a different state. No federal regulations have been set for the intrastate market.
a little regulatory history for bottled water:

- Bottled water quality standards were originally adopted in 1973 after studies revealed quality control and sanitation problems at bottled water plants and were based on the 1962 U.S. Public Health Service standards for drinking water.

- In 1974, the Safe Drinking Water Act (SDWA) made the EPA responsible for ensuring the safety of municipal water systems. When the EPA adds or amends primary drinking water standards, the FDA must set similar standards for bottled water within 180 days.

- The Food and Drug Administration (FDA) inspects bottled water facilities on a regular basis (according to the FDA!).
Comparison to tap water: Microbiological Quality

- While bottled water may initially meet the bacteriological standards the lack of a residual disinfectant (chlorine), and long periods of storage at room temperature (or higher) may result in elevated organism counts at the time the water is actually consumed. Microbial numbers reach a peak after one week of storage and remain fairly constant thereafter.

- Some data exist that suggest that water stored in PVC or plastic bottles have higher microbial counts than that stored in glass.
Comparison to tap water: Microbiological Quality

- Pathogenic organisms have been identified in bottled water - the Center for Disease Control (CDC) reports 12 outbreaks since 1973 caused by contaminated bottled water.
- Limited studies have shown that potential problems are most likely related to contamination by: (i) improperly cleaned equipment and bottles, (ii) failure of ozonation equipment, and (iii) contamination of the water by workers.
- Carbonated waters have lower microbial counts because of the anti-microbial nature of carbon dioxide.
Reported Outbreaks Associated with Bottled Water*

- **Contamination at Water Source**
  2000: acute gastrointestinal illness (AGI) caused by the bacteria *Salmonella bareilly*

- **Contamination During Commercial Bottling**
  1980: AGI caused by an unidentified agent
  1989: AGI caused by an unidentified agent
  1994: AGI caused by the bacteria *Vibrio cholerae*
  2003: AGI caused by the chemical *bromate*

- **Contamination During Shipping, Hauling, or Storage**
  2003: AGI caused by an unidentified chemical cleaning product

- **Contaminated at Point of Use**
  2000: AGI caused by the bacteria *Shigella sonnei* Type D
  2003: AGI caused by an unidentified agent

- **Unknown Point of Contamination**
  1973: AGI caused by an unidentified agent
  1999: AGI caused by an unidentified agent
  2001: AGI caused by the chemical *ethylbenzene*
  2004: AGI caused by *gasoline byproducts*

*source: Center for Disease Control
http://www.cdc.gov/healthywater/drinking/bottled/#asterisk
A study by Consumer Reports found elevated trihalomethane (THM) levels in several bottled waters. The elevated levels were found in those bottled waters that came from a municipal source that had been chlorinated then filtered to remove the chlorine.

The most famous case of organic chemical contamination was in 1990 when Perrier was found to be contaminated with 12 to 20 ppb benzene (a carcinogen). The contamination was apparently known to be in the aquifer itself and was normally removed by Perrier through the use of charcoal filters. The worldwide sale of the contaminated water occurred when workers forgot to replace the filters.
The primary route for contamination of bottled water by organic contaminants is from solvents and other chemicals used to clean or condition processing equipment.

Bisphenol-A, an estrogen mimic leaches from some types of plastics.

Other Contaminants: A 1991 study found elevated levels of constituents such as chloride, fluoride, sulfate, manganese, and barium in 24 out of 37 bottled waters examined. The pH of some waters was also less than the lower standard for drinking water (pH 6.5).
Comparison to tap water: Chemical Quality

- A study in 2008 of 10 popular brands of bottled water across the U.S. revealed great variation in quality.
  - A wide range of pollutants were found in the samples—caffeine, Tylenol, arsenic, ammonia, etc.
  - Several samples exceeded the voluntary industry standards and California legal limit for THMs.

Source: EWG Study,
http://www.ewg.org/reports/BottledWater/Bottled-Water-Quality-Investigation
The National Resource Defense Council (NRDC) did a 4 year study of bottled water.

- tested more than 1,000 bottles of water sold under 103 brand names.

- Results:

  - No Contaminants of Concern Found: 45%
  - Violate State Limits or Guidelines*: 33%
  - Violate Federal Standards: 4%
  - Chemicals of Concern at Levels Below Standards: 18%

* Source: NRDC, 1997-1999
The NRDC described one particularly troubling case of chemical contamination of bottled water in Massachusetts.

- The Ann & Hope commercial well in Millis, Mass., supplied several bottlers with "spring water" which was then sold under many brand names.

- According to State records, this well is located in a parking lot at an industrial warehouse facility and is sited near a state-designated hazardous-waste site. Several chemical contaminants were found in the water, including trichloroethylene (an EPA-designated probable human carcinogen).

- A State Dept. of Public Health employee blew the whistle on the problem. She was ordered not to speak to the media and was reassigned to other duties.

source: http://www.nrdc.org/water/drinking/bw/chap3.asp#box
Some bottled water = tap water

- Aquifina – which comes with a pleasing mountain logo is taken from a municipal water source.
  - The label was changed in 2007 to state that Aquifina has a “Public Water Source”.
- Dasani, and Nestle Pure Life also come from municipal water sources.
Some individuals object to bottled water based on its environmental impact.

- Bottled water is more or less a poster child for unneeded resource use:
  - Petroleum use to make plastic bottles
  - Energy use for distribution
Nov 4, 2010 the Cornell Student Assembly called to phase out bottled water sales on campus, citing environmental and financial cost as motivators.